Act 129 Statewide Evaluator Annual Report

Program Year 1: June 1, 2009 – May 31, 2010

Presented to:

Pennsylvania Public Utility Commission

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Prepared by The Statewide Evaluation Team:

GDS Associates, Inc., Nexant, Mondre Energy and Syntil, Inc.

Acknowledgements

The Statewide Evaluator (SWE) Team would like to thank the program staff and evaluation contractors at each of the seven Pennsylvania Electric Distribution Companies (EDCs) for their assistance over the past year in providing data and information to the SWE team about the costs, participants and savings of the EDC Act 129 programs that have been implemented. The SWE team especially appreciates the cooperation we have received from the EDCs, their evaluation contractors, and the Energy Association of Pennsylvania, as well as the many suggestions we have received from them to improve and streamline SWE audit and reporting activities. The SWE team recognizes the long hours that the EDCs' staff have put in during Program Year 1 to design and launch programs, and monitor their progress. The SWE team also emphasizes that a draft version of this SWE Annual Report to the Pennsylvania Public Utility Commission (PA PUC or PUC) has been circulated to the seven EDCs for their review. The SWE team has addressed all comments received from the EDCs on the draft version of this report.

The SWE team would also like to thank the Staff of the PA PUC's Bureau of Conservation, Economics and Energy Planning (CEEP) for their assistance and support since the beginning of the Statewide Evaluator project in September 2009. The CEEP Staff have been instrumental in providing input to the original Statewide Evaluator *Audit Plan* completed in December 2009, and to the development of efficient processes for the review and approval of interim measure protocols for the Technical Reference Manual and custom measure protocols. CEEP staff members have also provided comments on the draft version of this report.

The findings, conclusions, and recommendations contained in the Statewide Evaluator's Annual Report are the findings, conclusions, and recommendations of the Statewide Evaluator only and, as such, are not necessarily agreed to by the EDCs or the Commission. The Commission, while not adopting the findings, conclusions, and recommendations contained in the Statewide Evaluator's Annual Report, may consider and adopt some or all of them at a later date in appropriate proceedings, such as the annual Technical Reference Manual update, Total Resource Cost Test Manual update, and individual EDC Energy Efficiency and Conservation Plan revision proceedings.

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1. Executive Summary

The Pennsylvania Public Utility Commission (PA PUC, PUC or Commission) has been charged by the Pennsylvania General Assembly pursuant to Act 129 of 2008 (Act 129) with establishing an energy efficiency and conservation (EE&C) program. The seven Electric Distribution Companies (EDCs) subject to Act 129 include: West Penn Power Company d/b/a Allegheny Power (Allegheny); Duquesne Light Company (Duquesne); the FirstEnergy companies – Metropolitan Edison Company (Met-Ed), Pennsylvania Electric Company (Penelec), and Pennsylvania Power Company (PennPower); PECO Energy Company (PECO), and PPL Electric Utilities (PPL). Listed below is the section of Act 129 that discusses the kWh and kW savings targets to be achieved by May 31, 2011 and by May 31, 2013.

> 66 Pa.C.S. §§ 2806.1 and 2806.2 – The EE&C program requires each Electric Distribution Company (EDC) with at least 100,000 customers to adopt a plan to reduce energy demand and consumption within its service territory. Each EDC, through its approved plan, is to reduce electric consumption by May 31, 2011, by at least 1% of its expected consumption for June 1, 2009 through May 31, 2010. By May 31, 2013, the total annual consumption is to be reduced by a minimum of 3% of its consumption for June 1, 2009 through May 31, 2010. Also, by May 31, 2013, each covered EDC's peak demand is to be reduced by a minimum of 4.5% of the EDC's annual system peak demand in the 100 hours of highest demand, measured against the EDC's peak demand during the period of June 1, 2007 through September 30, 2007.

In order to fulfill this obligation, on January 16, 2009, the Commission entered an Implementation Order at Docket No. M-2008-2069887. As part of the Implementation Order and Act 129, the Commission sought a Statewide Evaluator (SWE or SWE team) to evaluate the EDCs' EE&C programs. GDS Associates, partnered with Nexant, Mondre Energy, and Syntil, has been retained as the PA Statewide Evaluator to fulfill requirements of the Implementation Order and Act 129. The SWE team is contracted to monitor and verify EDC data collection, quality assurance processes and performance measures, by customer class. The SWE team has other contractual obligations, including reviewing the Technical Reference Manual (TRM) information and savings values and developing recommendations for possible revisions and additions.

This report is the first annual report from the SWE team to the PA PUC. It is important to note that, for this first report only, an extension was granted by the Project Officer that modified the date the report was due from October 15th to December 15th. The reason for this extension was to allow for all necessary data to be collected and then to allow for enough time for an analysis to be completed. This report covers the first Program Year (June 1, 2009 through May 31, 2010). This report provides detailed information on the findings of the SWE team's Program Year One (PY1) audit activities of the Act 129 EE&C programs implemented by seven EDCs in Pennsylvania) The evaluation includes:

- An analysis of plan and program impacts (demand and energy savings) and cost-effectiveness[1],
- A report of results, and recommendations for program and plan improvements,
- Recommendations for improvements to the TRM, and
- Recommendations relating to changes proposed by some of the EDCs to their EE&C plans.

Contents of this report address:

- The status of programs (Section 2),
- Discussion of the SWE's methodology and approach to developing its findings and recommendations relative to processes and reported values (Section 3),
- Key qualitative findings and recommendations related to programs and M&V processes based on observations, site visits with EDCs and other field work (Section 4),
- Findings and recommendations related to EM&V processes and practices by program and EDC (Section 5),
- Quantitative findings and recommendations by program and EDC, including recommendations for the upgrade of the TRM (Section 6),
- A summary of findings and recommendations (Section 7), and
- A List of Acronyms and a Glossary of Terms found at the end of the report.

Overall, while the SWE team did identify minor errors in the kWh and kW savings that were reported for some of the EDCs for PY1, the errors were very small (less than 1% of reported savings).

The SWE team would like to thank all of the EDCs and the PA PUC staff for providing their feedback and comments on draft versions of this report. Their edits and recommendations have helped to clarify and improve this report. The SWE team, the PA PUC staff, the EDCs and the EDC evaluation contractors have worked hard to develop a solid foundation for the evaluation, measurement and verification of the Act 129 energy efficiency and demand response programs. The SWE team anticipates that improvements will continue to be made to the Statewide Evaluation audit processes, and we appreciate the support and responsiveness of the EDCs and their evaluation contractors.

To date, the seven EDCs have saved over 278,700MWh and 22MW. These savings are attributable to 38 EE&C programs implemented by the seven EDCs and evaluated in PY1.[2] Of these verified savings, 74% of the MWh and 52% of MW savings are attributed to residential lighting programs, comprised primarily of compact fluorescent light (CFL) bulbs. The SWE team and the EDCs expect that the annual savings will only grow as additional programs are implemented, existing programs mature, and evaluation findings and best-practices are incorporated into program delivery. The following table provides a status update on each EDC's progress towards reaching their 2011 and 2013 savings targets as of the end of PY1 on May 31, 2010.

[1] For the PY1 audit, the SWE team reviewed the cost data associated with the EE&C portfolio that was reported in each EDC's Annual Report. Cost-effectiveness, in terms of the Total Resource Cost (TRC) Test, will be reviewed in future program years pending data and reporting requirement resolutions to be clarified in upcoming TRC working group meetings.

[2] For PY1, 38 programs reported verified savings although several more projects were in fact implemented.

Table 1-1: EDC Compliance Goal Progress as of the End of Program Year 1[3] - Summary

	Allegheny	Duquesne	Met-Ed	Penelec	PennPower	PECO	PPL
% of 2011 Energy Savings Target Achieved	1.4%	19.0%	8.2%	8.9%	11.7%	40.0%	22.0%
% of 2013 Energy Savings Target Achieved	0.5%	6.0%	2.7%	3.0%	3.9%	13.0%	7.0%
% of 2013 Demand Reduction Target	0.3%	1.0%	1.0%	1.1%	0.9%	3.0%	2.0%

In PY1, the SWE team conducted an audit of the following general program categories and evaluations performed by the EDCs' EM&V contractors:

- Residential Programs:
  - Compact Fluorescent Lighting Programs,
  - Appliance Recycling Programs,
  - Efficient Equipment Programs, and
  - Low-Income Programs.
- Non-Residential Programs:
  - Commercial and Industrial (C&I) Equipment, For-Profit,
  - C&I Equipment, Non-Profit and Government,
  - C&I Performance Contracting, and
  - Pending Custom Measures:
    - Conservation Voltage Reduction.

A comprehensive list of programs evaluated is available in Table 2-2 of this report.

Based upon PY1 audit findings and a review of the up-to-date impact evaluations, the SWE recommends the following[4]:

- Update the 2010 TRM to reflect program findings and up-to-date impact evaluations for inclusion in 2011 TRM, for the following residential programs:
  - Update appliance recycling deemed savings values,
  - Update residential CFL hours of use and in-service rates, and
  - Add new measures and deemed savings for residential appliance recycling with appliance replacement.
- Update the 2010 TRM to provide the following C&I improvements:
  - Add measures to facilitate savings quantification by EDCs,
  - Clarify certain applications of the TRM for lighting and variable frequency drives (VFD),
  - Add lighting products to Appendix C of the TRM, and
  - Clarify baselines and code issues where appropriate.
- Update the *Audit Plan*'s Sampling and Uncertainty Protocol to clarify the following:

[3] Percentage of compliance target achieved calculated using verified Cumulative Program/Portfolio Inception to Date values (or Preliminary verified value, if not available) divided by compliance target value.
[4] These recommendations are based on SWE findings which are summarized in greater detail throughout this annual report.

- Ratio estimation approach for Evaluation Measurement and Verification (EM&V) inspections;
- Expected level of engineering rigor for EM&V inspections;
- The requirement of "frozen" ex-ante savings estimates in the realization rate calculations; and
- Stratification requirements by measure type.

In preparing this report, the SWE team has completed the following key audit activities for PY1:

- Conducted on-site inspections of the installations of energy efficiency measures at 63 randomly selected low-income households in Pennsylvania.
- Conducted on-site inspections of the installations of energy efficiency measures at 86 commercial and industrial facilities.
- Inspected the documentation for energy efficiency measures at 150 randomly selected program participants for the residential appliance recycling and residential efficient products programs.
- Verified the documentation for the purchase and distribution of CFL bulbs for each of the seven EDCs covered by Act 129.
- Verified the kWh and kW demand savings calculations for each EDC for PY1 for the residential lighting, efficient products, appliance recycling and low-income programs.
- Verified the kWh and kW demand savings calculations for each EDC for PY1 for all C&I programs.

The remainder of the SWE team's Annual Report submitted to the PA PUC is structured to provide the following:

- An analysis and assessment of each EDC's plan and program expenditures;
- An analysis of each EDC's protocol for measurement and verification (M&V) of energy savings attributable to its plan, in accordance with the Commission adopted TRM and approved custom measure protocols (CMPs);
- An analysis of the cost-effectiveness of each EDC's expenditures in accordance with the Commission adopted Total Resource Cost (TRC)Test Manual[5];
- Identification of best practices;
- A review of Pennsylvania TRM information and savings values with suggestions for possible revisions and additions;
- A review of the TRC Test Manual with suggestions for possible revisions and additions; and
- A review of any proposed revisions and updates to EDC plans.

This report also explains where kWh and kW savings calculations need to be revised based upon the SWE audit findings, and summarizes the revisions needed to the TRM in order to provide more accurate and reliable calculations of kWh and kW savings by each EDC. It is the SWE team's recommendation in this Annual Report that the verified savings reported by the EDCs in their respective PY1 Annual Report

[5] TRC reporting requirements have been waived for PY1 reporting purposes pending resolution of issues in upcoming TRC working group meetings. SWE audits of cost-effectiveness will occur in future program years.

remain as filed and that no revisions to the savings for PY1 are required. The SWE team has provided suggestions in this report for refining savings calculations and program implementation designs going forward, but the impacts on PY1 savings are minimal and fall within the acceptable range of variance expected or the verified Act 129 kWh and kW savings. Based on the SWE team findings, and EDC corrections, PY1 reported and verified savings will not be re-filed; however, going forward, the corrections may impact cumulative and verified savings reported in subsequent program years.

2. Electric Distribution Companies Portfolio Summaries

Act 129, signed on October 15, 2008, mandated energy savings and demand reduction goals for the largest EDCs in Pennsylvania. Pursuant to the establishment of savings targets, EE&C Plans were submitted by each EDC and approved by the PA PUC. This annual report documents the progress and effectiveness of the EE&C accomplishments for all seven EDCs subject to Act 129 through the end of PY1. The following table provides a summary of the EDCs' progress towards their targets reflecting their Cumulative Program Inception to Date (CPITD) MWh and MW savings.

Table 2-1: EDC Compliance Goal Progress as of the End of Program Year 1[6]

	Statewide	Allegheny	Duquesne	Met-Ed	Penelec	PennPower	PECO	PPL
CPITD Reported Gross[7] Energy Savings (MWh)	326,011	5,906	26,217	14,647	13,577	6,191	177,776	81,697
CPITD Verified[8] Energy Savings (MWh)	278,705	2,952	3,642	12,260	12,865	5,593	156,813	84,580
% of 2011 Energy Savings Target Achieved	**N/A**	**1.4%**	**19.0%**	**8.2%**	**8.9%**	**11.7%**	**40.0%**	**22.0%**
% of 2013 Energy Savings Target Achieved	N/A	0.5%	6.0%	2.7%	3.0%	3.9%	13.0%	7.0%
CPITD Reported Gross Demand Reduction (MW)	23.26	1.00	1.13	1.37	1.44	0.44	11.69	6.19
CPITD Verified Demand Reduction (MW)	22.18	0.50	0.16	1.21	1.24	0.41	11.29	7.37
% of 2013 Demand Reduction Target	**N/A**	**0.3%**	**1.0%**	**1.0%**	**1.1%**	**0.9%**	**3.0%**	**2.0%**

Statewide compliance progress as of the end of the reporting period:

Cumulative Portfolio Energy Impacts

- The CPITD reported gross energy savings is 326,011MWh.
- The CPITD verified energy savings is 278,705MWh.

Portfolio Demand Reduction[9]

[6] Percentage of compliance target achieved calculated using verified Cumulative Program/Portfolio Inception to Date values (or Preliminary verified value, if not available) divided by compliance target value.

[7] Gross savings represent change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated.

[8] Verified gross impact is calculated by applying the realization rate to reported gross impacts. Realization rate is a term used in several contexts in the development of reported program savings. The primary applications include the ratio of project tracking system savings data (e.g. initial estimates of project savings) to savings (a) adjusted for data errors and (b) that incorporate evaluated or verified results of the tracked savings.

- The CPITD reported gross demand reduction is 23.26MW.
- The CPITD verified demand reduction is 22.18MW.

Low-Income Sector

- There are 22,145 measures offered to the Low-Income Sector, comprising 28% of the total measures offered.
- The CPITD reported gross energy savings for low-income sector programs is 12,828MWh.
- The CPITD verified energy savings for low-income sector programs is 7,289MWh.

Government and Non-Profit Sector

- The CPITD reported gross energy savings for government and non-profit sector programs is 10,773MWh.
- The CPITD verified energy savings for government and non-profit sector programs is 4,276MWh.

Program Year portfolio highlights as of the end of the reporting period:

- The Program Year to Date (PYTD) reported gross energy savings is 326,011MWh.
- The PYTD verified energy savings is 278,705MWh.
- The PYTD reported gross demand reduction is 23.26MW.
- The PYTD verified demand reduction is 22.18MW.
- The PYTD reported participation is 149,847 participants.[10]

The savings presented above are based on the implementation and evaluation of the programs implemented and evaluated by the EDCs in PY1. The following table outlines the programs implemented and evaluated by the seven EDCs in PY1.[11] While the EE&C plans of the utilities listed a total of over 100 programs, the EDCs only reported participation for 38 of these programs during PY1.[12]

Table 2-2: Programs Launched and Evaluated by Each EDC

EDC	Programs Evaluated
Residential Programs	
Allegheny	Residential Home Performance Program

[9] Demand reduction to include both the demand savings from the installation of energy efficiency measures and the demand reduction associated with demand response programs.
[10] Statewide participants are based upon the participant numbers reported by each EDC. Most EDCs excluded the number of CFL bulbs distributed from these numbers; other EDCs estimated the number of bulbs per participant and included that estimate in their totals.
[11] Savings are based on programs that include reported savings. There were a few programs which were implemented in PY1, but did not accrue adequate participation to merit expenditures on evaluation activities. These savings will be included in subsequent reports.
[12] Participation and savings were not reported for all programs designed and/or implemented due to low participations levels and/or delayed program implementation. The low participation rates and/or delayed implementation of various programs is typical when launching new programs as there is generally a learning curve for utilities in implementing new programs and a ramp-up period for customer participation.

Duquesne	Residential Energy Efficiency Rebate
Duquesne	Residential School Energy Pledge
Duquesne	Residential Refrigerator Recycling
Met-Ed	Home Energy Audits
Met-Ed	Appliance Turn-In
Met-Ed	Energy Efficient Products
Penelec	Home Energy Audits
Penelec	Appliance Turn-In
Penelec	Energy Efficient Products
PennPower	Home Energy Audits
PennPower	Appliance Turn-In
PennPower	Energy Efficient Products
PECO	Smart Lighting Discounts Program
PECO	Smart Appliance Recycling Program
PECO	Smart Home Rebates Program
PPL	Appliance Recycling
PPL	Compact Fluorescent Lighting Campaign
PPL	Custom Incentive Program
PPL	Efficient Equipment Incentive
Low Income Programs	
Duquesne	Low-Income Energy Efficiency
Met-Ed	WARM Programs
Penelec	WARM Programs
PennPower	WARM Programs
PECO	Low-Income Energy Efficiency Program
PPL	Low-income WRAP
C&I Programs	
Met-Ed	C&I Performance Contracting/Equipment
Penelec	C&I Performance Contracting/Equipment
Penelec	Industrial Motors and VSD
PennPower	C&I Performance Contracting/Equipment
PECO	Smart Equipment Incentives – C&I
Government/Non-Profit Programs	
Allegheny	Governmental/Non-Profit Lighting Efficiency Program
Met-Ed	Remaining Government/Non-Profit
Penelec	Non-Profit
Penelec	Remaining Government/Non-Profit
PECO	Smart Equipment Incentives – Government/Non-Profit
Other Programs	
PECO	Conservation Voltage Reduction
PPL	Renewable Energy Program

2.1 Allegheny

2.1.1 Energy Efficiency and Conservation Portfolio Implementation Summary

Allegheny soft-launched[13] the following programs in the 3rd Quarter of PY1:

- Residential CFL Rewards Program
- Residential ENERGY STAR and High Efficiency Appliance Program
- Residential Heating, Ventilation and Air-Conditioning (HVAC) Program
- Low-Income Home Performance Check-Up & Appliance Replacement Program
- Low-Income Joint Utility Usage Management Program
- Low-Income Room Air Conditioner Replacement Program
- Commercial HVAC Efficiency Program
- Commercial Lighting Efficiency Program
- Commercial and Industrial Drives Program

In the 4th Quarter of PY1, Allegheny launched:

- Residential Home Performance Program – Online Energy Audit Measure
- Custom Technology Applications Program
- Custom Application Program
- Government/School/Non-Profit Portfolio Program

Allegheny will launch their remaining approved programs during Program Year Two (PY2).

In PY1, Allegheny focused on:

- Program process design improvement: Allegheny worked with its EM&V contractor and leveraged experience in another jurisdiction to identify program process changes. The most notable change was moving to the residential CFL point-of-sale design[14].
- EE&C tracking and reporting database: Allegheny designed and developed an internal tracking and reporting database as an interim solution as they transition to a longer term vendor solution. Allegheny expects to have a final solution in place in time for the PY2 Annual Report.

2.1.2 Portfolio Measurement and Verification Status

Allegheny's evaluation team completed the following activities:

- Developed an approved EM&V Plan;
- Designed survey instruments for impact and process evaluations;
- Conducted program manager interviews;

[13] The soft-launch made programs available to customers on the Allegheny Power Watt Watchers website and to those inquiring, but no active marketing began in the Third Quarter of PY1.

[14] Point-of-sale programs discount energy efficiency programs at the time of equipment sale. No coupons or rebate forms are required.

- Developed program logic models;
- Reviewed rebate applications and tracking databases;
- Participated in Technical Working Group (TWG) sessions with the SWE; and
- Conducted evaluations to determine verified savings for two programs:
    - Residential Home Performance Program and
    - Governmental/Non-Profit Lighting Efficiency Program.

2.2 Duquesne

2.2.1 Energy Efficiency and Conservation Portfolio Implementation Summary

Duquesne implemented the following programs in PY1:

- Residential Energy Efficiency Rebate Program
- Residential School Energy Pledge Program
- Residential Refrigerator Recycling Program
- Residential Low-Income Energy Efficiency Program
- Commercial Sector Umbrella Energy Efficiency Program
- Mixed Industrial Energy Efficiency Program
- Office Buildings – Large Energy Efficiency Program
- Office Buildings – Small Energy Efficiency Program
- Primary Metals Energy Efficiency Program
- Public Agency, Non-Profit Energy Efficiency Program
- Retail Stores Energy Efficiency Program

Duquesne focused their efforts on implementing energy efficiency kit programs. There was very limited participation in the non-residential programs; participation in these programs is expected to increase in the next program year.

2.2.2 Portfolio Measurement and Verification Status

Duquesne's evaluation team completed the following activities:

- Developed approved EM&V Plan;
- Developed survey instruments;
- Conducted surveys for Duquesne's energy efficiency kit programs; and
- Conducted impact evaluations to determine verified savings for four programs:
    - Residential Energy Efficiency Rebate Program,
    - Residential School Energy Pledge Program,
    - Residential Refrigerator Recycling Program, and
    - Residential Low-Income Energy Efficiency Program.

2.3 FirstEnergy Companies

2.3.1 Energy Efficiency and Conservation Portfolio Implementation Summary

Consistent with the PUC's Opinions and Orders in Docket Nos. M-2009-2092222, M-2009-2112952 and M-2009-2112956, FirstEnergy's Pennsylvania EDCs, Metropolitan Edison Company, Pennsylvania Electric Company and Pennsylvania Power Company (collectively, FirstEnergy) launched nearly all of the programs in PY1 and anticipate launching any remaining programs (e.g., Commercial/Industrial Demand Response) no later than the end of PY2.

FirstEnergy implemented the following programs in PY1:

- Residential Home Energy Audits
- Appliance Turn-In Program
- Energy Efficient Products Program
- Energy Efficient HVAC Equipment Program
- WARM Programs (WARM Plus and WARM Extra Measures)
- Commercial and Industrial Performance Contracting/Equipment Program
- Remaining Government/Non-Profit Program
- Industrial Motors and Variable Speed Drives
- Street lighting

FirstEnergy will launch their remaining approved programs during PY2.

FirstEnergy noted a few risks, which are summarized below, from the experience gained during PY1:

- Impact of the economic downturn on participation in FirstEnergy's EE&C programs and
- Uncertainty related to the quantification of savings for approved portfolio measures that have neither been incorporated into the TRM nor have an approved M&V protocol.

2.3.2 Portfolio Measurement and Verification Status

FirstEnergy evaluated the following programs in PY1:

- Home Energy Audits
- Appliance Turn-in Program
- Energy Efficiency Products Program
- WARM Programs
- Commercial and Industrial Performance Contracting/Equipment Program
- Remaining Government/Non-Profit Program

2.4 PECO

2.4.1 Energy Efficiency and Conservation Portfolio Implementation Summary

PECO's Annual Report reflects the results of seven programs launched in PY1. Four of the seven programs were launched in the 4th Quarter of PY1; only one program was launched prior to the 3rd Quarter. An additional seven programs are scheduled to be launched in PY2. No savings were realized for the Demand Response programs launched to date; PECO expects that the rate of progress towards the demand reduction target will increase in PY2.

PECO launched the following programs in PY1:

- PECO Smart Lighting Discounts
- Low-Income Energy Efficiency Program (LEEP)
- PECO Smart Appliance Recycling Program
- PECO Smart Home Rebates Program
- PECO Smart Equipment Incentives – Commercial and Industrial
- PECO Smart Equipment Incentives – Government and Non-Profit
- Conservation Voltage Reduction Program

PECO will launch the following programs in PY2:

- Commercial and Industrial New Construction Program
- Residential New Construction Program
- Residential Direct Load Control Program
- Commercial and Industrial Direct Load Control Program
- Demand-Response Aggregator Contracts
- Distributed Resources
- Commercial and Industrial Permanent Load Reduction

2.4.2 Portfolio Measurement and Verification Status

PECO's evaluation team evaluated the following programs for PY1:

- Smart Lighting Discounts Program
- Smart Appliance Recycling Program
- Smart Home Rebates Program
- Smart Equipment Incentives Program – Commercial and Industrial
- Smart Equipment Incentives Program – Government and Non-Profit

2.5 PPL

2.5.1 Energy Efficiency and Conservation Portfolio Implementation Summary

PPL's program evaluation and continuous improvement process has three basic components: activity tracking, quality assurance/quality control (QA/QC), and EM&V. PPL launched their Energy Efficiency Management Information System (EEMIS) to track all program activities and transactions. PPL's quality assurance process involves activities designed to ensure that both an effective process, and the necessary resources, are in place for the implementation process to operate efficiently and for PPL to meet its EE&C Plan objectives. PPL's quality assurance process includes:

- Development of a business process map of the implementation and operation of the portfolio and each individual program and
- Conducting QA/QC assessments to ensure that all data necessary for EM&V is properly collected.

PPL's portfolio of programs approved in the EE&C Plan includes 14 programs, all of which are in various stages of development and implementation. Of these, there were six programs with claimed savings in PY1. These include:

- Appliance Recycling Program,
- Efficient Equipment Program,
- Custom Incentive Program,
- CFL Distribution Program,
- Renewables Program, and
- Low-income WRAP.

Each of the current programs, except for portions of the Renewables Program, will continue in PY2, with expected growth in participation. Other programs that will claim savings in PY2 include:

- Energy Assessment and Weatherization (residential),
- Energy Efficiency Behavior and Education (residential),
- EPowerWise (low-income residential), and
- HVAC Tune-Up (commercial).

The residential New Construction program is in development. In Program Year 3 (PY3), additional programs will focus on demand reduction, including Direct Load Control and Load Curtailment.

2.5.2 Portfolio Measurement and Verification Status

PPL's evaluation team reported verified savings for the following programs in PY1:

- Appliance Recycling Program
- Compact Fluorescent Lighting Campaign
- Custom Incentive Program

- Efficiency Equipment Incentive
- Low-income WRAP
- Renewable Energy Program

3. Evaluation and Audit Methodology/Approach

This section provides an overview of the SWE evaluation and audit methodology. It includes a discussion of the statistical confidence and margin of error levels required for the different levels of evaluation rigor. It also provides an overview of key audit activities which include the following:

- Review of EM&V plans,
- Review of sample design,
- Desk-top audits and verification of kWh and kW savings calculations by program,
- Site visits to EDCs,
- Site visits to program participants, and
- Review of data tracking and reporting systems.

Additionally, the SWE team has provided recommendations for changes to the program implementation and evaluation process based on PY1 evaluation and audit findings.

3.1 Audit Plan

The *Audit Plan* was prepared by the SWE team, and approved by the Commission on December 1, 2009, in accordance with the directive of Act 129. The *Audit Plan* contains detailed expectations for the EDCs' EM&V protocols and plans as well as descriptions of the potential audit activities to be conducted by the SWE team. Specifically, the *Audit Plan* addresses the following:

- Specific audit activities to be undertaken by the SWE team;
- Review of EDC EE&C program plans and impact evaluation expectations;
- Clarifications of the TRM for PY1 and plans for developing and implementing annual updates for PY2 and beyond;
- The role of the TWG to update and clarify the TRM;
- EDC gross energy and demand impact evaluations with M&V plan guidelines based on specified M&V and sampling protocols;
- EDC process evaluations with guidelines for creating and conducting surveys;
- Review of EDC cost-effectiveness evaluations with guidelines for following the TRC Test as it is described in the TRC Order of June 2009;
- Data tracking and reporting guidelines; and
- Deadlines for evaluation activities, audit activities, and reporting.

The emphasis of the *Audit Plan* is on measuring near-term program energy and demand impacts, given that these impacts are critical to the success of each EDC's goal in attaining the energy and demand savings targets as outlined in Act 129. The value of the EDC programs is primarily established through the impact evaluations that verify the resource acquisition savings. Evaluation activities identify,

document, quantify, and monetize these impacts. For all EDC programs that have energy and demand impact objectives, the *Audit Plan* provides guidelines to the EDCs for adopting and implementing M&V plans and guidelines for reporting data to the SWE. The EDC or EDC evaluation contractors are expected to conduct program-specific data collection and reporting, as outlined in their respective EM&V plans, that supports unbiased independent estimations of verified gross energy and demand impacts for all programs with:

- Independent verification of the implementation of energy efficiency improvements, and the engineering calculations used to estimate the energy and demand saved; and
- Independent verification of the extent to which energy and demand savings can confidently be attributed to EDC efforts towards reaching the savings targets established in Act 129.

These energy and demand impacts, estimated by EDC evaluation contractors, are reported in their respective annual reports created by the EDCs and submitted to the Commission on September 15, 2010, for PY1. All of the issues pertaining to the impact evaluation process are detailed in Section 3.3 of the *Audit Plan*. The *Audit Plan* also outlined the SWE activities that were to be implemented throughout the evaluation process for PY1. For more information on what is audited, how it is audited, and possible audit outcomes, please refer to Sections 4, 5, 6, and 7 of the *Audit Plan* as well as the Audit Activities Checklist provided in Appendix C of the *Audit Plan*.

3.2 Audit Checklists

The SWE team outlined a generic process for auditing the evaluation of EDC EE&C programs. The process was then tailored for each specific EDC and program to account for variations in program design, implementation and performance. Starting with the generic process ensures that each program across all seven EDCs is reviewed by the SWE in a similar and consistent manner.

1. Define measure type and program characteristics:
   - The SWE team verified that each EDC was utilizing the appropriate savings protocol for a given measure: deemed, partially deemed, or custom.
2. Determine Value of Information (VOI)
   - The determination of a program's VOI is based upon the program's PY1 reported savings. VOI is then used as a metric to set the expected rigor levels for evaluation and audit activities.[15]
3. Review EDC EM&V Plans
   - Review for compliance with the TRM and TRC orders, CMPs, and the *Audit Plan*.
4. Audit EDC EM&V Plan Implementation
   - Verify that each EDC conducted their evaluation activities according to their approved EM&V Plan.
5. Conduct SWE Audit Activities
   - The following activities were conducted, as applicable, to analyze each EDC's program and evaluation activities.

[15] The SWE will issue an amendment to the Audit Plan following the Sampling Workshop in November 2010, which will set statistical expectations for EDC evaluators. A new version of the Audit Plan will be issued early 2011.

a. Independent site-visits or spot checks
b. Joint impact evaluations
c. QC data input
d. Review savings calculations at the program level for each EDC
e. Verify data collected
f. Review statistical summaries

6. Review EDC Quarterly and Annual Reports
   - The SWE team reviewed the reports to verify the accuracy of reported savings and costs.
7. Compile SWE Quarterly and Annual Audit Reports

3.3 Technical Reference Manual and Interim Technical Reference Manual Measure Protocols

Part of the SWE team's responsibilities is to verify the accuracy of current TRM protocols, modify existing TRM protocols as appropriate based on evaluation and audit findings, and to develop and approve Interim TRM protocols for measures not currently represented in the approved TRM manual but qualify for deemed or partially deemed savings.

More information on the SWE's activities and findings related to TRM and Interim TRM measure protocols is provided in Section 6.5.

3.4 Custom Measure Protocols

The impacts of the Custom Measures vary from project to project. However, before any project is approved, the method of measuring savings needs to be defined so the program risks can be assessed, rebates determined and savings estimated. As of December 6, 2010, the EDCs and the SWE have worked in collaboration to develop and finalize twelve approved CMPs for saving opportunities that are not standard measures, are often complex and are unique to the application:

1. Custom Motors and VFDs
2. Conservation Voltage Reduction – Substation
3. Schools for Energy Efficiency
4. Commercial Refrigeration Efficiency Improvement
5. Roof Improvements v1 (includes Worksheet)
6. Process Drive System Modifications v7
7. Lighting Circuit Power Controller v6
8. Solar PV
9. Small Measure (Temporary)
10. Lighting Control Time Clocks
11. Low-Income Usage Reduction Program (WRAP)
12. LEEP

For custom measures the assessment of the baseline is a key element in determining the savings that will be achieved by the measure in any unique application. Therefore, the M&V process usually involves the determination of savings by comparing the energy consumption pre-installation to the energy

consumption post-installation. Custom measure impact assessments may also include engineering models or simulations to estimate the savings. Therefore, the audit activities for Custom Measures depends on the CMP defined for the particular custom measure.

Currently, the SWE team has approved twelve CMPs, ten CMPs have been reviewed and returned by the SWE team for revisions, and an additional 15 are in some stage of the review and approval process. More information on the SWE's activities and findings related to CMPs is provided in Section 6.5.6.

4. Statewide Evaluator Audit Activity Summaries

This section will provide the key findings from SWE desk-top audits, SWE site visits to EDCs, SWE site visits to program participant locations, and other SWE audit activities. Findings in these Activity Summaries relate to field observations that EDCs should consider and address in their implementation, tracking, reporting and evaluation processes, but which may or may not have any bearing on SWE findings related to reported or verified impacts. Additionally, where the initial SWE findings have subsequently been addressed by an EDC, a description of the update is provided in this report in a footnote to the original finding.

4.1 Residential Sector Programs

This section summarizes initial observations, findings and recommendations issued to each individual EDC as a result of site inspections and desk audits performed over the program year. These inspections were conducted as a major part of the SWE's responsibilities to audit the EDC portfolios. EDCs have received audit findings and are already responding by incorporating comments and recommendations to improve implementation and evaluation of their portfolios.

4.1.1 Residential Lighting Programs

Residential lighting program design for PY1 varied by EDC and included the following strategies:

- Mail-in rebates,
- Point-of-sale rebates,
- Upstream buy-downs, and
- Giveaway events.

The SWE audit of these programs included the following tasks, which are summarized in Sections 4.1.1.1 through 4.1.1.4:

- Review reported kWh and kW program savings,
- Verify TRM savings calculations,
- Verify CFL_{watts} assumptions,
- Review database for accuracy, and
- Identify program anomalies.

4.1.1.1 Residential Lighting Program Savings Summary

Below is a summary of the savings reported for each EDC's residential lighting program. The tables include the gross and verified savings, where applicable, as well as the percent of PY1 savings attributed to the program. As indicated in the tables below, the savings associated with the residential lighting programs in PY1 constitute a large portion of the reported PY1 savings.

Table 4-1: PYTD Gross and Verified MWh Savings

EDC	Program	PYTD Reported Gross Impacts (MWh)	Realization Rate	Preliminary PYTD Verified Impact (MWh)	% of PY1 Verified MWh Savings
Allegheny	CFL Rewards Program	82	N/A	N/A	0%
PECO	Smart Lighting Discounts Program	133,212	1.00	133,212	84.9%
PPL	CFL Campaign	61,838	1.00	61,838	73.1%
Met-Ed	EE Product Program[16]	3,844	1.00	3,844	31.4%
Penelec	EE Product Program[17]	4,338	1.00	4,337	35.7%
PennPower	EE Product Program[18]	3,632	1.00	3,631	64.9%

Table 4-2: PYTD Gross and Verified MW Savings

EDC	Program	PYTD Reported Gross Impacts (MW)	Realization Rate	Preliminary PYTD Verified Impact (MW)	% of PY1 Verified MW Savings
Allegheny	CFL Rewards Program	0.00	N/A	N/A	0%
PECO	Smart Lighting Discounts Program	7.30	1.00	7.30	64.7%
PPL	CFL Campaign	3.68	1.00	3.68	49.9%
Met-Ed	EE Product Program[19]	0.21	1.00	0.21	17.4%
Penelec	EE Product Program[20]	0.24	1.00	0.24	19.4%
PennPower	EE Product Program[21]	0.20	0.999	0.20	48.8%

Table 4-3: PYTD CFLs Distributed

EDC	Program	PYTD Bulbs Distributed	Average per Bulb Reported Verified kWh Savings
Allegheny	CFL Rewards Program	1,692	48.46[22]
PECO	Smart Lighting Discounts Program	2,878,301	46.28
PPL	CFL Campaign	1,342,595	46.06
Met-Ed	EE Product Program[23]	242,693	48.44[24]
Penelec	EE Product Program[25]		

[16] CFL measures and savings are included as part of the EE Products Program. The data presented in this table pertains to the EE Products Program in its entirety and is not specific to the CFL portion. CFL specific data obtained from "All Locations" Excel file provided by FirstEnergy on October 7, 2010.
[17] *Ibid.*
[18] *Ibid.*
[19] *Ibid.*
[20] *Ibid.*
[21] *Ibid.*
[22] Based on reported Gross MWh Savings.
[23] CFL measures and savings are included as part of the EE Products Program. CFL specific data obtained from "All Locations" Excel file provided by FirstEnergy on October 7, 2010.
[24] Based on reported Gross MWh Savings.
[25] CFL measures and savings are included as part of the EE Products Program. CFL specific data obtained from "All Locations" Excel file provided by FirstEnergy on October 7, 2010.

PennPower	EE Product Program[26]		

4.1.1.2 Review of Technical Reference Manual Savings Calculations Method

The SWE team reviewed the method used by each EDC to calculate the savings per bulb based on the delta Wattage assumptions provided by each EDC. Given the percentage of CFL savings in comparison to the total reported savings, this information review process is crucial to the audit activities. Section 4.2 of the 2010 TRM provides the protocol to be used to estimate CFL savings. The following equations apply:

$$\text{Electricity Impact (kWh)} = ((CFL_{watts} \text{ X } (CFL_{hours} \text{ X } 365))/1000) \text{ X } ISR_{CFL}$$ **Equation 1: CFL kWh Savings**

$$\text{Peak Demand Impact (kW)} = (CFL_{watts}) \text{ X Light CF}$$ **Equation 2: CFL kW Savings**

Where:

- CFL_{watts} = Average delta watts per purchased ENERGY STAR CFL
  - CFL_{watts} = Variable determined by EDC Data Gathering
- CFL_{hours} = Average hours of use per day per CFL
  - CFL_{hours} = 3 hours
- ISR_{CFL} = In-service rate per CFL
  - ISR_{CFL} = 84%
- Light CF = Summer demand coincidence factor

Light CF =5%

A summary of the SWE's findings during the review of each EDC's implementation of the TRM protocols for reporting CFL savings is presented in the following table. Very few discrepancies were found in the review, and the differences uncovered amount to less than a 1% savings difference associated with the particular lighting program. Based on these findings, the SWE team does not recommend revisions to the reported PY1 verified savings; however, the Team recommends that each EDC take actions to ensure that any errors identified in the review process do not reoccur in subsequent program years.

Table 4-4: TRM Savings Calculation Method Summary Review

EDC	Program	Notes	kWh Difference	kW Difference	% Difference – PYTD Verified kWh Savings	% Difference – PYTD Verified kW Savings
Allegheny	CFL Rewards	• No issues identified; all	0	0	0%	0%

[26] *Ibid.*

	Program	calculations completed according to the TRM protocol.				
PECO	Smart Lighting Discounts Program	• <0.01% of kWh savings entries by SKU differ from TRM calculation by >1%.[27] • 54% of kW savings entries by SKU differ from TRM calculation by >1%.[28]	-40.648.5	60.66	-0.03%	0.84%
PPL	CFL Campaign	• 3 bulb savings calculations differed from TRM protocol.	-6,190.2	-0.2617	<-0.01%	<-0.01%
Met-Ed	EE Product Program	• No issues identified; all calculations completed according to the TRM protocol.	0	0	0%	0%
Penelec	EE Product Program	• No issues identified; all calculations completed according to the TRM protocol.	0	0	0%	0%
PennPower	EE Product Program	• No issues identified; all calculations completed according to the TRM protocol.	0	0	0%	0%

4.1.1.3 CFL_{watts} Assumption Review

The SWE team reviewed the base incandescent equivalent assumptions used by each EDC to calculate the savings per bulb based on the TRM savings algorithm. The SWE team verified the assumptions of a sample of 20 bulbs. The assumptions were verified against manufacturer specifications when available; alternatively the equivalency assumptions were verified against the ENERGY STAR® CFL savings calculator, which assumes an equivalency factor of 4.6[29], or the ENERGY STAR® equivalency guidelines.

Table 4-5: Summary of CFL_{watts} Assumption Review

<table>
<tr><th>EDC</th><th>Program</th><th>Notes</th></tr>
<tr><td>Allegheny</td><td>CFL Rewards Program</td><td>• Utilized ENERGY STAR® equivalency table to determine incandescent baseline equivalents.
• Assumed CFL wattage equivalent.
<table>
<tr><th>Incandescent Watts</th><th>ENERGY STAR® CFL W Range</th><th>Actual Watt in Calculator</th></tr>
<tr><td>25</td><td>4 to 9</td><td>7</td></tr>
</table>
</td></tr>
</table>

[27] This factor was calculated by determining the number of database entries that had EDC calculated kWh or kW savings that differed from the SWE calculated values by more than 1%. This number was then divided by the total database entries to determine the percent of entries with EDC calculated savings that differed from the SWE calculated savings. Please note that these discrepancies may be due in large part to rounding errors and truncation issues.

[28] This factor was calculated by determining the number of database entries that had EDC calculated kWh or kW savings that differed from the SWE calculated values by more than 1%. This number was then divided by the total database entries to determine the percent of entries with EDC calculated savings that differed from the SWE calculated savings. Please note that these discrepancies may be due in large part to rounding errors and truncation issues.

[29] The incandescent wattage equivalent can be estimated by multiplying the CFL bulb wattage by a factor of 4.6.

		40 | 9 to 13 | 10 60 | 13 to 15 | 13 75 | 18 to 25 | 19 100 | 23 to 30 | 26 150 | 30 to 52 | 38 • All equivalency assumption fall within the range of the ENERGY STAR® equivalency guidelines.
PECO	Smart Lighting Discounts Program	• The CFL_{watt} assumption for the Phillips 75W R30 2pk measure does not match the manufacturer's specification and does not fall within the ENERGY STAR® equivalency guidelines.[30] • The CFL equivalent for a 75W incandescent should fall between an 18-25W CFL. PECO assumed a 15W bulb replacement.
PPL	CFL Campaign	• All equivalency assumption fall within the range of the ENERGY STAR® equivalency guidelines.
Met-Ed	EE Product Program	• All equivalency assumption fall within the range of the ENERGY STAR® equivalency guidelines.
Penelec	EE Product Program	• All equivalency assumption fall within the range of the ENERGY STAR® equivalency guidelines.
PennPower	EE Product Program	• All equivalency assumption fall within the range of the ENERGY STAR® equivalency guidelines.

Below is a summary of the per bulb impacts of any discrepancies noted in the CFL_{watts} assumptions SWE review. Based on these findings, the SWE team does not recommend revisions to the reported PY1 verified savings; however, the Team recommends that each EDC take actions to ensure that any observed errors do not reoccur in subsequent program years.

Table 4-6: Summary of CFL_{watts} Assumption Review – per Bulb Impact

EDC	Program	Wattage Discrepancy	No. Bulbs Impacted	per Bulb kWh Difference	per Bulb kW Difference
Allegheny	CFL Rewards Program	none	N/A	N/A	N/A
PECO	Smart Lighting Discounts Program	Phillips 75W R30[31]: 18W/75W	5,502	-2.76kWh	-0.0002kW
PPL	CFL Campaign	none	N/A	N/A	N/A
Met-Ed	EE Product Program	none	N/A	N/A	N/A
Penelec	EE Product Program	none	N/A	N/A	N/A
PennPower	EE Product Program	none	N/A	N/A	N/A

Below the per bulb impacts are extrapolated to report the impact of the discrepancy on the overall residential lighting program. Based on these findings, the SWE team does not recommend revisions to the reported PY1 verified savings; however, the Team recommends that each EDC take actions to ensure that any errors identified in the review process do not reoccur in subsequent program years.

Table 4-7: Summary of CFL_{watts} Assumption Review – Program Impact

EDC	Program	Wattage Discrepancy	Program MWh Difference	Program MW Difference	% kWh Difference	% kW Difference
Allegheny	CFL Rewards Program	none	N/A	N/A	N/A	N/A
PECO	Smart Lighting Discounts Program	Phillips 75W R30: 18W/75W	15.19MWh	0.0011MW	<-0.01%	<-0.02%
PPL	CFL Campaign	none	N/A	N/A	N/A	N/A
Met-Ed	EE Product Program	none	N/A	N/A	N/A	N/A
Penelec	EE Product Program	none	N/A	N/A	N/A	N/A

[30] PECO noted that these bulbs are ENERGY STAR qualified because the reflector type has the same lumen output using the directional reflector with a lower CFL wattage.
[31] PECO noted that these bulbs are ENERGY STAR qualified because the reflector type has the same lumen output using the directional reflector with a lower CFL wattage.

PennPower	EE Product Program	none	N/A	N/A	N/A	N/A

4.1.1.4 Database Quality

The SWE team reviewed each EDC's database for quality and accuracy. The review included a verification of invoice bulb counts and type. Additionally, the SWE team noted any anomalies or discrepancies that were found during the review. The results of this audit are presented in the following tables. Based on these findings, the SWE team does not recommend revisions to the reported PY1 verified savings; however, the SWE team recommends that each EDC take actions to ensure that these errors do not reoccur in subsequent program years.

Table 4-8: Summary of Residential Lighting Database Review

EDC	Program	Notes:
Allegheny	CFL Rewards Program	• Incomplete Datasets: o 69% of Models have unknown or undocumented manufacturers. o 26% of Models have undocumented wattages. o Note: For undocumented wattages or counts by bulb-type, Allegheny assumes 13W CFLs and 2 bulbs per pack. • Not all CFLs can be verified ENERGY STAR® as database indicates.[32] • Database tracks UPC codes; recommend tracking Model No. • Database is inconsistent on the Wattage values tracked – CFL or base. • Cannot verify rebate amount and date of issuance with actual check or invoice to Allegheny.
PECO	Smart Lighting Discounts Program	• 6 ECOS invoices provided with corresponding individual manufacturer invoices. • No issues identified with invoices provided. • Database contained several negative entries – both bulb counts and savings. PECO responded that counts correspond to returned bulbs.
PPL	CFL Campaign	*20 Giveaway Event Invoices* • 2 duplicate entries • 2 incorrect bulb counts *20 Retail Sales Invoices* • No issues identified with invoices provided. •
Met-Ed	EE Product Program	• 5 entries contain a negative bulb count, but have positive savings recorded.
Penelec	EE Product Program	
PennPower	EE Product Program	

Table 4-9: Savings Impact of Residential Lighting Database Review

EDC	Program	Discrepancy	kWh Difference	% kWh Difference	kW Difference	% kW Difference
Allegheny	CFL Rewards Program	*Database Accuracy*[33]*:*	N/A	N/A	N/A	N/A
PECO	Smart Lighting Discounts Program	*None:*	N/A	N/A	N/A	N/A

[32] Allegheny notes that ENERGY STAR qualification is not a program requirement and that this data field will be removed from their tracking system for this program.

[33] Any potential savings associated with discrepancies due to unknown wattage types or multi-pack bulb counts is unknown as Allegheny assumes a 13W CFL bulb and 2 bulbs per multi-pack when specific wattages and counts unknown. The SWE acknowledges these assumptions and, although it prefers accurate counts and wattages, understands that Allegheny is taking a reasonably conservative approach in their assumptions.

PPL	CFL Campaign	*Giveaway:* *Buy-Down*[34]*:*	-43,284.15 CND	-0.07% CND	-2.3529 CND	0.06% CND
Met-Ed	EE Product Program	*None:*	N/A	N/A	N/A	N/A
Penelec	EE Product Program[35]	*Negative Package Count:*	-292.50	-0.09%	-0.0159	-0.00%
PennPower	EE Product Program	*Negative Package Count:*	-68.07	-0.01%	-0.0037	-0.00%

4.1.2 Efficient Equipment Programs

Each of the seven Pennsylvania EDCs has an efficient equipment program in which they offer residential customers rebates for efficient product purchases. For all efficient equipment programs, the customer is required to submit a rebate application which includes a proof of purchase (merchant receipt or vendor installation invoice) and completed application. The EDCs then process these applications and mail the customer a check for the rebated amount. Rebated products include ENERGY STAR Appliances, High Efficiency Heat Pumps, CFL light fixtures, and programmable thermostats. For PY1, the SWE checked a sample of 20 rebate applications and supporting documentation against the database entries for those 20 customers for each EDC.

4.1.2.1 PPL

To audit PPL's Efficient Equipment program, the SWE chose 20 random customers from PPL's database for the program and then requested all rebate applications and receipts corresponding to the 20 customers pulled as part of the sample. The SWE found that, in going forward, it is better to sample 20 different tracking numbers as opposed to individual customers. PPL has many customers who install more than one efficient product; PPL tracks each measure installation independently.

The SWE team identified a few QC errors within the sample; the SWE communicated with PPL's database manager to sort out all issues. In the SWE's initial audit work, it was seen that one customer submitted a rebate for two programmable thermostats; however, the data provided did not show the second thermostat. When alerted of this issue, PPL responded by providing the additional tracking number and data entry for the second measure. A similar issue was identified for another customer who purchased two thermostats. However, upon further review by PPL, it was determined that this customer was rebated for only one of the thermostats. PPL then relayed the issue to their Conservation Service Provider (CSP), who then processed a rebate for the second thermostat.

The SWE team identified another issue whereby one customer purchased one clothes washer but the rebate was processed and paid twice. The SWE was assured that this error occurred early in the program, and a "Duplicate Account Number" control has since been implemented by PPL's CSP to prevent this from happening again.

The last QC issue identified included inconsistencies or data entry errors associated with product information. For example, one customer installed an Air Source Heat Pump with a Seasonal Energy

[34] Cannot determine (CND) savings differences associated with any potential discrepancies noted within the CFL retails sales dataset because, as of this report, the invoices have not been provided to the SWE team.
[35] Percent difference calculations based on EE Products Program verified savings.

Efficiency Ration (SEER) rating of 16; the rebate application indicated the equipment was actually a SEER 19.1.

4.1.2.2 FirstEnergy

To audit FirstEnergy's ENERGY STAR Appliance Rebate program, the SWE requested ten customers' rebate applications from each of the FirstEnergy utilities and the corresponding database for this program. The SWE received the ten random customers per utility and proceeded to check these against the FirstEnergy CSP's database. The database sample uploaded by FirstEnergy was not as comprehensive as other database samples from the other EDCs; it kept track only of the customer information (account number, address, name, etc), the type of appliance recycled, the rebate amount and how the rebate payment was made. There was no information concerning kWh savings or the make and model of the appliance in the database. However, the information that was in the database was, for the most part, consistent with the corresponding rebate applications, meaning the actual savings from the PA TRM were claimed for each measure. One QC error occurred when a customer was rebated for a refrigerator but there was no record in the database of his ENERGY STAR clothes washer which was on the same rebate application. At the time of this report, the SWE team has not yet been able to confirm with ADM. However, it is possible that the reason for this inconsistency is that the customer's clothes washer rebate had not yet been approved and was thus not entered in the database for PY1.

4.1.2.3 PECO

To audit PECO's Smart Home Rebates program, the SWE requested that a sample of 20 customers' rebate applications be uploaded as well as those customers' corresponding database entries. PECO was able to upload the 20 customers' applications, as well as a database sample, that showed the customer information, the type of measure installed and information specific to that measurement. There were two separate columns in the database sample, one for "Submitted kWh" and one for "Calculated kWh." For the five clothes washers and four dishwashers in the sample, the calculated kWh was lower than the submitted kWh. (For clothes washers it was reduced from 258kWh to 93.7kWh and for dishwashers it was reduced from 137 kWh to 94.5 kWh.)[36]

For the five PECO customers that applied for rebates via the web, the SWE was only given merchant receipts and vendor invoices to check against the PECO database (not a paper application). For these customers the measures rebated matched up with the efficient products purchased.

The remaining 15 customers mailed in rebate applications with attached receipts and invoices for the rebated products. There was one question found by the SWE where a measure in the database did not match the measure for which the rebate application was submitted. For this particular customer, the

[36] According to PECO, the reason for the difference is that Ecos originally reported values assuming electric water heat. ANB calculated the weighted average of water heat type using the results of the PECO territory Residential Saturation Survey. Ecos started reporting the weighted average by July of 2010. Ecos did not deviate from the TRM. It is unclear what, if any implications this has. PECO corrected the errors in applications.

rebate application shows installation of a natural gas furnace while the database shows him as having a rebated central air conditioner.[37]

4.1.2.4 Allegheny

To audit Allegheny's Efficient Products program, the SWE asked for a database sample of 20 program participants and the corresponding rebate applications sent to Allegheny by each participant. Allegheny provided the SWE with a stratified sample of rebate applications for the following:

- 4 Dishwashers,
- 4 Clothes Washers,
- 4 Clothes Dryers,
- 4 Refrigerators, and
- 4 Freezers.

In the Excel database sample, only the dishwashers, clothes washers, refrigerators and freezers had reported kWh usage. Of those savings, the average kWh usage per purchased appliance is:

- Dishwashers: 312kWh,
- Clothes Washers: 185kWh,
- Refrigerators: 531kWh, and
- Freezers: 604kWh.

In checking the submitted customer rebate applications against the Allegheny database entries, the SWE found a few inconsistencies for some of the appliances installed by program participants. Specifically, in each rebate application in which the customer installed an ENERGY STAR Appliance, they submitted an *EnergyGuide* with their application. This *EnergyGuide* is a product of the ENERGY STAR program by the U.S. Government and records information specific to the make and model of a purchased ENERGY STAR appliance such as size, estimated yearly operation cost and estimated kWh use.

For one Allegheny customer, the *EnergyGuide* submitted with the rebate application and the corresponding information in the Allegheny database taken from this *EnergyGuide* was not for the actual model number of the appliance purchased by the customer. The model number on the store receipt was WFW8400TW but the model number in the database and the *EnergyGuide* is H7KB3A0. In another instance the fridge purchased by the customer was a Frigidaire but the *EnergyGuide* and database entry for that customer were for an Electrolux.

[37] According to PECO, this instance refers to a customer whose measures did not match up to their receipt which shows installation of a natural gas furnace. It appears as if the customer filled out an old gas furnace rebate form and attached their receipt that shows both a furnace and central air. Ecos processed both rebates even though the form did not have the central ac. The ANB database shows rebates for gas furnace and central air conditioner.

A few QC issues occurred when the information on the submitted *EnergyGuide* was not entered into the database correctly. In one such instance the size of the freezer was incorrect and in another the kWh usage was off.

While it does not impact the savings produced, one QC issue occurred when the price for the appliance in the database was inconsistent with the price on the merchant receipt.[38]Another QC issue was sited when the rebate form was filled out and signed by a participant who also received the rebate check. However, the customer in the database, and Allegheny's customer, is someone else with a different last name. This prompted further review to which Allegheny responded that the rebate was requested by the female resident of the home. This male resident of the home is the Allegheny account holder. Therefore, the rebate check was issued to the male resident of the home that is the Allegheny account holder. The address on the Allegheny account and the address on the rebate form were the same.[39]

4.1.2.5 Duquesne

In order to audit Duquesne's Efficient Equipment Rebate Program (REEP), the SWE traveled to Duquesne's headquarters. There, the SWE obtained a sample of 35 REEP participants and checked these participants' rebate applications against the Duquesne database. The SWE found that all participants sampled had active Duquesne accounts, and all measures that were rebated were on the approved list. Each measure could either be found in the energy catalog (which required the participant to submit an application and receipt) or was a part of a Duquesne approved energy efficiency kit, in which case Niagara LLC, Inc.'s, (Duquesne's CSP) invoices to Duquesne were cross-checked with shipping receipts and payment vouchers. These "Community Outreach Kits" would have been distributed at community events and include 2-13W CFLs, 1-20W CFL and a furnace whistle. Niagara manufactures and distributes these kits and the products within them.

While at Duquesne headquarters, the SWE also completed a desktop audit of Duquesne's "School Energy Pledge Program." In this program, participating schools' student bodies (all students in the school) attend an assembly where they learn about energy efficiency. After the assembly, the students take a Pledge Form home. If the family elects to participate in the program, the parent or guardian signs and dates the Pledge Form and submits the form to the Program via the participating school. In return for the family's commitment to install energy efficiency kit components, the School Energy Pledge Program pays the participating school a cash incentive per student ($25). Upon receipt of the completed Pledge Form, the program mails an energy efficiency kit to the home. For participating schools this is a school fundraiser program.

It is important to note that the program does not provide free energy efficiency kits and assume they are installed. The program provides money to schools in return for performance from voluntary parent/guardian participants.

[38] While the SWE recognizes this error does not affect savings, the SWE is also responsible for checking expenditures of both EDCs and customers.

The Pledge Form is a signed and dated commitment to install EE kit components, comprising participant self-certification regarding their performance of agreed-to program parameters. Payment of a cash incentive to their child's school constitutes monetary consideration for participant performance. Survey questions regarding participant performance serves to confirm and verify the participant's written self-certification.

The energy efficiency kits either contain:

1. 5-13W CFL, 2-Limelight, Furnace Whistle or
2. Limelight, Furnace Whistle, 3-13W CFL, 1-20W CFL, 1-23W CFL.

There were 4,750 kits distributed through the School Energy Pledge Program during PY1. For this program the SWE team found the deemed savings adjustment (DSA) for kW was very low because PMRS, Duquesne's internal database and tracking system, overstated kW as compared to TRM values.

The proof-of-purchases, invoices, and receipts paid from Duquesne Light were all verified by the SWE via Niagara's invoices.

As part of their own EM&V, Duquesne verified participation via telephone survey of 35 participants of both the School Energy Pledge Program and REEP. The SWE found that the surveys do not verify installation of specific measures within a kit.[40] For this reason the SWE could not verify from Duquesne's EM&V that all individual kit measures were installed and were generating kWh savings.

4.1.3 Appliance Recycling Programs

In general, the SWE team audited the appliance recycling programs by reviewing a sample of 20 Appliance Recycling work order from JACO, the implementation contractor, for each of the seven EDCs against the database entries used by each EDC to track program participants. A summary of the SWE team findings by EDC are provided in the following sections. Section 6.2.1.3 explains the SWE's findings and its review of the kWh and kW savings calculations for this program for each EDC. Section 4.1.3.1 to 4.1.3.5 explains our findings relating to the documentation maintained by each EDC to support program savings calculations.

Please note that the numbers provided in this section of the report (Section 4.1.3) represent the average kWh usage for refrigerators, freezers and room air conditioners at the time they were manufactured. These usage figures are listed in JACO's databases for each utility. The SWE team has simply summarized the kWh usage data in this section of our report. The SWE team believes that this data is informative, however, we are not recommending that this data be used as a basis for updating the deemed savings in the TRM because it does not adjust for energy savings degradation over time and the data is not representative of the age of the appliances removed. In response to comments provided by the EDCs, the SWE team has clarified the data tables in this section to note that the data reported is the

[40] While the survey did not track installation of individual kits components, each kit component has a deemed TRM savings and in-service-rate. The in-service rate represents the percentage of customers that install the associated measures. It is recommended that Duquesne track the installation of each measure in PY2.

kWh usage at the time an appliance was manufactured, not at the time an appliance is removed. The clarified data will be retained in this section (1) because it is an indicator that annual kWh savings may be less than the 1,728 annual kWh savings in the TRM and (2) the data in the JACO databases for Pennsylvania EDCs provides up to date reporting of the specific characteristics (manufacturer, model, etc.) of removed appliances in the state of Pennsylvania. More information on the SWE team's recommendations for updating the TRM is provided in Section 6.5.3.[41]

4.1.3.1 PPL

A random sample of 20 different Appliance Recycling participants from the PPL database was provided to the SWE team for review against PPL's database entries for these participants. The database entries were obtained on a site visit to PPL.

For each participant, the SWE verified that the number and type of appliances removed was accurate. The SWE team observed that each of the 20 participants' data was consistent in both PPL and JACO's databases; PPL's reported savings are also consistent with the TRM.

The following tables summarize the annual kWh usage data collected by JACO for individual recycled appliances. JACO obtains this data for the time of purchase of the appliance from a database from Home Energy Magazine.

Table 4-10: JACO Supplied Annual kWh Usage Data Summary for Recycled Refrigerators – PPL

Total number of Refrigerators Recycled:	4,462
Number of Refrigerator with Reported kWh Usage:	1,630
Percent of Refrigerator with Reported kWh Usage:	37%
Mean:	1,080.7
Median:	1,043.5
Mode:	690.0
Standard Deviation:	344.5

Table 4-11: JACO Supplied Annual kWh Usage Data Summary for Recycled Freezers – PPL

Total number of Freezers Recycled:	1,608
Number of Freezers with Reported kWh Usage:	213
Percent of Freezers with Reported kWh Usage:	13%
Mean:	1,105.9

[41] The annual kWh usage data reported in the JACO database is the annual kWh usage of the refrigerator at the time it was originally manufactured. This clarification was provided to the SWE team by JACO via an email from Sam Sirkin, JACO's Program Development Manager, on October 14, 2010. This clarification applies to all of the JACO supplied kWh usage data for refrigerators, freezers and room air conditioners. JACO stated that the energy performance should be degraded based on age of unit to determine savings.

Median:	1,046.0
Mode:	1,046.0
Standard Deviation:	382.1

4.1.3.2 FirstEnergy

Because FirstEnergy does not yet have an independent database system in place, the SWE reviewed a sample of 20 JACO invoices for recycled appliances against the 20 corresponding database entries in the JACO database. In this review, the SWE found that the numbers and types of appliances recycled agreed between the database entries and the work orders, and that FirstEnergy's reported savings are consistent with the TRM.

In its additional evaluation efforts related to review of the savings used in the TRM, the SWE team also discovered that many recycled appliances have actual kWh usage data recorded by JACO in their database for FirstEnergy and other EDCs. This usage data refers to the kWh usage at the time of purchase or manufacturer of the appliance. Therefore these numbers are not consistent with the actual kWh usage of the appliance at the time of pick-up. The SWE Team had access to the entire JACO database corresponding to the appliance recycling in FirstEnergy's service territory. The findings from a review of the savings (mean, medians, modes, etc) are reported in the following tables.

Table 4-12: JACO Supplied Annual kWh Usage Data Summary for Recycled Refrigerators – FirstEnergy

No. of Appliance with Reported kWh Usage:	74
Mean:	1,005.6
Median:	845
Mode:	845
Standard Deviation:	331.4

Table 4-13: JACO Supplied Annual kWh Usage Data Summary for Recycled Freezers – FirstEnergy

No. of Appliance with Reported kWh Usage:	702
Mean:	1,083.35
Median:	1,039
Mode:	690
Standard Deviation:	360.9

Table 4-14: ADM Supplied Annual kWh Usage Data Summary for Recycled Room ACs – FirstEnergy

No. of Appliance with Reported kWh Usage:	193
Mean:	261.5
Median:	268

Mode:	268
Standard Deviation:	37

The SWE team concludes that the average annual kWh usage (at the time of manufacture) reported by JACO for recycled refrigerators of 1,083kWh for the FirstEnergy services area is likely to be far less than the 1,728kWh assumed in the 2010 TRM. On the other hand, the SWE team recognizes that it is important to factor in degradation of refrigerators and freezers over time, and this will result in higher annual kWh use as these appliances age. More information on this TRM savings issue for these residential appliances is provided in Section 6.5.4.1.

4.1.3.3 PECO

To audit PECO's Smart Appliance Recycling Program, the SWE checked a sample of 20 program participants from PECO's database against their corresponding JACO work orders. In this random sample there were a total of seven recycled room air conditioners, six recycled freezers and 15 recycled refrigerators.

Of the 20 work orders sampled, all 20 work orders lacked a signature from the owner/representative at the bottom of the JACO work order.

All information on the 20 participants sampled was consistent between the database and corresponding work orders. One participant's work order stated in the comments section that the rebate check should be issued to a customer different from the participant information on the work order. This information is also noted in the database for that customer.

4.1.3.4 Allegheny

To audit Allegheny's Appliance Recycling Program, the SWE checked a database sample of 20 program participants against their corresponding work orders sent by Allegheny. In the sample there were 20 refrigerators and one freezer recycled.

Of the 20 work orders sampled, 12 lacked a signature from the owner/representative at the bottom of the invoice.

Only one QC issue was found in this audit where the refrigerator recycled by a participant was reported as being 19 cubic feet in one place on the JACO work order, and then 15 cubic feet in another. The number reported by Allegheny was 15 cubic feet.

The SWE also was able to obtain a full JACO database for Allegheny's recycled appliances. The summary tables of the SWE's findings are below.

Table 4-15: JACO Supplied Annual kWh Usage Data Summary for Recycled Refrigerators – Allegheny

Total number of Refrigerators Recycled:	267
Number of Refrigerator with Reported kWh	148

Usage:	
Percent of Refrigerator with Reported kWh Usage:	55%
Mean:	1,074.8
Median:	1,016
Mode:	1,632
Standard Deviation:	361.2

Table 4-16: JACO Supplied Annual kWh Usage Data Summary for Recycled Freezers – Allegheny

Total number of Freezers Recycled:	49
Number of Freezers with Reported kWh Usage:	5
Percent of Freezers with Reported kWh Usage:	10%
Mean:	909
Median:	948
Mode:	N/A
Standard Deviation:	272

(No information was given on actual kWh usage of the 13 recycled room air conditioners).

4.1.3.5 Duquesne

The SWE traveled to Duquesne to audit a sample of Appliance Recycling program participant work orders against the corresponding entries in the Duquesne database. Of the 20 participants sampled by the SWE, no QC issues were identified, and Duquesne's reported savings are consistent with the TRM.

In addition to checking vendor invoices against the Duquesne database, the SWE team was able to audit a sample of surveys sent to Appliance Recycling program participants. The surveys asked participants questions concerning their recycled appliances. Part of survey verification was to confirm with the customer that the recycled appliance was working (i.e., does the participant remember JACO testing the unit). In the SWE's review of the surveys it was discovered that one customer surveyed said the refrigerator was unplugged and therefore not tested. Upon review of JACO's work orders, the SWE discovered that JACO, the vendor, claimed the refrigerator was in working order before it was picked up.[42]

The SWE also was able to obtain a full JACO database for Duquesne's recycled appliances. The summary tables of the SWE's findings are below

[42] As stated in Duquesne Light's Annual Report to the Pennsylvania Public Utility Commission for the Period December 2009 to May 2010 Program Year 2009 For Act 129 of 2008 Energy Efficiency and Conservation Programs, September 15, 2010, Exhibit 1, Section 3.3 : Verification check list Step 5-Participation and Installation Verification, at page 24, for this program included a telephone survey where after implementing Duquesne Light reported one out of 35 sampled participants reported their refrigerator was not tested; further described in Exhibit 1 Appendix J footnote 1 "Participant reports to have had the refrigerator running but unplugged it prior to JACO's arrival to pick it up; fails participation test.

Table 4-17: JACO Supplied Annual kWh Usage Data Summary for Recycled Refrigerators – Duquesne

Total number of Refrigerators Recycled:	275
Number of Refrigerator with Reported kWh Usage:	105
Percent of Refrigerator with Reported kWh Usage:	38%
Mean:	1,062
Median:	998
Mode:	690
Standard Deviation:	351

4.1.4 Home Performance Program

Allegheny implemented a Residential Home Performance Program in PY1 which includes the following:

- On-line energy analysis,
- 4 CFLs mailed to requesting participants, and
- CFL give-away events to promote the program.

For PY1, the only savings attributed to this program are those associated with the distributed CFLs.

The SWE audit of this program included the following tasks:

- Review reported program savings,
- Verify TRM savings calculations,
- Verify CFL_{watts} assumptions,
- Review database for accuracy, and
- Identify program anomalies.

A summary of the reported and verified savings associated with this program is identified in the following tables.

Table 4-18: PYTD Gross and Verified MWh Savings

EDC	Program	PYTD Reported Gross Impacts (MWh)	Realization Rate	Preliminary PYTD Verified Impact (MWh)	% of PY1 Verified MWh Savings
Allegheny	Home Performance Program	714	0.96	685	23.2%

Table 4-19: PYTD Gross and Verified MW Savings

EDC	Program	PYTD Reported Gross Impacts (MW)	Realization Rate	Preliminary PYTD Verified Impact (MW)	% of PY1 Verified MW Savings
Allegheny	Home Performance Program	0.00	0.96	0.00	0.0%

Table 4-20: PYTD CFLs Distributed through Home Performance Program

EDC	Program	PYTD Bulbs Distributed	Average per Bulb Reported

			Verified kWh Savings
Allegheny	Home Performance – Give-Away	2,419	57.68
Allegheny	Home Performance – Online Analyzer	9,456	

The SWE team reviewed the method utilized by Allegheny to compute the savings associated with the CFLs distributed under the Home Performance Program. Allegheny adhered to the protocols outlined in the TRM and explained in Section 4.1.1.2 of this report. There were also no issues with regards to the CFL_{watts} assumptions utilized by Allegheny in this program.

The SWE team reviewed Allegheny's database for quality and accuracy. The review included a verification of invoice bulb counts for a sample of the give-away and online audit recipient invoices. The SWE team noted any anomalies or discrepancies that were found during the review. The results of this audit are presented in the following tables. The savings difference associated with any issues identified during the review amount to a change of less than 0.5%.

Table 4-21: Summary of Home Performance Database Review

EDC	Program	Notes:
Allegheny	Home Performance	• Give-Away Events o Uniontown Mall ▪ An extra bulb was included in the database. o Westmoreland Earth Day Event ▪ 203 participant records, 200 recorded in database. ▪ 12 participant records indicated NOT Allegheny customers, but savings were in fact reported. ▪ 9 participant records indicated that they did not know if they were Allegheny customers, but savings were in fact reported. • Online Analyzer Recipients o No invoice for bulb mailed 3/18/2010.

Table 4-22: Savings Impact of Home Performance Database Review

EDC	Program	kWh Difference	% kWh Difference	kW Difference	% kW Difference
Allegheny	Home Performance – Give-Away	-2,620.51	-0.38%	-0.1424	-0.38%
Allegheny	Home Performance – Online Analyzer	-283.30	-0.04%	-0.0154	-0.04%

4.1.5 Residential Low-Income Programs

This section summarizes initial observations, findings and recommendations issued to each individual EDC as a result of site inspections and database verification performed between June 2010 and August 2010 at the completion of PY1. These inspections were conducted as part of the SWE's responsibilities to audit the EDC portfolios. EDCs have received Site Visit Summary Reports and have responded to comments and recommendations to improve implementation and evaluation of their portfolios.

The SWE conducted site visit inspections of the six currently active Low-Income Energy Efficiency programs. These site-visits took place on various dates between June 2010 and August 2010. The purpose of these site visits was to verify that the number and type of energy efficiency measures listed in each EDC's database for their low-income program participants (the ones selected at random for the site visits) were installed and operational. Another purpose of these site visits was to verify that the

energy efficiency measure information in each utility's data base was accurate. It should be noted that Duquesne did not implement a standalone Low-Income Program in PY1 and therefore no site visits were conducted for this utility.

The site visits were coordinated between the SWE representative and either an EDC representative or the EDC evaluation implementation contractor. To improve the efficiency of this process, some site visits were conducted concurrent with the EDC's own evaluation efforts. In total, 63 site visits were conducted of Low-Income program participant locations. The SWE was aiming to complete at least 10 site-visits per EDC but conduct more where the program distributed energy efficiency kits, to ascertain the rates of installation for the individual measures within the kit. It conducted less where the total sample size was too small to schedule enough willing participants.

One major reason for conducting the site visits is to verify the installation of each line item in the contractor invoices or work orders provided to the SWE. Some EDCs (PPL, PECO, FirstEnergy) conducted a direct install program where the efficiency measures were to be installed on an *as needed* basis. In this instance, the invoices should accurately reflect the quantities and types of measures installed. In another delivery approach, the Allegheny Low-Income Program distributed "energy efficiency kits" to program participants rather than directly installing the devices.

Where possible, the SWE compared the site inspection observations and each EDC's set of invoices with the EDC's "Program Tracking" database. Each EDC provided database extracts or remote access to their data tracking and reporting systems (e.g. PPL's EEMIS system).

The qualitative results of the SWE's on-site visits are based on visual observations and questions directed to the householder. The official list of energy efficiency measures to be checked at each participant location was developed well in advance of the on-site inspection. The SWE team found that the inspection results could be affected by a customer's level of awareness and his/her ability to recall the location of non-program related CFLs. Additionally, participant statements regarding each CFL's usage level (hours of use) could affect the amount of kWh savings achieved. The on-site visits provided information that indicates that many CFL bulbs were installed in low hours of use sockets.

During the site-visits, the SWE representative found issues related to what was installed and the resulting amount of savings. The common issues identified during site-visit verification of all EDC Low-Income Programs are:

- Incorrect CFL counts;
- Installation of CFLs in low usage sockets;
- Difficulty identifying, with accuracy, which CFLs were installed by the EDC as part of the Act 129 program; and
- Where Energy Efficiency Kits were provided, low installation rates for faucet aerators and night lights.

The specific issues identified during each set of EDC customer site-visits are recorded in the following list. Please note that at the time of this publication, some of these issues may already be resolved as the

SWE team provided detailed findings and recommendations to each EDC in a site visit report during July 2010 and August 2010.

4.1.5.1 Allegheny

The 18 site-visits to Allegheny's customers raised the following issues for Allegheny's Low-Income Energy Efficiency Program[43]:

- Because measures are distributed in "kits," there is no data in the utility's database representing the actual individual unique measure installations. Based upon the information collected during the site-visits, the current estimated installation rate on the unique measures within the kits, such as bathroom faucet aerators is approximately 25%. Currently, the savings are entered into the EDC's energy savings calculator at the product level (CFLs, low-flow showerheads, and faucet aerators) and product levels are summed to estimate total Energy Efficiency Kit savings.
- The spot checks identified low installation rates. Most faucet aerators and low-flow showerheads were not installed.
    - 11 out of 18 cases (61%) did not have the low-flow showerhead installed.
    - 9 out of 18 cases (50%) did not have the kitchen faucet aerator installed,
    - 13 out of 18 cases (72%) did not have at least one of the two bathroom aerators installed.
    - In most cases, the faucet aerators provided by the contractor had the incorrect thread, (i.e. the aerator had a male thread where the faucet required a female thread).
    - Contractors did not install the aerators in every case. For example, if an old low-flow aerator (e.g., 1.5 to 2gpm) of some kind already existed, that aerator might not be replaced with the 1.0gpm aerator provided in the kit.
- CFLs were not installed but left in the kit for the homeowner to install. In three out of 18 (17%) cases, five or more of the six CFLs provided were not installed.
- For the SWE to accurately review the savings achieved and to ensure a high measure installation rate, it would be ideal to revert to a per-measure basis rather than a savings estimate for the kit.[44]

4.1.5.2 Duquesne

No site-visits were conducted in PY1.

4.1.5.3 PECO

The ten site visits to PECO's customers raised the following issues for PECO's Low-Income Energy Efficiency Program:

[43] Allegheny Power is working with its program administrator to be able to track the energy efficiency kit measures installed by program participants. Additionally, Allegheny Power is working with its program administrator to improve options available for replacement of the water heating measures as well as the overall installation rates.

[44] As of the filing of this report, Allegheny is working with its program administrator to track the energy efficiency kit measures installed by program participants. Additionally, Allegheny is working with its program administrators to improve options available for replacement of water heating measures as well as to improve the overall installation rate of each measure.

- There were some instances where the number of CFLs installed differed from the number recorded in the work order/invoice.
- In one case where two faucet aerators were provided and invoiced, only one aerator was actually installed. The contractor left a second aerator with the customer but did not install it.
- For the most part, CFLs are being installed in the correct high-use sockets. In some cases, however, the CFLs provided by the contractor are being installed in low-use sockets including the basement and closets[45].
    - There are cases where customers indicated that some high-use sockets in bedrooms or other high-use rooms did not receive CFLs. It is possible that the contractors did not properly identify all of the high-use sockets.
    - In fixtures with multiple sockets (e.g. dining room or bathroom vanity) some customers had de-lamped the provided CFLs by twisting them enough to disable them. This may be an installation rate issue.

4.1.5.4 PPL

The 10 site-visits to PPL's customers raised the following issues for PPL's Low-Income Energy Efficiency Program:

- Formatting issues with the EEMIS system – measure lists within the case file were incomplete; either due to incomplete data entry or that the user interface truncated the list at 10 entries without providing the facility to move to the next page of measures.[46]
- Inaccurate recording of the number of units in package measures resulting in extremely high, incorrect savings values in the EEMIS system.
    - For example, attic installation was often recorded in square feet of coverage, instead of the default "1" for the package measure. This creates a large discrepancy, often as large as 100,000+ kWh. It will be essential to ensure that this discrepancy is remedied immediately. The EDC representative was unsure if it was an error with the user interface or the database.
- For attic insulation measures, the contractors are recording these on the invoice multiple times for the various sections of the attic that were insulated. For example, the slope, flat section and knee wall could be recorded as three individual measures. In most cases these measure unit quantities default to "1" but in some cases there three identical measures recorded in the EEMIS system for each part of the attic blow-in task. This has the effect of tripling the deemed savings.
- Data is currently heavily dependent on the accuracy of each Installation contractor's entries.
- There is some doubt surrounding the invoice/measure summary counts for smaller measures (e.g., CFLs and faucet aerators).
    - There were multiple cases where the number of CFLs installed differed from the number recorded in the work order/invoice.

[45] The SWE team asked program participants if the CFLs installed were placed in the low-usage socket by the EDC's conservation service provider. It was determined by the SWE team during these on-site inspections that there is a high probability that these bulbs were installed in low-usage sockets by the EDC CSP.
[46] This issue has now been resolved in a recent version of the PPL EEMIS system.

- There was one case where it was doubtful that more than one faucet aerator was installed, but two aerators were invoiced. The customer was unsure of the number installed.

- It appears that some contractors were overzealous in installing CFLs. s indicated that some houses received over 20 CFLs, with many located in low usage sockets such as closets.
  - In fixtures with multiple sockets (e.g., dining room or bathroom vanity) some customers had de-lamped the provided CFLs by twisting them enough to disable them. This may be an installation rate issue.
  - According to the PPL EEMIS database, several participants received 20 or more CFL bulbs with the highest quantity installed for one participant was 37.[47]

4.1.5.5 Met-Ed

FirstEnergy's low-income direct-installation programs include WARM Plus (treatment of homes in addition to LIURP WARM program) and WARM Extra Measures (installation of measures that are not included in the LIURP WARM Program). The nine site-visits to Met-Ed's customers raised the following issues for Met-Ed's Low-Income Energy Efficiency Program:

- Lighting socket eligibility for CFLs was extended by Met-Ed by reducing the required hours-of-use per socket from 2+ hours per day to 1+ hours per day under the WARM Extra Measures program. While the current PA TRM stipulates 3 hours per day for CFL usage, FirstEnergy reports impacts for the WARM Extra Measures program based on a protocol using 1.5 hrs/day.[48]
- Numerous cases of bulbs being installed in sockets identified by the customer as low-use sockets. In this Met-Ed site-visits sample, no CFLs were identified in basement sockets.
- Lack of detail and suspected CFL location errors in contractor's field notes.

[47] The SWE requires the EEMIS system to accurately represent the cost and quantity of measures installed in the Low-Income Energy Efficiency Program. Because contractors invoice PPL with measure level detail on costs and quantities, it is important that the SWE, PPL and EDC evaluators are able to verify measure installations during spot-check site-visits, conduct verification of measure-level savings calculations if changes in the Audit Plan necessitate it, verify measure costs and conduct any measure-level cost-benefit analyses, and identify anomalies in cost or quantity of measure installations.

The SWE also needs to be able to verify installations to ensure that a diverse and comprehensive set of energy efficiency measures are being implemented to justify the deemed packaged savings sourced from previous LIURP data. PPL's EE&C Plan (pg.104) submitted on September 15, 2010 stipulates that "ongoing monitoring of program activities through the planned Energy Efficiency Management Information System [EEMIS] and impact evaluations will be the primary means of tracking and validating savings for all proposed programs in the Plan." It also continues to stipulate that "The Company will ensure the necessary data for conducting impact evaluations will be available from the Tracking System. At a minimum, these data will include the following: "Type and frequency of installed measures", "Estimated savings" and "Measure cost".

[48] This "Low-income Lighting" protocol was submitted to the SWE. It was recommended to FirstEnergy to calculate the savings based upon the hours-of-use threshold used in their WARM Extra Measures program. This protocol was not approved for use in the TRM due to the lengthy deliberations on lighting hours of use for all EDCs. This protocol was abandoned in favor of a homogenous protocol for all EDCs.

- Some spare bulbs distributed (according to customer) but false locations recorded in contractor's notes.
- Some bulb burnouts – either due to faulty wiring or faulty bulbs.

4.1.5.6 Penelec

FirstEnergy's low income direct-installation programs include WARM Plus (treatment of homes in addition to LIURP WARM program) and WARM Extra Measures (installation of measures that are not included in the LIURP WARM Program). The nine site-visits to Penelec's customers raised the following issues for Penelec's Low-Income Energy Efficiency Program:

- Lighting socket eligibility for CFLs was extended by Penelec by reducing the required hours-of-use per socket from 2+ hours per day to 1+ hours per day. While the current PA TRM stipulates 3 hours per day for CFL usage, FirstEnergy reports impacts for the WARM Extra Measures program based on a protocol using 1.5 hours per day.[49]
- A total of four invoiced CFLs were unable to be located and identified during the site-visits.
- A review of the contractor documentation and the site-visit notes on the locations of CFLs found in the participant's home indicated that the recorded locations of the CFLs were not always accurate. Although the locations of the CFLs are incorrect, the total count is typically correct.
- Most bulbs installed are 13 Watts; the invoiced Act 129 CFLs are recorded as 15-16 Watts. There were no 15-16 Watt CFLs in this sample.[50]
- It was difficult to ascertain which bulbs were attributable to Act 129 and which were not.[51]
- There were 16 CFLs installed in low-usage sockets in basements across the site-visits in the Penelec sample. More bulbs were found in low-usage sockets (as determined by the householder present) around the participants' homes.
- Some *apparent* opportunities to install CFLs in high use sockets were missed. Note that this may not have been the case during the original installation and that the customer does not recall the reason or if perceived hours of use changed.

4.1.5.7 PennPower

The seven site-visits to PennPower's customers raised the following issues for PennPower's Low-Income Energy Efficiency Program:

[49] This "Low-income Lighting" protocol was submitted to the SWE. It was recommended to FirstEnergy to calculate the savings based upon the hours-of-use threshold used in their WARM Extra Measures program. This protocol was not approved for use in the TRM due to the lengthy deliberations on lighting hours of use for all EDCs. This protocol was abandoned in favor of a homogenous protocol for all EDCs.

[50] FirstEnergy reported to the SWE that a database error was identified by contractors in late June and corrected in early July. The price of the different size CFLs was the same. However, this error caused FirstEnergy to understate deemed savings.

[51] First Energy has made program policy changes based on ADM and SWE's comments after initial SWE site-visits. One major improvement involves marking all CFLs installed through these programs with a permanent pen. This will facilitate M&V and EM&V field efforts hereafter.

- Lighting socket eligibility for CFLs was extended by PennPower by reducing the required hours-of-use per socket from 2+ hours per day to 1+ hours per day. While the current PA TRM stipulates 3 hours per day for CFL usage., FirstEnergy reports impacts for the WARM Extra Measures program based on a protocol using 1.5 hours per day.SWE[52]
- In some site-visits the number of CFLs installed/identified differed from the quantity recorded in the work order/invoice. This could be attributed to either the differences in programs, data entry errors, different invoicing methods between programs, post installation removal by customer, non-disclosure of other locations by customer, etc. Every effort was made to locate all CFLs and identify which CFLs were pre-existing.
- CFLs provided by the contractor are being found in low-use sockets either in the basement or in sockets identified as low use sockets by the resident.
- There were cases where some exterior and kitchen high-use sockets did not receive new CFLs.

4.2 Non-Residential Sector Programs

This section summarizes initial observations, findings and recommendations issued to each individual EDC as a result of site inspections and desk audits performed over the program year. These inspections were conducted as a major part of the SWE's responsibilities to audit the EDC portfolios and were designed to capture a wide perspective over the portfolio, including pre-installation and post-installation visits, implementation and evaluation visits, and ride-along and independent visits. For PY1, the SWE team conducted 86 on-site visits to program participations. EDCs have received site inspection findings and are already responding by incorporating comments and recommendations to improve implementation and evaluation of their portfolios.

The SWE C&I Team has and is continuing to conduct audit activities to provide feedback to the EDCs and the PA PUC relative to the processes in place to assure the quality of savings claimed by the EDCs. The quality control activities performed by the SWE include site inspection for a small sample of C&I projects to confirm that savings estimation methods follow approved protocols and to note areas where the methods used to measure and validate savings can be improved. Feedback in the field from implementer CSPs and evaluator CSPs is important to the SWE as modifications to the TRM and the *Audit Plan* are considered and as new protocols that may be required are defined.

Efforts for the first program year have been largely qualitative. Areas where compliance to protocols can be improved have been highlighted and areas where the TRM or its application may need to be improved have been noted. As part of this process, the SWE team has also spent considerable time working productively with EDC representatives to help develop CMPs on key projects.

4.2.1 Allegheny

The SWE C&I team has performed a total of seven site inspections to date for C&I facilities for Allegheny to verify savings and compliance with the TRM and CMPs. Three programs were sampled for inspection:

[52] This "Low-income Lighting" protocol was submitted to the SWE. It was recommended to FirstEnergy to calculate the savings based upon the hours-of-use threshold used in their WARM Extra Measures program. This protocol was not approved for use in the TRM due to the lengthy deliberations on lighting hours of use for all EDCs. This protocol was abandoned in favor of a homogenous protocol for all EDCs.

C&I Lighting Efficiency Program; Government, Institutional, and Non-Profit Program; and Custom Applications Program. Individual site inspection reports can be provided upon request for review. The major findings are discussed in the following sections.[53]

4.2.1.1 Database Calculations

The majority of the programs implemented by Allegheny generally follow a prescriptive approach in which customers are awarded incentives on a per measure basis. This does not require the customer to determine the estimated energy and demand savings associated with the project. Instead, measure savings are based upon a prescriptive list, and total savings for a project are calculated after the application is completed and submitted. When Allegheny originally submitted their C&I database to the SWE for review in July 2010, calculations were performed by hand and manually entered into the database, leaving potential for mathematical and data entry errors.

Auditing the database for the C&I Lighting Efficiency Program revealed that savings were calculated improperly for two of the four projects inspected. In one case, retrofit watts were used to calculate savings instead of delta watts ("existing watts" minus "retrofit watts"). In another case, a decimal point error resulted in dramatically underestimated savings. There is no impact on the current reported or verified savings because no C&I Lighting Efficiency savings were reported for PY1. Allegheny and its evaluators noted this issue, reviewed their database, and will correct for such errors during the program evaluation during the next program year. It is recommended that Allegheny prioritize the development of a central database that can be monitored to catch these errors. Ideally, a tracking system would handle the inputs and calculate savings automatically according to the appropriate protocol, minimizing calculation errors.

4.2.1.2 Lighting Protocol

Allegheny's C&I Lighting Efficiency programs generally calculated savings according to TRM protocols, but omitted key variables, including: stipulated hours of use, stipulated coincidence factors, interactive effects, and lighting controls savings factors. Application of these variables has the potential to increase Allegheny's reported savings for this program and more accurately represent impacts. The impact of this issue is relatively minor since lighting impacts were marginal in PY1. Allegheny's application forms have subsequently been updated to include worksheets that follow 2010 TRM standards.

4.2.1.3 Quality Assurance/Quality Control of Implementers

The only C&I program to experience claimed and evaluated savings was the Government, Schools, and Non Profit (G/S/NP) program, specifically the no-cost CFL and Light Emitting Diode (LED) exit sign giveaways. The implementation for this program was conducted internally by Allegheny. This portion of the G/S/NP program was considered a pilot program, with more lighting options available for rebate starting in PY2. The implementation of this pilot segment began with a direct-mail marketing campaign. This effort was considered effective as post-implementation surveys indicate that the program participants thought the mailing/email newsletter campaign was most causal in participation. Questionnaire surveys also indicate that participant satisfaction is 33% or higher, in part due to the no-

[53] The projects audited by the SWE which prompted these comments were processed prior to the TRM update on June 3, 2010. Allegheny has addressed the majority of the noted issues by modifying worksheets and templates.

cost of the equipment, speedy return process for broken equipment, and lack of barriers to participation. It was determined that 66% of CFL and 62% of the LED signs bulbs were installed upon receipt.[54] Some customers shared that they are waiting to install for various reasons, but will indeed install the measures in the near term. Considering this response, the installation rate jumps to 75% and 76% for CFL bulb and LED sign installation, respectively. Looking forward, the program will expand to include other efficiency measures available for rebate, which is reinforced by customer sentiment that indicates the desire for more options under the program.

4.2.2 Duquesne

Site inspections were not performed for Duquesne because no "true" non-residential impacts were reported, i.e., some impacts were reported as non-residential which in actuality represent residential type measures at master metered multi-family units. Therefore results reported as non-residential impacts pertain to residential type measures and were verified as residential measures.

4.2.3 Met-Ed

The SWE C&I team has performed a total of 21 site inspections for FirstEnergy (Met-Ed, Penelec, and PennPower) to verify savings and compliance with the TRM, Interim and CMPs. The projects were sampled from the Standard Lighting for Business (SLB) Program, the Non-Standard Lighting for Business (NSLB) Program, and the Motors and Drives Program (MD). Individual site inspection reports can be provided upon request. The major findings are discussed in the following sections.

4.2.3.1 Threshold for Non-Standard Lighting for Business

FirstEnergy implemented two C&I programs for lighting, SLB and NSLB. SLB is intended for small standard projects, while NSLB is intended for large complex projects. Projects surpassing the incentive threshold of $10,000 or demand reduction threshold of 20 kW must apply for NSLB. Several facilities submitted multiple applications under the SLB program instead of a combined application under the NSLB program. FirstEnergy indicated that it would direct its implementer to combine smaller projects into one larger project to guarantee fair application of M&V protocols.

4.2.3.2 Non-Standard Lighting for Business Use of Stipulated Variables

NSLB requires the use of a line-by-line inventory in the form of 2010 TRM - Appendix C. Several issues have been identified regarding the application of stipulated variables and customization of the variables. Hours of Use, coincidence factor, and fixture wattages were being applied either incorrectly or at the discretion of the customer rather than according to the TRM.[55] These issues were common across the EDCs and are being addressed by the TWG.

4.2.3.3 Standard Lighting for Business Calculation Methodology

SLB ex-ante savings are calculated according to a spreadsheet developed by the implementer based on a combination of Appendix C from the 2010 TRM and Table 12 from the 2009 TRM. A baseline fixture and

[54] Installation rates were not applied during ex-ante savings calculations because this program was implemented as a non-residential program. According to the TRM, no adjustment is made for installation rates.

[55] FirstEnergy is taking corrective actions to ensure that the implementer is using approved protocols to claim savings. The EDC evaluator calculated verified savings according to TRM protocols.

retrofit fixture are assumed based on the incentivized fixture. The applicant selects building type and space conditioning type, which are translated into TRM values in the savings calculation methodology. This methodology should be improved to address baseline determination, occupancy sensor savings calculations, fixture quantities, and hours of use. FirstEnergy indicated that it would direct its implementers to incorporate these changes.

4.2.3.4 Motors and Drives Protocol

One site installed industrial process motors, which qualifies as a custom measure as per the TRM. The savings should be calculated per the approved CMP for industrial process motors and drives.[56] FirstEnergy and its evaluators have collaborated at length with the SWE to help develop this protocol that will be available to all EDCs.

4.2.4 PECO

The SWE C&I team has performed a total of 26 site inspections in the PECO service territory to verify savings and compliance with the TRM and CMPs. Eleven of the projects were randomly sampled from the Smart Equipment Program and were inspected as part of the formal evaluation process by EDC evaluators. The other 15 inspections were quality control inspections by the SWE at different stages of the implementation process. Individual site inspection reports can be provided upon request. The major findings are discussed in the following sections.

4.2.4.1 Claimed Savings

Applications provided by customers to the CSP Implementers are often inaccurate and need to be corrected in Post-Inspections prior to being classified as "Claimed Savings". This is a critical step. Customer and Trade Ally training may be needed. Many customers lack the technical skills to fill out applications and place a burden on the CSP Implementers to help them and correct errors.

4.2.4.2 Electric Distribution Company Audit Procedures

The site inspections revealed that the EDC evaluator had in some cases interpreted the TRM differently than the SWE. SWE inspectors, applying the SWE interpretation of the TRM, pointed out requirements that were not being adhered to as required by the TRM on a few occasions. Familiarity with protocols is a prerequisite to effective savings verification. The 2010 TRM provides an approved protocol for calculating savings for C&I lighting projects, which takes into account hours of use, coincidence factors, interactive effects, and lighting controls savings factors. The SWE acknowledges, however, the evolving nature of the TRM. In some cases, the site inspections revealed that the TRM was not being followed explicitly when determining savings for C&I lighting. For some jobs with greater than 20kW savings, there were no line-by-line entries with specific locations entered into Appendix C. This prohibits the inspector and the EDC evaluator from efficiently identifying a specific location and auditing that line completely, which is the preferred method when there are a significant amount of fixtures. The second most common lighting TRM discrepancy was that effective full load hours (EFLH) were not determined through a combination of interviews and light logging as specified for projects greater than 50kW. This was routinely found to be neglected as site inspectors went to various locations. This was brought to

[56] This project was completed early in the year before the EDC evaluator had the opportunity to perform pre-installation monitoring. The EDC evaluator indicated that it is currently fulfilling monitoring requirements.

the attention of the TWG and the TRM language is being clarified, as it is acknowledged that language concerning baseline conditions should be improved. Third, on one project reviewed by the SWE the ex-post savings were incorrectly calculated due to a transposition error when entering a figure.

4.2.4.3 Baseline Assumptions

The baseline assumptions are not always supported by field observation. Verifying the baseline has proven difficult, as most implementers have already removed and recycled any baseline fixtures. On some occasions, the stock room of the location may yield a surplus of baseline bulbs/ballasts. Facility worker interviews can suffice, but should not be relied on if possible.

4.2.4.4 Quality Assurance and Quality Control

Formalizing QA/QC processes in the Pre-Installation and Post-Installation stages of a project cycle may improve both accuracy and Realization Rates. In the long run it may also reduce evaluation costs by reducing variance in the population to be evaluated, and thereby reducing the size of the sample needed.

4.2.4.5 Custom Measure Protocols

Many larger projects inspected prior to installation lacked appropriate CMPs and there is limited expertise available in crafting appropriate M&V protocols using guidelines established by International Performance, Measurement and Verification Protocols (IPMVP) and the *Audit Plan*. When crafting CMPs it may be important to have a team which includes the Implementer CSPs who have more practical field experience and know what the customer needs. Since these initial visits, KEMA has helped in developing protocols that satisfy custom measure requirements for savings verification.

4.2.4.6 Audit Plan

Certain aspects of the *Audit Plan* and TRM need to be improved to increase clarity and, where possible, streamline the evaluation process.

4.2.5 PPL

The SWE C&I Team has performed a total of 23 site inspections to verify savings and compliance with the TRM and CMPs. The projects were sampled from the C&I Efficient Equipment Program, the Renewable Energy Program, and the Custom Incentive Program. Individual site inspection reports can be provided upon request. The major findings are discussed in the following sections.

4.2.5.1 Heat Pumps

The SWE performed post-installation inspections for eight heat pump installations. The reported savings for these projects were independent of the heat pump cooling capacities, which is not in accordance with the appropriate sections of the TRM (Section 2.1 for residential units and Section 6.6.1 for commercial units). PPL has noted that EEMIS, PPL's data tracking and reporting system, will be reprogrammed to adjust for TRM protocols. Until the time that PPL is able to fully reprogram its tracking system, PPL has agreed to report savings using an additional column labeled "TRM Adjusted" to distinguish systemic changes from realization rate changes. For PY1, PPL's evaluator incorporated differences between claimed savings and the TRM in the realization rate calculation.

4.2.5.2 Programmable Thermostats

The SWE performed post-installation inspections for nine programmable thermostat installations. A wide variety of installations were noted, encompassing different types of buildings, zone sizes, baseline thermostats, controlled equipment, and control strategies, which cannot be captured by deemed savings. PPL noted that an interim TRM measure will be developed to address these concerns.

4.2.5.3 Custom Measure Protocols

Four of the projects inspected in the Custom Incentive Program lacked CMPs and M&V Plans to determine project savings. All of these projects contain control measures, and appropriate baseline data will be necessary for accurate determination of savings. For three projects, it was not apparent from site visits that baseline data had been collected, or that there were plans to collect the data prior to installation, which had already started for one of the projects. PPL noted that CMPs for non-TRM measures/technologies and Site Specific M&V plans are being developed for all projects in the Custom Incentive Program for accurate validation and ex-post verification of savings.

Protocols are being developed by the EDCs in collaboration with the SWE and as part of the TWG. In November of 2010, this process was streamlined by the SWE to appropriately balance the measurement cost with the value of the information derived and to assure that protocols are in place that enable the EDCs to account for verified savings. This includes the definition of methods for defining the baseline and the development of classes of CMPs that minimize the need for Site Specific M&V at every participant facility. The SWE team worked closely with the EDCs, the EDCs' evaluators and PA PUC CEEP staff to develop this streamlined development and review process for CMPs.[57]

4.2.5.4 Logging for Lighting Projects

One of the inspected projects was a large lighting project with greater than 50kW of projected savings. For projects of this size, Section 6.2.5 of the TRM has special requirements that include the logging of operating hours for various Hours of Use Groups. The M&V Plan provided in the "PPL Custom Incentive Application" does not require such logging and instead uses "Agreed Upon Hours of Operation", some of which differed from site inspection findings. Requirements for projects with greater than 50kW in savings are being discussed in the TWG for PY2 and beyond.

4.2.6 Penelec

Penelec findings were combined with Met-Ed and PennPower findings and are presented in Section 4.2.3.

4.2.7 PennPower

PennPower findings were combined with Met-Ed and Penelec findings and are presented in Section 4.2.3.

[57] The Statewide Evaluator issued a guideline memo on November 24, 2010, that explained the new development and review process for custom measure protocols. The SWE Team utilized input from the EDCs, the EDC evaluators, and the PA PUC CEEP staff to development this new review process for custom measure protocols.

5. Statewide Evaluator Assessment of Electric Distribution Company Measurement and Verification Plans and Plan Execution

Pursuant to page 114 of the *Audit Plan*, the SWE responsibilities include review of each EDC's EM&V plan "to determine plan adequacy given the guidelines and expectations as outlined in [the] *Audit Plan*. The EDC EM&V plans are very important because they are the foundation for all EDC EE&C evaluations. If this roadmap is not in compliance with the recommendations and expectations of the SWE, then the ultimate evaluation findings of the EDC evaluators may not be verifiable by the SWE." This section summarizes key results of the SWE team's review of EDC EM&V Plans, and recommendations made to the EDCs.

5.1 Residential Sector

For PY1, all residential programs implemented and evaluated offered measures that were either included in the TRM or Interim TRM process. Thus, the evaluation requirements for these measures were at a basic rigor level. As such, the M&V requirements included only a verification of measure implementation. The majority of the verification efforts were conducted through participant surveys administered over the phone. The one exception was for Allegheny's Residential Online Analyzer Program; the verification of these measures was conducted via an online survey. The method was appropriate for this program, considering the fact that the actual program was offered online and thus the participants are already accustomed to the internet.

The SWE team recommends that the EDCs perform some type of due diligence to verify the appropriateness of the deemed savings assumptions associated with these measures. Any findings could be reviewed as part of the annual TRM update process and would strengthen the overall accuracy and applicability of savings protocols deemed in the TRM. One of the most important research issues that need to be examined in the service area of the EDCs affected by Act 129 is the actual daily hours of use of CFL bulbs by room type. A second assumption that needs to be re-examined is the annual kWh savings due to refrigerator and freezer removal.[58] It is important to note that the SWE team has a contractual responsibility (in the SWE contract with the PA PUC) to provide recommendations in the Annual Reports to the PA PUC for the revisions to existing measures in the TRM as well as for additions of new measures to the TRM.

5.2 Non-Residential Sector

This section includes a discussion of EM&V plan compliance issues related to the non-residential sectors.

[58] EDCs will have the opportunity to provide comments on any recommendations made by the SWE for updating the TRM. The EDCs have provided comments on such recommendations in response to the SWE's Draft Annual Report distributed October 15, 2010. Additional comments can be provided during the public comment period on a draft TRM, which is part of the annual TRM update procedures. The SWE recognizes the importance of the public vetting of potential changes to the TRM and the SWE team welcomes comments on our recommendations for updates to the TRM.

5.2.1 Allegheny

5.2.1.1 Plan Review and Observations

5.2.1.1.1 Government/Non-Profit Lighting Efficiency Program and Commercial Lighting Efficiency Program

The EM&V plan for the Commercial Lighting Efficiency Program references the Government/Non-Profit Lighting Efficiency Program plan; therefore the two programs have been described together below. Both programs provide incentives for lighting, occupancy sensors, and LED Exit signs. The Government/Non-Profit Program also includes LED traffic signals.

Savings for measures in this program are either deemed, for projects less than 20kW, or partially deemed. The M&V rigor is based on whether or not the project has deemed or partially deemed savings and the size of the project. Telephone surveys are to be conducted on the sample of deemed projects to verify the equipment installation, baseline equipment, and operation. Partially deemed projects that are sampled are to undergo site visits to verify equipment installation and operation hours. The evaluation team plans on conducting site visits on a sample of projects with savings under 50kW and all projects with over 50kW savings.

The EM&V plan lays out a nested sample approach where the sample for project file reviews, site visits, and metering will be drawn from the participant survey sample and further nested in that order. Sample sizes are designed to achieve 90/10 confidence and precision each year. Up to 68 projects will be sampled each year. A quarterly batch process is to be used to develop the sample of projects for which a site visit will be conducted. A third party M&V contractor is to provide assistance with M&V plans and baseline site visits. Allegheny's EM&V team will review the M&V plan before sending it to the SWE for review.[59] The post-installation project verification is to be conducted based on the project's SWE-approved M&V plan by the EM&V team. The EM&V plan also includes plans to conduct short-term monitoring on a number of custom projects and projects with greater than 50kW savings. Additionally, a sub-sample of projects is to have pre-installation M&V.

5.2.1.2 Recommendations

Key observations and recommendations about the compliance to the EM&V plans are listed below. Further discussion about site inspections, QA/QC of CSPs, TRM compliance, and the baseline verification process can be found in Section 4.2. SWE desk audit observations, realization rate review, and sample methodology assessment are elaborated on in Section 6.1.

- Program savings desk audits revealed small entry errors in database and incorrect application of TRM Lighting Protocols. Savings for Commercial Lighting Efficiency were not verified due to limited PY1 participation levels and will be evaluated in PY2.

[59] While generally the Allegheny EM&V plan refers to the project specific M&V plans as M&V plans, there are a few instances where it is called an EM&V plan. In this report's discussion of Allegheny's EM&V plan, project specific M&V or EM&V plans are referred to as M&V plans and EM&V plan is used to mean the program EM&V plan.

- Evaluation audit shows that the realization rate of 75% for the Government/Non-Profit Lighting Efficiency Program includes survey responses saying the participant *will* install measure within six months. This methodology poses issues during compliance years and it is recommended that the realization rate definition be adjusted for PY2.

5.2.2 Duquesne

Evaluation of Duquesne's non-residential programs did not occur in PY1 because Duquesne did not report a significant amount of savings for non-residential customers. Therefore, though the EM&V plan was reviewed and approved, actual compliance by Duquesne's evaluators to the non-residential aspects of the EM&V plan could not be observed.

5.2.3 Met-Ed

5.2.3.1 Plan Review and Observations

5.2.3.1.1 Commercial and Industrial Prescriptive and Custom Programs

FirstEnergy provided a single EM&V plan for four C&I programs because they share a common CSP and list of eligible measures. For the purposes of the impact evaluation, ADM Associates, FirstEnergy's evaluator, has divided all measures into prescriptive and custom categories, and defined these categories as separate Impact-Based-Programs. The prescriptive measures will be evaluated using algorithms in the TRM or algorithms to be added to the TRM. Custom measures will be evaluated using site-specific M&V plans written or reviewed by ADM, and approved by the SWE. ADM has provided standard procedures for reviewing project documentation, collecting on-site data, and performing on-site monitoring.

A stratified random sample will be selected for each EDC to estimate the total achieved savings with 90/10 confidence and precision. The specific sampling approach is provided and real-time sampling will be used. Criteria are defined for pre-installation monitoring (lighting retrofits over 50kW in connected load or custom sites with estimated savings over 100,000kWh/year).

5.2.3.2 Recommendations

Key observations and recommendations about the compliance to the EM&V plans are listed below. Further discussion about site inspections, QA/QC of CSPs, TRM compliance, and the baseline verification process can be found in Section 4.2. Desk audit observations, realization rates, and sample methodology are elaborated on in Section 6.1.

- Ex-ante savings calculations for Standard Lighting for Business Program should be improved to address baseline determination, occupancy sensor savings calculations, fixture quantities, and hours of use.
- FirstEnergy evaluators combined all non-residential programs into a single population to classify and group measures by Prescriptive and Custom measure types. Such grouping is acceptable as long as the sample chosen is representative of the population.

5.2.4 PECO

5.2.4.1 Plan Review and Observations

5.2.4.1.1 Smart Equipment Incentives – Commercial and Industrial and Smart Equipment Incentives – Government and Non-Profit

A combined evaluation of the two programs was conducted for PY1. Measures for both programs are the same except the Government and Non-Profit program includes traffic lighting. The program had a total of 87 participants in PY1, 62 are commercial and industrial customers and 25 are government and non-profit customers. PECO's evaluator had stated this combined approach would be taken in its evaluation plan. As noted in the plan, the "Government Program provides all of the same services offered to C&I customers within a single program, including retrofits, new construction, and renewable energy resources. In addition, it provides assistance with obtaining facility audits and incentives for street lighting and traffic signals. Impact evaluation activities and reporting will differentiate savings between C&I and Government/Non-Profit sectors for compliance with Act 129 requirements." The SWE approved this plan. In further discussions prior to submission of the final report, the SWE indicated it understood that the two plans would be combined for PY1, but would be evaluated separately in PY2.

The EM&V plan states that the sampling methodology is to follow a dynamic sampling approach, with quarterly batches being a possibility. Since the program was launched in the fourth quarter of PY1, the PY1 sample consists of one quarterly batch. In general, the confidence and precision used to define sample sizes for a program are based on the level of rigor the measure requires, basic or enhanced. Programs for which the basic rigor is sufficient have a confidence and precision of 90/30. Programs which require an enhanced rigor are sampled with 90/10 confidence and precision.[60]

Measures which are evaluated with basic rigor include the deemed measures; traffic signals and street lights; and partially deemed measures; CFL give-away measures, lighting project with less than 20 kW savings, and small HVAC installations. The EM&V plan states that a desk review and telephone survey verification of equipment installation are to be conducted to evaluate deemed measures. Partially deemed projects that are sampled are to undergo a desk review and on-site inspection.

Enhanced rigor evaluations are to be conducted for partially deemed measure projects in which basic rigor has not been approved and for all custom measures. The protocol approved by the Director of CEEP is to be used for the verification of such projects. Desk reviews and on-site inspections are conducted on sampled projects that require enhanced rigor evaluations. The EM&V plan states that engineering based estimates for the ex-post gross annual energy and summer peak demand impact are to be developed for each sampled measure as prescribed by approved protocols.

[60] The SWE will issue an amendment to the Audit Plan following the Sampling Workshop held on November 16, 2010, which will set statistical expectations for EDC evaluators. The SWE team has already issued a PowerPoint presentation in early December 2010 that summarizes and clarifies revised expectations for sampling procedures.

5.2.4.2 Recommendations

Key observations and recommendations about the compliance to the EM&V plans are listed below. Further discussion about site inspections, QA/QC of CSPs, TRM compliance, and the baseline verification process can be found in Section 4.2. Desk audit observations, realization rates, and sample methodology are elaborated on in Section 6.1.

- The Claimed Savings Database must be frozen for projects completed in the program year. PECO had multiple databases of Claimed Savings (Gross Impact) and provided a database to the SWE which did not correspond to the Annual Report. The Database should be "frozen" at a certain date for projects completed before the end of the program year and this data should be forwarded to the SWE prior to the sample being pulled to facilitate a clean audit trail.
- For PY1, PECO claimed 93.9% of the ex-ante kWh program impacts, for the population of 87 projects, were for the lighting measures within the current TRM, 5.5% were for TRM non-lighting measures and 0.6% were custom measures. The sample was therefore weighted towards the lighting measures. The SWE team conducted a conscientious review of the PECO program databases and the reported numbers and distributions by measure type were found to be accurate.

5.2.5 PPL

PPL developed an EM&V plan for each of its four programs that were available in PY1 to commercial and institutional customers, Appliance Recycling, Custom Incentive Program, Efficient Incentive Program, and Renewable Energy Program.

5.2.5.1 Plan Review and Observations

5.2.5.1.1 Appliance Recycling Program

The appliance recycling program picks up and recycles functioning inefficient refrigerators, freezers, and room air conditioners. The program is aimed at residential customers, but all customers are eligible to participate. In PY1 63 commercial customers participated in the program.

The verification is conducted by phone surveys to program participants. In PY1, the plan was to conduct 100 phone surveys to achieve 90/10 confidence and precision. In PY2, quarterly batches with sample sizes that have 90/10 confidence and precision will be conducted. Based on the information gathered in PY1 and PY2, it will be determined if surveys should be conducted in PY3 and Program Year 4 (PY4). The TRM includes deemed savings for refrigerator and freezer turn-ins. To determine the verified savings of the program, reported savings are to be adjusted by verified appliance recycling rates.

5.2.5.1.2 Custom Incentive Program

The Custom Incentive Program is available to all PPL Electric non-residential retail electric customers. According to the Annual Report submitted by PPL, one custom project was completed in PY1. Originally this project was not included in the sample, but was added toward the end of the program year when it was discovered to be the only completed project.

In order to be eligible for funding, projects must demonstrate a verifiable and permanent reduction in annual electric energy consumption. To that end, all applicants are required to submit an M&V plan and commissioning plan. All M&V plans must follow CMPs. The EM&V contractor will be involved with

projects from the initial stages and will approve all M&V and commissioning plans. This is to ensure compliance with the CMPs. The EM&V plan states that all technical studies and custom project applications will undergo a pre-approval technical and financial review. Pre-installation and post-installation inspections are anticipated for nearly all custom projects. Inspections for small or repetitive projects may be conducted by telephone.

Throughout the EM&V plan for the Custom Incentive Programs, projects are divided into three strata and have different levels of rigor applied. Large projects (those with anticipated savings of 500,000 kWh/year or greater) have the greatest amount of rigor with almost all of the projects in that stratum undergoing pre- and post-installation site visits and a review of the applicant's M&V plan. The EM&V evaluator will prepare a Site Specific M&V Plan for each project and determine the project's energy savings using the SWE-approved CMP. Small projects (those with less than 500,000 kWh/year savings anticipated) will be randomly sampled by the EM&V contractor. The sample will also be weighted toward projects with the largest savings. Energy savings will be independently reviewed by the EM&V contractor, using the SWE-approved CMP. The smaller projects stratum will be further divided into two groups, projects with anticipated savings between 250,000 and 500,000kWh/year and those with less than 250,000 kWh/year. Projects between 250,000 and 500,000kWh/year will be sampled at a rate of every third project. For projects less than 250,000kWh/year, every ninth project will be selected for the sample. Projects in the large strata will not have a realization rate as the project's final savings will be calculated by the EM&V evaluator. A realization rate will be calculated for the small strata sample, and the realization rate will be applied to the rest of the small strata population.

5.2.5.1.3 Efficient Incentive Program

The Efficient Incentive Program provides incentives for a variety of high efficiency equipment. The program is for customers in both the residential and commercial sectors. In PY1, 233 commercial and institutional customers participated. The discussion on the EM&V plan below will concentrate on the EM&V plan for the commercial sector.

Site visits on a sample of commercial projects are to be used to verify measured data, equipment installation, and the accuracy of reported variables. Samples for site visits and telephone verifications are to be drawn quarterly during PY2 through PY4 using a dynamic, stratified, batch-wise sampling approach. For PY1, a single annual sample was drawn. The sample size is designed so that the level of statistical rigor meets 90/10 confidence and precision. The sample selection for EM&V site visits is to be stratified based on the amount of project reported savings and weighted toward projects with large savings. The sample is also to include all projects that provide the top 80% of savings in the commercial sector. Additional projects are added at random to meet the sample size targets for that quarter. Projects in this program have been divided into five measure groups, lighting with less than 50 kW savings, lighting with greater than 50 kW savings, HVAC, motors and fans, and all other measures. The EM&V plan states that 90/10 confidence and precision is to be achieved annually for each measure group in PY2 through PY4.

When pre-installation data is needed to determine energy savings, a QA/QC pre-installation site visit is to be conducted. Currently that only applies to lighting projects with savings over 50 kW.

The level of M&V rigor will vary depending on if the measure is a deemed, partially deemed, or custom measure. The review of deemed measures is to simply be a verification that the inputs in the program database are accurate and an examination of the nameplate of the installed equipment. The rigor for projects that require enhanced rigor will involve a review of engineering calculations and possibly measurements, depending on the TRM and the CMP. All evaluation site visits will be post-installation visits. An additional sample of lighting projects with savings over 50 kW will have QA/QC post-installation site visits.

5.2.5.1.4 Renewable Energy Program

The Renewable Energy Program offers a financial incentive for PPL Electric's customers to install solar photovoltaic (PV) arrays or ground source heat pumps (GSHP). The program is available to residential and institutional customers, government, non-profit, and schools. In PY1, among institutional customers, two GSHP and zero PV projects were completed.

A sample size of 10% of GSHP and PV systems installed during PY1 and PY2, and 5% during PY3 and PY4 will receive post-installation site inspections and participant surveys. The sampling rates are designed to meet 90/10 confidence and precision. If additional GSHP or PV systems are installed after PY1, the sample sizes for PY2 through PY4 will be adjusted accordingly.

GSHP verified savings are calculated using the methodology laid out in the TRM. For each sampled project, the engineering calculations are reviewed to determine whether appropriate measure and baseline data were used in the correct TRM equations. For PV systems, savings are calculated using the National Renewable Energy Laboratory's PVWatts™ software. The ex-ante savings were determined by reviewing the project's assumptions used in the PV Watts Solar Calculator and then running the PV Watts Solar Calculator to verify the results. If a bidirectional meter was installed, a review of the billing data will also be conducted. Billing analyses will be conducted for all PV systems. The results of which will also inform the selection of the field inspection sample. The EM&V plan also states that a billing analysis will be conducted on a sample of facilities that participate in the Renewable Energy Program to compare the energy and demand savings with the calculated results.

5.2.5.2 Recommendations

Key observations and recommendations about the compliance to the EM&V plans are listed below. Further discussion about site inspections, QA/QC of CSPs, TRM compliance, and the baseline verification process can be found in Section 4.2. Desk audit observations, realization rates, and sample methodology are elaborated on in Section 6.1.

- The EM&V process should start with a "frozen" population of ex-ante savings. TRM revisions, updates and QA/QC identified retroactive errors should be applied to all projects in the population as ex-ante revisions. All systemic revisions such as equipment baseline efficiency assumptions, EFLH values by region, changes to equipment configuration assumptions in the TRM equations, etc., should be revised for all projects in the population before the ex-ante savings are "frozen."[61]

[61] Until PPL database can be reconciled with the TRM protocols, PPL will report "TRM Adjusted Savings" to isolate systemic changes from the realization rate.

- A certain level of verification is necessary for residential appliances installed in commercial settings. The installation rates, equipment types and specifications should be verified on a statistically valid sample pool and the verification activities should include an adequate number of on-site inspections. If necessary, the level of sampling precision can be relaxed to reduce sample sizes assuming the level of anticipated variance is low.[62]

5.2.6 Penelec

Penelec was combined with Met-Ed and PennPower. See Section 5.2.3.

5.2.7 PennPower

PennPower was combined with Met-Ed and Penelec. See Section 5.2.3.

6. Statewide Evaluator Review of Electric Distribution Company Annual Reports

This section of the SWE Annual Report to the PA PUC provides the information required for annual reports as described in the PUC's 2009 Request for Proposal (RFP) for the Statewide Evaluation. The Commission's RFP (at page 34) listed seven requirements relating to the content of the Statewide Evaluator's Annual Report to the PUC. The Annual Report should include the following:

- An analysis of each EDC's plan expenditures and an assessment of the program expenditures.
- An analysis of each EDC's protocol for M&V of energy savings attributable to its plan, in accordance with the Commission adopted TRM and approved custom measures.
- An analysis of the cost-effectiveness of each EDC's expenditures in accordance with the Commission adopted TRC Test Manual.
- Identification of best practices.
- A review of the TRM with suggestions for possible revisions and additions.
- A review of the TRC Test Manual with suggestions for possible revisions and additions.
- A review of any proposed revisions and updates to EDC plans.

This section of the SWE Annual Report also provides the following additional information:

- A detailed discussion of the verified findings provided in each EDC's Annual Report to the PA PUC, including the total energy and demand impacts (realization rate) by EDC, program, and sector.[63]
- Explanations and definitions of types of savings.
- Status update on the TRC Working Group underway in PY2.

6.1 Annual Electric Distribution Company Portfolio Summary

The following sections contain summary excerpts from each EDC's Annual Report. Each section provides the energy and demand savings achieved during PY1 for all programs. In instances where no savings are

[62] PPL's evaluators will verify such measures with a 90/30 confidence and precision level for upcoming years.
[63] This information is located in Section 1: Executive Summary of the SWE's Annual Report.

reported either (a) the program has not yet launched or (b) participation is not yet sufficient to support reported and/or verified savings.

6.1.1 Allegheny

Table 6-1: Allegheny - Summary of PY1 Program Impacts – MWh and MW Savings

Programs:	PYTD Reported Gross Impacts (MWh)	PYTD Verified Impact (MWh)	PYTD Reported Demand Reduction (MW)	PYTD Verified Demand Reduction (MW)
CFL Rewards Program	82		0.0	
Critical Peak Rebate Rate				
Residential ENERGY STAR & High Efficiency Appliance Program	1,052		0.2	
Residential Home Performance Program	714	685	0.0	0.0
Programmable Controllable Thermostat Program				
Residential HVAC Efficiency Program	3		0.0	
Residential Efficiency Rewards Rate				
Pay Ahead (Smart) Service Rate				
Residential Low-income Home Performance Check-up Audit & Appliance Replacement Program	844		0.0	
Residential Low-income Joint Utility Usage Management Program	0		0.0	
Residential Low-income Room AC Replacement Program	0		0.0	
G/NP Lighting Efficiency Program	3,023	2,267	0.7	0.5
Commercial HVAC Efficiency Program	0		0.0	
Commercial Lighting Efficiency Program	188		0.0	
Customer Resources Demand Response Program				
Distributed Generation Program				
Custom Technology Applications Program	0		0.0	
TOU with Critical Peak Pricing Rate				
Hourly Pricing Option Rate				
Custom Application Program	0		0.0	
Customer Load Response Program				
C&I Drives Program	0		0.0	
Total Portfolio:	**5,906**	**2,952**	**1.0**	**0.5**

6.1.2 Duquesne

Table 6-2: Duquesne - Summary of PY1 Program Impacts – MWh and MW Savings

Programs:	PYTD Reported Gross Impacts (MWh)	PYTD Verified Impact (MWh)	PYTD Reported Demand Reduction (MW)	PYTD Verified Demand Reduction (MW)
Residential: EE Rebate	767	745	0.026	0.025
Residential: School Energy Pledge	1,913	7,859	0.062	0.060
Residential: Refrigerator Recycling	453	440	0.062	0.060
Residential: Low-Income EE	510	510	0.019	0.019
Total Portfolio:	**3,642**	**3,553**	**0.169**	**0.164**

6.1.3 Met-Ed

Table 6-3: Met-Ed - Summary of PY1 Program Impacts – MWh and MW Savings

Programs:	PYTD Reported Gross Impacts (MWh)	PYTD Verified Impact (MWh)	PYTD Reported Demand Reduction (MW)	PYTD Verified Demand Reduction (MW)
Demand Reduction	0	0	0.00	0.00

Home Energy Audits	5,921	3,925	0.37	0.22
Appliance Turn-in	1,833	1,831	0.34	0.34
EE HVAC	0	0	0.00	0.00
EE Products	3,844	3,844	0.21	0.21
New Construction	0	0	0.00	0.00
Whole Building	0	0	0.00	0.00
Multiple Family	0	0	0.00	0.00
WARM Programs	63	62	0.01	0.01
Energy Audit, Assessment & Equipment Rebate	0	0	0.00	0.00
C&I Performance Contracting/Equipment	2,973	2,585	0.43	0.43
Industrial Motors and VSD	0	0	0.00	0.00
PJM Demand Response	0	0	0.00	0.00
Street lighting	0	0	0.00	0.00
Non-Profit	0	0	0.00	0.00
Remaining Government/Non-Profit	15	13	0.00	0.00
Total Portfolio:	**14,647**	**12,260**	**1.37**	**1.21**

6.1.4 Penelec

Table 6-4: Penelec - Summary of PY1 Program Impacts – MWh and MW Savings

Programs:	PYTD Reported Gross Impacts (MWh)	PYTD Verified Impact (MWh)	PYTD Reported Demand Reduction (MW)	PYTD Verified Demand Reduction (MW)
Demand Reduction	0	0	0.00	0.00
Home Energy Audits	4,211	2,779	0.27	0.16
Appliance Turn-in	1,541	1,541	0.24	0.24
EE HVAC	0	0	0.00	0.00
EE Products	4,338	4,337	0.24	0.24
New Construction	0	0	0.00	0.00
Whole Building	0	0	0.00	0.00
Multiple Family	0	0	0.00	0.00
WARM Programs	87	77	0.01	0.01
Energy Audit, Assessment & Equipment Rebate	0	0	0.00	0.00
C&I Performance Contracting/Equipment	3,037	3,191	0.55	0.48
Industrial Motors and VSD	118	656	0.08	0.07
PJM Demand Response	0	0	0.00	0.00
Street lighting	0	0	0.00	0.00
Non-Profit	66	69	0.01	0.01
Remaining Government/Non-Profit	177	185	0.04	0.03
Total Portfolio:	**13,577**	**12,865**	**1.44**	**1.24**

6.1.5 PennPower

Table 6-5: PennPower - Summary of PY1 Program Impacts – MWh and MW Savings

Programs:	PYTD Reported Gross Impacts (MWh)	PYTD Verified Impact (MWh)	PYTD Reported Demand Reduction (MW)	PYTD Verified Demand Reduction (MW)
Demand Reduction	0	0	0.00	0.00
Home Energy Audits	1,468	907	0.09	0.05
Appliance Turn-in	359	359	0.05	0.05
EE HVAC	0	0	0.00	0.00
EE Products	3,632	3,631	0.20	0.20
New Construction	0	0	0.00	0.00
Whole Building	0	0	0.00	0.00
Multiple Family	0	0	0.00	0.00

WARM Programs	20	22	0.00	0.00
Energy Audit, Assessment & Equipment Rebate	0	0	0.00	0.00
C&I Performance Contracting/Equipment	713	675	0.10	0.11
Industrial Motors and VSD	0	0	0.00	0.00
PJM Demand Response	0	0	0.00	0.00
Street lighting	0	0	0.00	0.00
Non-Profit	0	0	0.00	0.00
Remaining Government/Non-Profit	0	0	0.00	0.00
Total Portfolio:	**6,191**	**5,593**	**0.44**	**0.41**

6.1.6 PECO

Table 6-6: PECO - Summary of PY1 Program Impacts – MWh and MW Savings

Programs:	PYTD Reported Gross Impacts (MWh)	PYTD Verified Impact (MWh)	PYTD Reported Demand Reduction (MW)	PYTD Verified Demand Reduction (MW)
Low-Income Energy Efficiency Program	3,407	N/A	0.29	N/A
Smart Lighting Discounts Program	133,212	133,212	7.30	7.30
Smart Appliance Recycling Program	4,538	4,487	0.94	0.93
Smart Home Rebates Program – Approved Measures	2,963	2,963	0.68	0.68
Smart Home Rebates Program – Pending Measures	8	N/A	0.00	N/A
Smart Equipment Incentives C&I – Approved Measures	11,373	14,444	2.30	2.23
Smart Equipment Incentive C&I – Pending Measures	73	N/A	0.02	N/A
Smart Equipment Incentives G/NP – Approved Measures	1,345	1,708	0.16	0.15
Smart Equipment Incentives G/NP – Pending Measures	38	N/A	0.01	N/A
Conservation Voltage Reduction	20,819	N/A	0.00	N/A
Total Portfolio:	**177,776**	**156,813**	**11.69**	**11.29**

6.1.7 PPL

Table 6-7: PPL - Summary of PY1 Program Impacts – MWh and MW Savings

Programs:	PYTD Reported Gross Impacts (MWh)	PYTD Verified Impact (MWh)	PYTD Reported Demand Reduction (MW)	PYTD Verified Demand Reduction (MW)
Appliance Recycling	9,069	9,237	1.37	1.94
CFL Campaign	61,838	61,838	3.68	3.68
Custom Incentive Program	39	56	0.003	0.005
Efficient Equipment Incentive	8,074	9,573	0.87	1.16
Low-income WRAP	1,087	1,087	0.13	0.13
Renewable Energy Program	1,591	2,791	0.13	0.45
Total Portfolio:	**81,697**	**84,580**	**6.19**	**7.37**

6.2 Annual Program Results and Expenditures

This section provides the SWE audit assessment of the savings results and expenditures reported in each EDC's annual report. The audit sought to verify that the numbers reported for savings and costs were supported by data tracked in each EDC's tracking and reporting system.

Table 6-8: PY1 EDC EE&C Expenditures

	Statewide	Allegheny	Duquesne	Met-Ed	Penelec	PennPower	PECO	PPL
Subtotal EDC Incentive Costs	$14,789,021	$135,393	$328,693	$1,526,690	$1,466,888	$332,090	$5,826,122	$5,173,145
Subtotal EDC Implementation Costs	$29,331,964	$4,415,898	$3,500,268	$1,981,440	$1,884,834	$591,169	$8,285,377	$8,672,978
EDC Evaluation Costs	$1,584,986	$138,056	$84,000	$106,314	$102,485	$27,434	$333,391	$877,222
Total Costs	$40,946,768	$4,983,381[64]	$4,204,840	$3,762,602	$3,581,354	$973,239	NR	$23,441,352

6.2.1 Residential Sector

The following sections contain the results of the SWE review of the savings reported in the EDCs' Annual Reports. This analysis was done as a check to verify that the reported savings numbers matched the actual deemed and/or partially deemed savings values used to estimate the savings and accurately represents the number of measure distributed as they are reported in the EDCs' respective databases.

6.2.1.1 Program Savings Verification – CFL Programs

An analysis of the per unit savings for CFL programs cannot be conducted solely from the numbers reported in the Annual Report due to the variety of bulb types distributed through this program. Thus, the per unit analysis was conducted as part of the larger CFL program audit. The results of the SWE's assessment can be found in Section 4.1.1.

6.2.1.2 Program Savings Verification – Efficiency Equipment Programs

The SWE team was able to verify the reported gross energy and demand savings for four out of the seven EDCs offering an Efficient Equipment (EE) Products Program or its equivalent.[65] Each EDC provided the SWE team with detailed information from program databases regarding the types of measures included in the program, the number of measures distributed during PY1, as well as the per unit kWh and kW savings. The SWE team then used this data to independently calculate and verify the gross energy and demand savings reported in each of the EDC's PY1 Annual Report. The SWE calculations were either 100% consistent with the EDC calculations or less than 0.3% different.

Table 6-9: Residential Efficient Equipment Program Savings Verification - Summary

EDC	Reported by EDC		Calculated by SWE		% Difference	
	MWh	MW	MWh	MW	MWh	MW
Allegheny Energy	1,052	0.2	1,053	0.20	0.1%	0.0%
Duquesne Light Co.	723	0.04	724	0.04	0.1%	0.0%
FirstEnergy (Met-Ed)	3,844	0.21	3,844	0.21	0.0%	0.0%
FirstEnergy (Penelec)	4,338	0.24	4,338	0.24	0.0%	0.0%
FirstEnergy (PennPower)	3,632	0.20	3,632	0.20	0.0%	0.0%
PECO	2,971	0.68	2,981	0.68	0.3%	0.0%
PPL Electric (Residential Only)	7,990	0.86	7,990	0.86	0.0%	0.0%

[64] Allegheny notes that this cost includes the $294,034 of SWE Costs for PY1.

[65] Each individual EDC has a different title for programs offering incentives for the installation of efficient products. Any discrepancies found during the SWE team review are addressed in the individual EDC reviews included in the following sections of this report.

6.2.1.2.1 Allegheny

The SWE team was unable to reconcile the reported savings with the SWE team's calculated savings for the Residential ENERGY STAR and High Efficiency Appliance Program. Allegheny provided detailed participation counts and per unit energy and demand savings to the SWE team. Per unit savings assumptions were based on several sources including: 2010 TRM, Interim TRM protocols, and a white paper detailing clothes washer/dryer savings. Demand savings included a Coincidence Factor adjustment for clothes dryers and room air conditioning (AC) units. Total calculated savings based on data provided by Allegheny differed from reported savings by 1MWh, or 0.1% of the reported savings.

6.2.1.2.2 Duquesne

The SWE team was unable to reconcile the reported savings with the SWE team's calculated savings for the Residential EE Rebate Program. Detailed measure counts and per unit savings assumptions were available as part of Duquesne's EM&V Report. The SWE team's total calculated savings were slightly less than reported savings by 1MWh, or 0.1% of the reported savings. The difference in savings is attributed to the CFL Fixture (>26W) measure savings. Duquesne reported providing a rebate for six CFL Fixtures (>26W) and per unit annual savings of 972kWh. Calculated savings are 1,458kWh for these measures; reported savings are 486kWh.

6.2.1.2.3 FirstEnergy

The SWE team was able to verify the energy and demand savings reported for each of the Residential EE Products Program offered by the three FirstEnergy EDCs. Per unit savings assumptions reflect those found in the 2010 TRM. Demand savings included a Coincidence Factor adjustment for room AC units. Detailed participation counts were provided for each EDC. The SWE calculated savings match reported savings.

6.2.1.2.4 PECO

The SWE team was unable to verify a small fraction of the energy and demand savings reported for the Smart Home Rebates program offered by PECO based on detailed participation counts and per unit savings assumptions provided by PECO. Calculated savings included the impacts of one Efficient Gas Furnace (fuel-switch) measure. The PECO database recorded one gas furnace replacement that was not included in the reported savings.[66] Demand savings included a Coincidence Factor adjustment for room AC units. The total difference between reported and calculated savings was 10MWh, or 0.3% of reported savings.

6.2.1.2.5 PPL

The SWE team was able to verify the energy and demand savings reported for PPL. The source of the per unit savings assumptions appeared conservative and similar to those recorded in the TRM. Reported demand savings include a 1.0833 line loss factor adjustment. Detailed participation counts

[66] PECO notes that this issue has since been corrected. The initial discrepancy was due in part to the savings associated with fuel switching measures. PECO did not include these savings in their Annual Report because no protocol had yet been established to handle the savings associated with these measures.

were provided by PPL Electric and include only the residential sector and appliance recycling approved prior to June 2010.

6.2.1.3 Program Savings Verification – Appliance Recycling Programs

The SWE team was able to verify the reported gross energy and demand savings for all six EDCs offering a Residential Appliance Recycling Program.[67] Each EDC provided the SWE team with detailed information from program databases regarding the types of measures included in the program, the number of measures distributed during PY1, as well as the per unit kWh and kW savings. The SWE team then used this data to independently calculate and verify the gross energy and demand savings reported in each EDC's PY1 Annual Report.

Table 6-10: Residential Appliance Recycling Program Savings Verification - Summary

EDC	Reported		Calculated by SWE team		% Difference	
	MWh	MW	MWh	MW	MWh	MW
Allegheny Energy	N/A	N/A	N/A	N/A	N/A	N/A
Duquesne Light Co.	453	0.06	435	0.06	0.0%	0.0%
FirstEnergy (Met-Ed)	1,831	0.34	1,831	0.34	0.0%	0.0%
FirstEnergy (Penelec)	1,541	0.24	1,541	0.24	0.0%	0.0%
FirstEnergy (PennPower)	359	0.05	359	0.05	0.0%	0.0%
PECO	4,538	0.94	4,538	0.94	0.0%	0.0%
PPL Electric (Residential Only)	8,940	1.35	8,940	1.35	0.0%	0.0%

6.2.1.3.1 Allegheny

Allegheny does not implement an independent Residential Appliance Recycling Program. All recycling measures are included as part of their Residential ENERGY STAR and High Efficiency Appliance Program and verified by the SWE under that program. See Section 6.2.1.1 on the verification of Allegheny's reported savings.

6.2.1.3.2 Duquesne

The SWE team was able to verify the energy and demand savings reported for Duquesne. Per unit savings assumptions reflect those found in the TRM and Interim TRM protocols. Detailed participation counts were available from Duquesne.

6.2.1.3.3 FirstEnergy

The SWE team was able to verify the energy and demand savings reported for each of the FirstEnergy EDCs. Per unit savings assumptions reflect those found in the TRM and Interim TRM protocols. Detailed participation counts were available from the JACO database for all three FirstEnergy utilities.

[67] Allegheny Energy offers refrigerator, freezer and room air conditioner recycling as part of their "Residential ENERGY STAR and High Efficiency Appliance" program.

6.2.1.3.4 *PECO*

The SWE team was able to verify the energy and demand savings reported for PECO based on per unit saving assumptions reflected in the TRM and Interim TRM protocols and detailed participation counts from PECO databases.

6.2.1.3.5 PPL

The SWE team was able to verify the energy and demand savings reported for PPL. Per unit savings are based on per unit saving assumptions reflected in the TRM and Interim TRM protocols. Reported demand savings include a 1.0833 line loss factor adjustment. Detailed participation counts were provided by PPL and include only the residential sector and appliance recycling approved prior to June 2010.

6.2.2 Residential Low-Income Sector

This section will summarize key results of the SWE team's review of EDC EM&V Plans, and our recommendations made to the EDCs. The following table presents the methods of calculating the kWh savings values for low-income program participants for PY1. The total program savings for a specific EDC can be calculated by multiplying the savings per participant times the number of program participants.

Table 6-11: Residential Low-Income Sector Measure Savings Calculation Methods

EDC	Low-income savings calculation method	Savings type
Allegheny	Allegheny's reported savings in their Annual Report were found to be incorrect due to a formula error in the original calculation spreadsheet. The corrected reported savings provided by Allegheny applied the savings values in the interim TRM protocols to the total quantity of measures that were distributed within the energy efficiency kits. Actual installation rates will not be applied until they are determined through evaluation and verification processes. It is estimated that installation rates will be not applied until the end of PY2.	Savings per measure
FirstEnergy	The Low-Income Energy Efficiency programs of the FirstEnergy utilities are implemented on a direct-install basis. For the WARM Extra Measures programs, the savings were calculated on a measure by measure basis, i.e. CFLs and Smartstrips using protocols reviewed and supported by the SWE. The savings for WARM Plus measures were calculated by job type (electric heat, water heating, base-load) based on the 2008 LIURP savings which were the most-recently approved values by the PA PUC. The sum of the two programs, 'Extra' and 'Plus' form the total reported savings for the Act 129 low-income programs.	Savings per Measure (WARM Extra) Savings by job type (WARM Plus)

PPL	Act 129 WRAP savings will be deemed values based on the most recent PA PUC-approved savings protocol for each Low-Income Usage Reduction Program (LIURP) job type from a prior period until such time as a billing analysis can be completed for Act 129 WRAP projects. For PY1, PPL used billing analysis from the 2008 LIURP savings for each applicable job type. The 2008 LIURP savings are the most-recently approved values by the PA PUC.	Savings per job type
PECO	The reported savings by type of job were based on the PECO Approved Energy Efficiency Plan, which was, in turn, based on the data presented in the 2007 LIURP report. The savings values contained in the Energy Efficiency Plan are slightly different than the values in the savings protocol that the Statewide Evaluation team approved in late September 2010, which was also based on LIURP results, but for the years 2005 to 2008.	Savings per job type
Duquesne[68]	Duquesne did not implement a standalone Low-Income Program in PY1. Duquesne calculated savings based on recorded residential participants that were flagged as "low-income eligible." Savings are based on the measures contained in the residential energy efficiency kits.	Savings per measures

[68] Please refer to Section 6.2.2.2 for more information.

6.2.2.1 Allegheny

The SWE team reviewed the reported savings for Allegheny's Low-Income Home Performance Check-Up & Appliance Replacement program. The SWE identified a significant discrepancy in the reported data. An average per participant savings value of 3,473kWh was calculated from the initially reported PYTD savings and PYTD participants. This average savings value appeared to be very high and indicated a potential error in Allegheny's savings calculations. Allegheny confirmed that PYTD kWh savings values were incorrectly reported and Allegheny subsequently provided documentation containing the correct savings data. The SWE team reviewed this new documentation and found no errors or discrepancies. The error was caused by a cell reference error linking the report to the source document containing the intended values.

The PYTD kWh savings and participant count that were reported in Allegheny's Annual Report for PY1 are presented in Table 6-13. A summary of the corrected data based on documentation provided by Allegheny is presented in Table 6-14. Thus the reported kWh savings for PY1 for this program were too high by a factor of 3.4. No errors were found in the corrected data spreadsheet. Allegheny used the interim TRM measure protocols approved by the SWE to calculate the corrected reported savings.

Due to the low installation rates of some measures identified during the PY1 site-visits, Allegheny will be required to apply installation rates for each individual measure within the energy efficiency kits for PY2. The following table presents an example of energy efficiency kit measure installation rates identified during site-visits at Allegheny Power low-income program participants in PY1. For more information see low-income site visit reports at Section 4.2.1.1.

Table 6-12: Example Installation Rate from Low-Income Site Visits in PY1

Measure	Installation Rate
Low-flow showerhead	39%
Kitchen Faucet Aerators	50%
Bathroom Faucet Aerators	28% (with at least 1)

Table 6-13: Allegheny Low-Income Program Reported Data (Incorrect)

Allegheny Low-Income Program **Incorrectly** Reported Data		
	PYTD Savings	**Participants**
kWh	844,000	243
kW	0	

Table 6-14: Allegheny Low-Income Program Corrected Data

Allegheny Low-Income Program Corrected Data		
	PYTD Savings	**Participants**
kWh	249600	243

kW	50

6.2.2.2 Duquesne

The SWE has conducted an evaluation of Duquesne's reported savings and has completed an analysis of the savings assumptions. Duquesne's evaluation contractor (MCR) provided the SWE with the Excel spreadsheets used to calculate the reported savings in the Annual Report for PY1. In a review of the spreadsheet, no errors were found.

Duquesne did not have a standalone Low-Income Program in PY1. The savings are derived from the "Low-Income eligible" participants in Duquesne's Residential Energy Efficiency Program.[69] These participants registered their accounts to receive an energy efficiency kits at a variety of public events and locations such as the Beaver County Home and Garden Show, Allegheny County Court House, Friendship Folk Festival, Kane Regional Centers and through the School Energy Program.

Table 6-15: Duquesne Low-Income Program Corrected Data

Duquesne Low-Income Program Reported Data		
	PYTD Savings	**Participants**
kWh	508000	1296
kW	0.148	

6.2.2.3 PPL

The SWE conducted a desktop audit of the low-income section of PPL's PY1 Annual Report. Based on discussions between PPL, other EDCs, and the SWE, Act 129 WRAP savings will be based upon deemed values that are based on the most recent PA PUC-approved savings for each LIURP job type from a prior period until such time as a billing analysis can be completed for Act 129 WRAP projects.[70]

[69] While Duquesne is initiating new program options targeting the low-income sector in PY2 Q1, participation by income qualifying customers in PY1 programs provides evidence that programmatic offerings were accessible, used and useful to low-income customers. In PY1 Duquesne reported savings for the Low-Income Energy Efficiency Program from the installation of CFLs, furnace whistles, night lights, ENERGY STAR dehumidifiers, ENERGY STAR outdoor lighting fixtures, ENERGY STAR refrigerators and from refrigerator recycling.

[70] The SWE requires the EEMIS system to accurately represent the cost and quantity of measures installed in the Low-Income Energy Efficiency Program. Because contractors invoice PPL with measure level detail on costs and quantities, it is important that the SWE, PPL and EDC evaluators are able to verify measure installations during spot-check site-visits, conduct verification of measure-level savings calculations if changes in the Audit Plan necessitate it, verify measure costs and conduct any measure-level cost-benefit analyses, and identify anomalies in cost or quantity of measure installations.

The SWE also needs to be able to verify installations to ensure that a diverse and comprehensive set of energy efficiency measures are being implemented to justify the deemed packaged savings sourced from previous LIURP data. PPL's EE&C Plan (pg.104) submitted on September 15, 2010 stipulates that "ongoing monitoring of program activities through the planned Energy Efficiency Management Information System [EEMIS] and impact evaluations

For PPL in PY1, the ex-ante and ex-post savings for each Act 129 WRAP project will equal the 2008 LIURP savings for the applicable Job Type. The 2008 LIURP savings are the most recently approved values by the PA PUC. A copy of the 2008 LIURP results was provided by PPL to the SWE. The following table presents PPL's reported savings for their Low-Income WRAP program for PY1. Using the savings per job and number of participants, the SWE is able to replicate PPL's total reported savings in the Annual Report. The data reported in PPL's Annual Report for Low-Income Programs is included in the following tables:

Table 6-16: PPL Low-Income Program Reported Data

PPL Low-Income Program Reported Data		
	PYTD Savings	**Participants**
kWh	1086502	*See next table below*
kW	134	

Table 6-17: PPL – Prescribed Savings per Job, Total Participants and Verified Total Savings by Job Type

Job Type	Savings per Job	Participants/Jobs	Total Savings
Baseload	1042 kWh/yr	491 jobs	511,622 kWh/yr
Low Cost	1588 kWh/yr	112 jobs	177,856 kWh/yr
Full Cost	1306 kWh/yr	304 jobs	397,024 kWh/yr
		Total	**1,086,502 kWh/yr**

PPL's method of calculating the savings per job type and the results are described in PPL's PY1 Annual Report, section 4.5. From the 2008 WRAP dataset, 869 of 2212 cases were excluded (e.g. outliers and customers who have moved out). The following table is the source of the aforementioned job type savings values.

Table 6-18: 2008 WRAP Cases - Average Bill Reduction

Job Type	Participants (2008)	KWh Usage Change Pre-to-Post	Electric Bill Change Pre-to-Post
Baseload	1,474	1,042	$105
Low Cost	256	1,588	$160
Full Cost	1,351	1,306	$132

will be the primary means of tracking and validating savings for all proposed programs in the Plan." It also continues to stipulate that "The Company will ensure the necessary data for conducting impact evaluations will be available from the Tracking System. At a minimum, these data will include the following: "Type and frequency of installed measures", "Estimated savings" and "Measure cost".

6.2.2.4 PECO

The SWE has conducted an evaluation of PECO's reported savings and has completed an analysis of the savings assumptions. PECO's evaluation contractor (Navigant) provided the SWE with the Excel spreadsheets used to calculate the reported savings in the Annual Report for PY1. In a review of the spreadsheet, no errors were found.

PECO's Low-Income section of the Annual Report contained footnotes that incorrectly referenced several tables which indicated that the results were based on the proposed protocol. During consultations, PECO (via Navigant) indicated that the reported savings were based on PECO's Approved Energy Efficiency Plan, which was, in turn, based on the 2007 LIURP report. The prescribed savings values contained in the Energy Efficiency Plan are slightly different than the values in the proposed protocol, which was also based on LIURP results, but from multiple years. The difference between the values in the two documents only generated a minor overall impact (less than 1% or 23MWh). The reported results were 3407.5MWh and if the savings were based on the proposed LEEP protocol, they would total 3430.6MWh.[71]

Table 6-19: PECO Low-Income Program Reported Data

PECO Low-Income Program Reported Data		
	PYTD Savings	**Participants**
kWh	3407000	1994
kW	290	

6.2.2.5 FirstEnergy Utilities

The following tables present the reported annual savings and participants for each of the FirstEnergy EDCs by low-income program. FirstEnergy is implementing identical programs across each of its three utilities to capitalize on economies of scale and maximize administrative efficiencies.

Table 6-20: Met-Ed Low-Income Program Reported Data

		PYTD Savings	**Participants**
WARM[72]	kWh	63,000	185
	kW	10	
Home Audits	kWh	983,000	3,307
	kW	100	
EE Products	kWh	794,000	3,407
	kW	40	
Appliance	kWh	144,000	83

[71] PECO has made adjustments to the savings associated with their LEEP program due to the protocol approved on October 2010 in their PY2 Q1 report.
[72] References to WARM in this report include FirstEnergy's "WARM PLUS" and "WARM Extra Measures" programs.

Turn-in	kW	20

Table 6-21: PennPower Low-Income Program Reported Data

PennPower Low-Income Program Reported Data			
		PYTD Savings	**Participants**
WARM	kWh	20,000	135
	kW	0	
Home Audits	kWh	360,000	1,187
	kW	30	
EE Products	kWh	737,000	3,749
	kW	40	
Appliance	kWh	43,000	25
Turn-in	kW	10	

Table 6-22: Penelec Low-Income Program Reported Data

Penelec Low-Income Program Reported Data			
		PYTD Savings	**Participants**
WARM	kWh	87,000	539
	kW	10	
Home Audits	kWh	1,032,000	3,685
	kW	110	
EE Products	kWh	1,315,000	6,290
	kW	70	
Appliance	kWh	284,000	138
Turn-in	kW	40	

6.2.2.5.1 Low-Income WARM Programs

The Low-Income Energy Efficiency programs of the FirstEnergy utilities are partially implemented on a direct-install basis. For the WARM Extra Measures programs, the savings were calculated on a measure by measure basis, i.e. CFLs and Smartstrips using protocols reviewed and supported by the SWE. The WARM Extra Measures program provides CFLs and Smartstrips to eligible participants and records quantities of unique measure installations in a project database where the total program savings are calculated. In the WARM Plus program, the savings are calculated by job type (electric heat, water heating, base-load) based on the 2008 LIURP savings which were the most recently approved values by

the PA PUC.[73] The sum of the total savings from each of the two programs constitutes the WARM savings reported in the Annual Report for PY1 (and presented in the tables below).

FirstEnergy's evaluation contractor, ADM Associates (ADM), provided the documentation in support of the reported PY1 savings. The total savings for the WARM program for PennPower and Met-Ed could be accurately verified using this documentation. The Penelec reported savings could not be accurately verified using the provided documentation. Upon consultation with ADM, it was determined that the reported savings in Table 2-5 and Table 2-6 on page 24 of the Penelec Annual Report were derived from an earlier version of the same document. The reported MWh savings for the Penelec WARM program is 87MWh and the supporting documentation presents savings of close to 90MWh. The cause of the error was isolated to the savings value assigned to the Penelec job type "Water Heat" – the earlier document used a value of 1170 and the latest version used 2170.[74]

6.2.2.5.2 Energy Efficiency Products (Low-Income Component)

FirstEnergy's evaluator provided the documentation for the SWE to review the reported savings for the low-income (defined as 150% of the federal poverty level) component of the Energy Efficiency Products (EE Products) program. Over 99% of the kWh savings from this low-income program component are attributed to the buy-down of FEIT and GE brand CFL bulbs at major retailers, including Sam's Club, Costco and Wal-Mart. The low-income savings component of the CFL buy-down effort is calculated by applying a "low-income weight" to the total residential CFL savings. The weighting adjusts for the difference in the percentage of low-income customers "tagged" in the EDC's billing system and the estimated percentage of low-income customers according to each specific county's demographic data. For example, if there are 15% of customers in FirstEnergy's billing system tagged as low-income (due to demographic surveys, CAP programs or other targeted initiatives), and 30% of the county is designated as low-income, the weighting factor would be 2.0. FirstEnergy applied an in-service rate (ISR) of 84% to the CFL buy down program in accordance with the TRM.

A review of the documentation provided by FirstEnergy's evaluator indicated that the Met-Ed and Penelec reported savings for the low-income component of the EE Products program are incorrect.

- Penelec reported savings of 1,315MWh for the low-income EE Products component and the documentation used to develop this value indicates savings of 1,313MWh, a difference of 2MWh.
- Met-Ed reported savings of 794MWh for the low-income EE Products component and the documentation used to develop this value indicates savings of 788MWh, a difference of 6MWh.

ADM confirmed that the incorrectly reported values were accidentally derived from an earlier version of the working spreadsheets used to develop both these savings estimates.[75]

[73] WARM Plus savings will be based on deemed values based on the most recent PA PUC-approved savings.
[74] Given the minimal impact of this error, ADM and FirstEnergy reports for future periods will reflect the change in cumulative totals and the adjustment will be noted.
[75] Given the minimal impact of this error, ADM and FirstEnergy reports for future periods will reflect the change in cumulative totals and the adjustment will be noted.

6.2.2.5.3 Appliance Turn-In Programs (Low-Income Component)

FirstEnergy's evaluator provided the documentation for the SWE to review the reported savings for the low-income component of the Appliance Turn-In Program.

The SWE reviewed the Annual Report submitted by FirstEnergy. Upon review, the SWE identified a minor anomaly - the reported average annual savings per participant for the low-income Appliance Recycling component for Penelec was notably higher (2,058kWh) than the savings reported in the same programs operated by PennPower (1,720kWh) and Met-Ed (1,734kWh). The current annual kWh savings value per participant for a removed refrigerator in the PA TRM is 1,728kWh. After bringing this issue to the attention of ADM, the SWE received an explanation as to why the Penelec MWh Savings per low-income participant is over 2MWh, while PennPower and Met-Ed are 1.72MWh and 1.74MWh per participant. According to Sasha Boroiant of ADM Associates on September 27, 2010, the explanation for this discrepancy is [edited for clarity]:

> *A participant in the program is defined as a "pick-up" order that has been fulfilled. In principle, an order can include up to two refrigerators and up to two room air-conditioners. As most orders are for single refrigerators the savings per participant should be close to 1.73 MWh. Orders with one refrigerator and at least one other appliance will increase the average savings per participant and orders with just one or two room ACs will tend to decrease the average. The reason that the Penelec average savings per participant is higher is because Penelec had several low-income participants who recycled two refrigerators, and they had few or none that did not recycle at least one refrigerator. The other utility companies also had low-income participants that recycled two refrigerators, but their contributions were offset by other participants that only recycled room ACs.*

The SWE accepts that the proximity of PennPower's and Met-Ed's per participant savings averages to the current TRM Deemed savings value of 1,728 kWh per participant as a coincidence.

6.2.2.5.4 Home Energy Audits (Low-Income Component)

The low-income component of the Home Energy Audits program calculates savings based on the number of low-income customers tagged in the FirstEnergy EDCs' billing system multiplied by the savings value assigned to the energy efficiency kits in each EDC service territory. FirstEnergy's evaluator provided the documentation for the SWE to verify reported program savings. No errors or anomalies were identified in the documentation and the report.

6.2.3 Commercial and Industrial Sector

The SWE reviewed and audited each EDC's annual report, verifying that gross, verified, and net impacts were properly reported. The general audit approach traced impacts from the application to the implementer database to the verification process to the evaluation. Because each EDC's portfolio structure and implementation had its own nuances, slight differences in the audit procedure between EDCs may be observed. The specific observations, findings, and recommendations can be found in the following sections.

6.2.3.1 Allegheny

6.2.3.1.1 General Description of Audit

Allegheny had two C&I programs that reported savings for PY1. The results are summarized in Table 6-23 below.

Table 6-23: Allegheny C&I Reported Energy Savings

Program	Gross Impact (MWh)	Unverified Ex-Post (MWh)[1]	Realization Rate[2]	Confidence and Precision	Net Impact (MWh)
Governmental/Non-Profit Lighting Efficiency Program	3,023	0	0.75	90%/±10	2,267
Commercial Lighting Efficiency Program	188	0	N/A[3]	N/A[3]	0

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact. See definition of Realization Rate in Glossary.3. Evaluator did not evaluate the Commercial Lighting Efficiency Program due to PY1 participation levels.

Table 6-24: Allegheny C&I Reported Demand Savings

Program	Gross Impact (MW)	Unverified Ex-Post (MW)[1]	Realization Rate[2]	Confidence and Precision	Net Impact (MW)
Governmental/Non-Profit Lighting Efficiency Program	0.7	0.0	0.75	90%/±10	0.5
Commercial Lighting Efficiency Program	0.0	0.0	N/A[3]	N/A	0.0

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact. See definition of Realization Rate in Glossary.
3. Evaluator did not evaluate the Commercial Lighting Efficiency Program due to PY1 participation levels.

6.2.3.1.2 Claimed Savings Audit: Observations and Recommendations

6.2.3.1.2.1 Governmental/Non-Profit Lighting Efficiency Program

The Governmental/Non Profit Lighting Efficiency (GNPLE) Program consisted of a pilot CFL and LED Exit Sign give away for PY1. Customers qualifying under the program requested quantities of CFLs and Exit Signs, which were shipped to the customer. Allegheny provided a final database in October detailing participant information and savings per participant. A review of the database yielded savings of 3,023MWh and 0.676MW, matching numbers in the Annual Report. The Annual Report shows 324 participants, while the database contains only 205 rows, representing customer account numbers. If a customer requested both CFLs and LED Exit Signs, Allegheny counted that customer as two participants. The database shows 326 participants using this methodology. Further review with Allegheny revealed a small data entry error, which was considered negligible and bore no impact on savings. This method of accounting for participants allowed better segmentation and control over sample selection.

The desk audit of the GNPLE Program showed that savings calculations were inconsistent yet conservative compared to TRM Protocols. The algorithm used by Allegheny to calculate savings potentially understates savings by as much as 12% because it did not factor in the interactive effects. Review with Allegheny revealed that the program was rolled out prior to the release of the approved TRM and could not incorporate changes accordingly. This has been corrected for PY2. Other assumptions, including delta watts, were reviewed and found to be appropriate for this program segment.

6.2.3.1.2.2 Commercial Lighting Efficiency Program

The Commercial Lighting Efficiency Program consisted of prescriptive rebates for fluorescent lighting and occupancy sensors. Savings were determined by use of an adapted Appendix C. The program only had three participants claiming a total savings of 188MWh and 0.0MW. Because these savings were not verified by Allegheny's evaluators, the claimed savings database was not reviewed. Savings will be audited in the next program year.

6.2.3.1.3 Audit of Statistics Underlying the Realization Rate

Due to the low participation in the Government/Non Profit Lighting Efficiency Program, a detailed statistical audit of the realization rate calculations is not necessary. The calculated installation (realization) rate is deemed appropriate for this population of projects. The methods used to sample projects and calculate realization rates are in line with the SWE approved EM&V plan.

6.2.3.1.4 Evaluation Audit: Observations and Recommendations

The GNPLE Program savings were adjusted by applying a 75% realization rate and verified as 2,267MWh. Because this program consisted of deemed measures (CFLs and Exit Signs), the EDC evaluator used survey verification to determine installation rates, which was the only component considered for the realization rate. Review of survey results show that the 75% installation rate includes measures that customers have not yet installed but plan to install within the next six months. The installation rate of measures installed at the time of the survey was 68%. This methodology is acceptable for PY1.

However, this methodology poses issues during compliance years because CFLs installed six months after May 31, 2011, should not count towards the 2011 savings goals and CFLs installed six months after May 31, 2013, should not count towards the 2013 savings goals. It is recommended that the realization rate definition be adjusted to address this issue.

6.2.3.2 Duquesne

An Annual Report audit was not performed for Duquesne because no "true" non-residential impacts were reported, i.e., some impacts were reported as non-residential which in actuality represent residential type measures at a master metered multi-family units. Therefore, results reported as non-residential impacts pertain to residential type measures and were verified as residential measures.

6.2.3.3 Met-Ed

For the purposes of Section 6.2.3, FirstEnergy's three companies – Met-Ed, Penelec, and PennPower – have been combined. Because the implementation and evaluation methodologies were identical between the three companies, the audit activities for each of the three companies were performed simultaneously. The following describes Met-Ed, Penelec, and PennPower.

6.2.3.3.1 General Description of Commercial and Industrial Audit

Met-Ed had two programs that reported energy savings in PY1. Savings were reported as shown in Table 6-25.

Table 6-25: Met-Ed C&I Reported Energy Savings

Program	Gross Impact (MWh)	Unverified Ex-Post (MWh)[1]	Realization Rate[2]	Confidence and Precision	Net Impact (MWh)
C&I Performance Contracting/Equipment	2,973	0	86.9%	90%/±9.0%	2,585
Remaining Government/Non-Profit	15	0	86.9%	90%/±9.0%	13

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact. See definition of Realization Rate in Glossary.

Table 6-26: Met-Ed C&I Reported Demand Savings

Program	Gross Impact (MW)	Unverified Ex-Post (MW)[1]	Realization Rate[2]	Confidence and Precision	Net Impact (MW)
C&I Performance Contracting/Equipment	0.43	0.00	100.9%	90%/±9.0%	0.43
Remaining Government/Non-Profit	0.00	0.00	N/A	90%/±9.0%	0.00

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact. See definition of Realization Rate in Glossary.

Penelec had four programs that reported energy savings in PY1. Savings were reported as shown in the following table.

Table 6-27: Penelec Reported Energy Savings

Program	Gross Impact (MWh)[1]	Unverified Ex-Post (MWh)[2]	Realization Rate[3]	Confidence and Precision	Net Impact (MWh)
C/I Performance Contracting/Equipment	3,039	0	105.0%	90%/±19.0%	3,191
Industrial Motors and VSD	118	686	579.2%	90%/±10.0%	686
Non-Profit	66	0	105.0%	90%/±19.0%	69
Remaining Government/Non-Profit	177	0	104.7%	90%/±19.0%	185

Notes
1. The Gross Impact of these four programs totals to 3,400MWh, and could be verified in the FirstEnergy database; however, this did involve some manipulation of data. This indicates a possibly unfrozen reported savings population.
2. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
3. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact. See definition of Realization Rate in Glossary.

Table 6-28: Penelec Reported Demand Savings

Program	Gross Impact (MW)[1]	Unverified Ex-Post (MW)[2]	Realization Rate[3]	Confidence and Precision	Net Impact (MW)
C/I Performance Contracting/Equipment	0.55	0.00	86.7%	90%/±19.0%	0.48
Industrial Motors and VSD	0.08	0.07	90.6%	90%/±10.0%	0.07
Non-Profit	0.01	0.00	92.3%	90%/±19.0%	0.01
Remaining Government/Non-Profit	0.04	0.00	86.8%	90%/±19.0%	0.03

Notes
1. The Gross Impact of these four programs totals to .68MW, and could be verified in the FirstEnergy database; however, this did involve some manipulation of the data. This indicates a possibly unfrozen reported savings population.
2. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
3. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact. See definition of Realization Rate in Glossary.

PennPower had one program that reported energy savings in PY1. Saving reported are shown in the following tables.

Table 6-29: PennPower Reported Energy Savings

Program	Gross Impact (MWh)	Unverified Ex-Post (MWh)[1]	Realization Rate[2]	Confidence and Precision	Net Impact (MWh)
C/I Performance Contracting/Equipment	713	0	94.6%	90%/±1.0%	675

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact. See definition of Realization Rate in Glossary.

Table 6-30: PennPower Reported Demand Savings

Program	Gross Impact (MW)	Unverified Ex-Post (MW)[1]	Realization Rate[2]	Confidence and Precision	Net Impact (MW)
C/I Performance Contracting/Equipment	0.10	0.00	114.6%	90%/±1.0%	0.11

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact. See definition of Realization Rate in Glossary.

6.2.3.3.2 Claimed Savings Audit: Observations and Recommendations

Met-Ed reported impacts of 2,988MWh and 0.43MW for PY1 for all non-residential programs. This figure includes contributions from the Commercial and Industrial Performance Contracting/Equipment (CIPCE)

and the Government/Non-Profit Programs. The participant levels discussed in the Annual Report match what was discovered in the database, with 29 coming from C&I sectors and one participant from the Government/Non-Profit sector. The claimed savings were verified between the reported savings in the database and that in the PY1 Annual Report.

PennPower reported impacts of 713MWh and 0.1MW for PY1 for all non-residential programs. This figure includes a contribution from only *CIPCE* programs. The *CIPCE Program* utilizes end-use products such as lighting and HVAC to supplement C&I equipment. These products can be of a prescriptive or custom nature, with some projects requiring on-site evaluation of methodology or to verify a partially deemed measure. The sampling was accomplished using batches, from which three stratifications were developed. It should be noted there was no implementation for performance contracting in PY1. Therefore, all database claimed savings resulted from the Equipment program, particularly the Standard Lighting for Business program. Review of the database shows that PennPower is claiming 713MWh and 0.1MW savings from these programs, which matches the PY1 Annual Report. The eleven participants in the Annual Report match those in the database.

Penelec reported impacts of 3,400MWh and 0.68MW for PY1 for all non-residential programs. This figure includes contributions from the following programs: *CIPCE*, Industrial Motors and Drives, and Government/Non Profit. The claimed savings database matches the claimed savings. Penelec had 70 participants from each of the preceding programs, which was matched to the participants logged in the FirstEnergy database.

6.2.3.3.3 Audit of Program Evaluation, Measurement and Verification Methodology

The EE&C programs offered by the three FirstEnergy operating companies were collectively audited by the SWE team as a single portfolio due the similar nature of the programs. Gross impacts for demand and energy were verified by FirstEnergy Evaluators through different approaches for TRM and Custom measures. The *Audit Plan* and Implementation Order require the EDCs to obtain the Commission's approval for TRM and CMPs. The SWE team conducted an audit of the evaluation performed by FirstEnergy Evaluators based on the approved protocols. The audit of the EM&V methodology included the following:

1. Due diligence review of the program tracking data and supporting documentation to validate the "frozen" population used for the evaluation.
2. Sampling and review of several projects to validate the engineering methods and level of rigor employed by the FirstEnergy Evaluators. The data collection methods used for on-site verification of installation quantity, operating conditions and system loading conditions, validation of baseline selection and verification of persistence were found to be consistent with standard engineering practice.
3. Verification that the parameters and data used to design the TRM and Custom protocols are accurate and well founded.
4. Verification that monitoring and metering activities are conducted as required by the SWE approved protocol.

5. A total of 25 ride-alongs and independent site inspections were conducted to audit the evaluation methods used by FirstEnergy Evaluators to generate ex-post savings estimates. During the site visits, the SWE team observed that a few large Commercial and Industrial projects receiving substantial rebates had low savings persistence due to prevalent economic conditions. The spaces were either unoccupied or closed for business. The SWE team agrees with the FirstEnergy Evaluators' assessment that prevalent economic conditions can impact FirstEnergy's progress towards the compliance target; however, the net effect of such market conditions on target achievement is difficult to quantify.

FirstEnergy implements a separate program for Motors and Variable Speed Drives in the C&I Sector. Only one project was implemented under the program in PY1. One observation made by the SWE team during the audit visits was that pre-installation monitoring was not conducted on the Custom project as required by the SWE approved protocol. The issue was discussed and FirstEnergy Evaluators clarified that this was a one-time error due to time constraints. The SWE team believes this non compliance does not have a material effect on the reported results.

6.2.3.3.4 Audit of Program Sampling

The SWE team's audit activities on program sampling methods yielded the following results:

1. EM&V sampling should be conducted at the program level using the selected confidence and precision from the *Audit Plan*. Stratification by savings weights and measure types should be applied. Additional stratification by sector type e.g. Small C&I and Large C&I is also recommended to ensure homogeneity of the population and the sample pool FirstEnergy implements dedicated programs for the Small C&I, Large C&I and Government/Non Profit sectors. FirstEnergy Evaluators have combined multiple non-residential programs into a single population to classify and group measures by Prescriptive and Custom measure types. Such grouping is acceptable as long as the sample chosen is representative of the population. The Government/Non Profit sector has an individual compliance target and should not be combined with other sectors for realization rate calculations and sampling.
2. The Prescriptive and Custom measure groups were not stratified further by measure or technology type e.g. lighting, HVAC, building controls etc. because savings approved in PY1 were all lighting. For future evaluations, the SWE team recommends sampling by measure type to ensure the sample selected has a good mix of measures and is representative of and similar to the population from which it is selected. If segmentation by multiple measure types is not possible, broad classification by lighting and non-lighting measures is recommended to ensure a certain level of control over the random sample selection. The SWE team has addressed the sampling inadequacies with FirstEnergy and the sampling protocols will be revised for future evaluations.
3. FirstEnergy Evaluators used the dynamic batch-wise sampling methodology recommended by the SWE team. The samples were drawn on a bi-weekly basis. The SWE team conducted a due diligence review of the batch sampling algorithms and the calculations were verified and found to be accurate.

4. For PY1, one measure with interim protocols not approved by the SWE team was included in the "frozen" ex-ante population. The one measure accounted for 683kWh of the ex-ante savings claimed by the non residential programs. The SWE team reviewed the FirstEnergy databases and the values were found to be accurate. FirstEnergy has classified these savings as "Unverified Ex-Post" savings as required by the SWE, since an approved protocol is not yet in place.

6.2.3.3.5 Audit of Realization Rate Calculations

FirstEnergy Evaluators have calculated realization rates using a weighted average method for all non-residential programs. The realization rate is calculated by dividing the sum of the ex-post savings by the sum of the ex-ante savings. The ex-ante savings were calculated using a "frozen" population as required by the SWE team. The realization rate calculations were reviewed and were found to be accurate.

The SWE team's review of the relative precision calculations associated with the realization rates however, revealed that FirstEnergy has not achieved 90/10 confidence and precision for the Penelec C&I programs. The resultant precision was 19% with a high variance in the sample pool. The SWE team also observed that the target sample size for 90/10 confidence and precision at an assumed Coefficient of Variance (COV) of 0.5 was not achieved individually for each operating company.[76] This was largely attributed to several samples being dropped from the overall PY1 population.[77] The FirstEnergy Evaluators could not verify additional projects to make up for the diminished sample size due to time constraints.[78] Because contributions made by C&I programs in PY1 were relatively small compared to overall compliance targets, the SWE team recommended, and PUC staff approved, a one-time exception for the inadequate sample size, provided that the sample sizes are correct and do not skew results. The *Audit Plan* and Implementation Order require that gross verified impacts be reported at the specified precision value individually for each EDC. In the future, FirstEnergy evaluators should ensure that each individual company meets statistical expectations. If a COV less than 0.5 is achieved for any sample pool, the representative trend of low variance should be consistently demonstrated before reporting the relative precision at a lower COV. Sample sizes should only be reduced if the COV trend consistently shows values lower than 0.5.

6.2.3.3.6 Evaluation Audit: Observations and Recommendations

The SWE selected a sample of projects from the population of projects reported in PY1 to perform a desk audit of the savings. The desk audit consisted of a due diligence review of the EDCs' Evaluator verification processes, including engineering calculations and data entry, to ensure compliance with TRM protocols. Eight projects were provided, with at least two projects from each utility comprising FirstEnergy. Verification techniques were examined and database entries for savings calculations were cross-checked. The reported savings numbers were verified in the FirstEnergy database, and evaluator-determined realization rates were compared from calculation results to database entry, which all proved accurate. The EDC Evaluator noted that several projects were not reviewed properly for the

[76] Clarification regarding COV value will be addressed in a future amendment to the Audit Plan following the November 2010 Sampling Workshop.
[77] EDC evaluator noted that corrective action will be taken to avoid this situation in future years.
[78] FirstEnergy is working with the CSP to ensure that the rebate approval status and claimed savings are QC'd and frozen as an applicant's status is changed from pre-approved to approved.

initial Annual Report filing. Issues with proper application of coincidence factors and hours of use values affected the verified savings for a portion of the sampled projects, and therefore modified the realization rate. These errors were identified and corrected for the FirstEnergy Annual Report filed on September 30, 2010. Regarding to evaluator techniques, the provided calculation files show that the evaluation contractors are aware of TRM practices for program evaluation. For example, in multiple forms there are comments illustrating evaluator changes to conditioned space type, full load hours, and coincidence factors, and fixture type that show proper TRM application. A minor discrepancy is the difference between evaluator site visit notes regarding fixture counts, what is shown on the application, and what is in the evaluator's calculations. These numbers are not always the same, and the reason for the difference is hard to identify through a desk audit. The techniques used by the evaluators are deemed appropriate for the selected sample projects.

6.2.3.4 Penelec

Penelec was combined with Met-Ed and PennPower. For further description of the audit, please see Section 6.2.3.3.

6.2.3.5 PennPower

PennPower was combined with Met-Ed and Penelec. For further description of the audit, please see Section 6.2.3.3.

6.2.3.6 PECO

6.2.3.6.1 General Description of C&I Audit

PECO had three programs which reported energy savings in PY1. Savings were reported in the three programs areas shown in Table 6-31.

Table 6-31: PECO C&I Reported Energy Savings

Program	Gross Impact (MWh)	Unverified Ex-Post (MWh)[1]	Realization Rate[3]	Confidence and Precision	Net Impact (MWh)
Smart Equipment -C&I	11,446	73	1.27	90%/±5.9%[4]	14,444
Smart Equipment- Gov/Non Profit	1,383	38	1.27	90%/±5.9%[4]	1,708
Conservation Voltage Reduction (CVR)[2]	20,819	20,819	1.94	90%/±0.5%	N/A

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. As of 10/6/20109, PECO is finalizing the CVR Protocol based on data which was presented to the SWE by PECO on 9/30/2010. The protocol has been approved conceptually, subject to final review.
3. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact.
4. Monitoring and verification was conducted jointly for the C&I and Government/Non Profit segments of this program.

Table 6-32: PECO C&I Reported Demand Savings

Program	Gross Impact (MW)	Unverified Ex-Post (MW)[1]	Realization Rate[3]	Confidence and Precision	Net Impact (MW)
Smart Equipment -C&I	2.32	0.02	0.97	90%/±23%[4]	2.23
Smart Equipment- Gov/Non Profit	0.17	0.01	0.97	90%/±23%[4]	0.15
Conservation Voltage Reduction[2]	0	0	N/A	N/A	0

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. As of 10/6/2010, PECO is finalizing the CVR Protocol based on data which was presented to the SWE by PECO on 9/30/2010. The protocol has been approved conceptually, subject to final review.
3. Applied to Gross Impact less Unverified ex-post which was included in Gross Impact.
4. Monitoring and verification was conducted jointly for the C&I and Government/Non Profit segments of this program.

6.2.3.6.2 Claimed Savings Audit: Observations and Recommendations

The audit of these results included the following:

1. Site Inspections and QA/QC reviews of projects in various stages of development discussed in Section 4 of this SWE Annual Report.
2. A review of the Claimed Savings Database ("Gross Impact") incorporating projects completed prior to May 31, 2010. Activities included matching the total of Claimed Saving for each participant to the Annual Report.
3. A desk audit of the Claimed Savings to provide assurance that Commission approved TRM Protocols or Interim Protocols were followed. Interim Protocols include both measures that will be included in future TRM Updates or CMPs that are not suitable for the TRM pursuant to the 2009 TRM Order.
4. A desk audit of the sample population pulled from the entire population of participants comprising the Claimed Savings Database. This desk audit confirmed that the engineering

verification performed by the EDC Evaluators of the Claimed Savings of randomly selected sample participants was performed according to accepted measurement protocols.

5. A review of the sample selection process and the underlying statistics used to attain the specified and approved levels of confidence and precision of the verified results.
6. A review of the Conservation Voltage Control Program's savings calculation methodology has been performed. The M&V Protocol has been approved conceptually by the SWE and is currently being finalized by PECO for the SWE's review. Therefore the savings reported in PECO's Annual Report have been classified as "Unverified Ex-Post".

6.2.3.6.3 Audit of Program Evaluation, Measurement and Verification Methodology

Gross impacts for demand and energy savings were verified by PECO through different approaches for TRM and Custom measures. The *Audit Plan* and Implementation Order require the EDCs to obtain Commission approval for TRM and CMPs. The SWE team conducted an audit of the evaluation performed by PECO based on the approved protocols. The audit of the EM&V methodology included the following:

1. Due diligence review of the program tracking data and supporting documentation to validate the "frozen" population used for the evaluation.
2. Sampling and review of several projects to validate the engineering methods and level of rigor employed by the PECO Evaluators. The data collection methods used for on-site verification of installation quantity, operating conditions and system loading conditions, validation of baseline selection and verification of persistence were verified and found to be consistent with standard evaluation practice.
3. A total of 26 ride-alongs and independent site inspections with evaluators and implementers were conducted to audit the evaluation methods used by the PECO Evaluators to generate the ex-post savings estimates. Eleven of these inspections were performed after September 15, 2010, and are not reported in Section 4.1.6 since the results have not been compiled. Observations made during audit visits indicate that the PECO Evaluator's on-site inspectors relied heavily on customer self-reported information to generate equipment load shapes. Logging/Metering was not conducted by the PECO Evaluators for several large C&I projects even when the baseline and post retrofit data collected by the implementation CSP was deemed inadequate. Both the clarity of the TRM and TRM compliance can be improved.

The *Audit Plan* offers some flexibility to the EDC evaluators to select the level of engineering rigor appropriate for the programs reviewed but the key variables are defined by the M&V protocols approved by the Commission and, relative to Interim and CMPs, by the SWE. The costs incurred in using a higher level of rigor need to be balanced with the relative impact of the variations in engineering estimates compared to the project size. The level of rigor, however, should not be compromised on projects with high impact and high uncertainty. For future evaluations, sampled projects should be evaluated based on the specified level of rigor, independent of the M&V activities of the CSP or issues of compliance to the TRM at the customer level. Although small to medium size projects do not warrant a high level of engineering rigor, the level of accuracy should not be compromised on projects that have a

relatively high impact on the program and portfolio savings. The goal is not to achieve 100% accuracy with a 0% margin of error. The goal is to verify real savings at reasonable accuracy and precision, as defined by standard evaluation practice. For the PECO evaluation, the SWE team noted that the level of rigor was compromised on several medium to large size borderline projects which can collectively have a substantial impact on the program's gross savings. The SWE team will provide further clarifications on the expected level of engineering rigor by project size in the next *Audit Plan* update.

6.2.3.6.4 Audit of Program Sampling

The PECO evaluators completed an evaluation review of 21 sampled projects from a population of 87 projects completed in the C&I and Government/Non Profit sectors. The SWE team's audit activities on program sampling methods yielded the following results:

1. Although the C&I and Government/Non-Profit sectors have dedicated compliance targets, PECO rolled two program sectors into a single population for the evaluation. This approach is inconsistent with the *Audit Plan* sampling requirements, yet the SWE team recommends a onetime waiver to PECO to use the ratio estimation approach as described by PECO Evaluators to provide flexibility in light of the time constraints. The SWE team will issue an Amendment to the Act 129 *Audit Plan* to clarify the sampling expectations. Combining multiple program or sector types compromises the homogeneity of the project population, which is essential to ensure the sample selected is representative of the population.
2. For PY1, PECO claimed 93.9% of the ex-ante kWh program impacts, for the population of 87 projects, were for the lighting measures within the current TRM, 5.5% were for TRM non-lighting measures and 0.6% were custom measures. The sample was therefore weighted towards the lighting measures. The SWE team conducted a conscientious review of the PECO program databases and the reported numbers and distributions by measure type were found to be accurate.
3. For sampling purposes, the PECO evaluator stratified the program population into Prescriptive TRM measures in one group, and Custom Measures in the second group. The SWE team studied the population distribution and determined that the stratification methodology used is appropriate.

For PY1, four measures within the Smart Equipment Programs with interim protocols not approved by the SWE team were included in the "frozen" ex-ante population. The four Smart Equipment Program measures accounted for 111MWh or 0.9% of the ex-ante savings claimed (not verified) by the Smart Equipment Programs. Unverified ex-post savings of 20,819MWh were also claimed for the Conservation Voltage Reduction Program. Total unverified ex-post savings account for 62% of the total ex-ante claimed savings (not verified). The SWE team reviewed the PECO data for both Smart Equipment and Conservation Voltage Control and the values were found to be consistent. PECO has classified these savings as "Unverified Ex-Post" savings as required by the SWE, since an approved protocol is not yet in place. The SWE team conducted a detailed review of the sampling algorithms and stratification methods used by the PECO evaluator and noted that the Prescriptive project population was not stratified further by measure type. Although TRM approved measures share an extensive level of completed research and

analysis on their savings and they use deemed and partially deemed variables, the nature and complexity of the equipment energy consumption profiles varies significantly by measure type. The *Audit Plan* requires EDC evaluators to stratify the project population by measure type. If the population cannot be stratified into multiple measure types, broad measure types such as lighting and non-lighting should be used to divide the population into sub groups, and to ensure the sample selected has a good mix of measures and is representative of the population.

The SWE team observed that the population of Prescriptive TRM based projects had an energy savings distribution skewed towards three large projects that account for approximately one-third of the program savings. For this reason, the PECO evaluator used a savings weighted ratio estimation approach to reduce sample sizes required for evaluation. The audit of the sampling pool yielded several observations.

1. The required sample for 86 prescriptive projects have 90/10 confidence and precision with an assumed error ratio of 0.5 is 39 projects. PECO evaluators reviewed a total of 21 projects based on the ratio estimation approach. The project population was divided into small, medium and large size projects. The stratification by project size is reasonable.
2. The PECO evaluators conducted a census review of the projects in the medium and large strata. There were a total of 11 projects in these strata leaving 75 projects in the small projects strata. PECO has claimed to have achieved 90/10 confidence and precision by conducting a census review of the 11 projects that represent 66% of the program energy savings. If the high impact projects collectively account for over 80% of the population then a combined sampling/census approach may be justified, but if that is not true for the program under consideration, focusing only on the largest contributors compromises the level of auditing rigor on the mid and small size projects. The high impact projects are generally more complex, have high incentives paid for the measures, and have a high level of due diligence review conducted by the program implementation contractors. The probability of error is low. On the other hand, the probability of error is high in the mid-size or borderline projects and needs to be probed by drawing a reasonable number of samples that are representative of the population.
3. For the C&I and Government/Non Profit sectors, the contribution of PECO's PY1 programs to the 2011 goals is less than 7%. Given the time constraints and the fact that PY1 is a partial year, the ratio estimation approach applied on a somewhat heterogeneous population may be allowable. As mentioned above, the SWE team recommends a one-time waiver allowing PECO to use the ratio estimation approach as described by PECO evaluators to provide flexibility in light of the time constraints. The SWE team will issue an Amendment to the *Audit Plan* to clarify the sampling expectations by November 31, 2010.

6.2.3.6.5 Audit of Realization Rate Calculations

The PECO evaluators have calculated realization rates using a weighted average method for the small, medium and large projects strata. The realization rates for non-residential programs are shown in Table 6-31 and Table 6-32. The realization rate was calculated by dividing the sum of the ex-post savings by the sum of the ex-ante savings. The realization rate calculations were verified by the SWE team and

were found to be accurate. The ex-ante savings were calculated using a "frozen" population as required by the SWE team. Relative precision associated with the mean estimate of the realization rates was computed accurately.

6.2.3.6.6 Evaluation Audit: Observations and Recommendations

The audit of the C&I portion of PECO's Annual Report confirmed the reported results with some minor qualifications. Several observations by the SWE team may serve to improve the reporting process in future years.

1. The Claimed Savings Database must be frozen for projects completed in the program year. PECO had multiple databases of Claimed Savings (Gross Impact) and provided a database to the SWE which did not correspond to the Annual Report. The database should be "frozen" at a certain date for projects completed before the end of the program year and this data should be forwarded to the SWE prior to the sample being pulled to facilitate a clean audit trail.
2. Claimed Savings should not be based on planning estimates for the purpose of calculating Realization Rates. Claimed Savings (Gross Impact) should be based on the application of an approved protocol or protocol underdevelopment, in the case of "Unverified Ex-Post Saving". This was not the case for the reported Conservation Voltage Reduction Program.
3. Based on a review of some of the sample population, minor discrepancies were also noted. One related to an error in a manual data entry process. Another was related to the use of measurement methodologies not specified in approved TRM protocols related to the hours of use of a lighting system in a warehouse. These issues are being addressed and the SWE believes they do not have a material effect on the reported results.

6.2.3.7 PPL

6.2.3.7.1 General Description of Commercial and Industrial Audit

PPL had four programs that reported energy savings in PY1. Savings were in Table 6-33.

Table 6-33: PPL C&I Reported Energy Savings

Program	Gross Impact (MWh)	Unverified Ex-Post (MWh)[1]	Realization Rate[2]	Confidence and Precision[2,3]	Net Impact (MWh)[2]
Efficient Equipment Program	84	57	119%	90%/±0.1%	N/A
Appliance Recycling Program	129	0	102%	90%/±8.4%	N/A
Custom Incentives Program	39	0	144%	100%/±0.0 %	56
Renewables Program	98	0	175%	90%/±0.04 %	N/A

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. Realization rates are to be applied at the program level. Realization rates include adjustments made due to both residential and non-residential projects and therefore cannot be applied to part of the population. Planning estimates are also captured in the realization rates. See §6.1.5.2 and §6.1.5.3 for additional discussion.
3. Confidence and Precision levels are determined on an overall program level including all sectors.

Table 6-34: PPL C&I Reported Demand Savings

Program	Gross Impact (MW)	Unverified Ex-Post (MW)[1]	Realization Rate[2]	Confidence and Precision[2,3]	Net Impact (MW)[2]
Efficient Equipment Program	0.01	0	133%	90%/±0.1%	N/A
Appliance Recycling Program	0.02	0	141%	90%/±8.4%	N/A
Custom Incentives Program	0.00	0	164%	100%/±0.0 %	56
Renewables Program	0.01	0	352%	90%/±0.04 %	N/A

Notes
1. Unverified ex-post includes savings estimated by Interim TRM Protocols and CMPs under collaborative development between the EDCs and the SWE not yet finalized by PY1 end.
2. Realization rates are to be applied at the program level. Realization rates include adjustments made due to both residential and non-residential projects and therefore cannot be applied to part of the population. Planning estimates are also captured in the realization rates. See §6.1.5.2 and §6.1.5.3 for additional discussion.
3. Confidence and Precision levels are determined on an overall program level including all sectors.

6.2.3.7.2 Claimed Savings Audit: Observations and Recommendations

The audit of these results included the following:

1. Site Inspections and QA/QC reviews of projects in various stages of development discussed in Section 4 of this SWE Annual Report.
2. A review of the Claimed Savings Database ("Gross Impact") incorporating projects completed prior to May 31, 2010. Activities included matching the total of Claimed Savings for each participant to the Annual Report.
3. A desk audit of the Claimed Savings to provide assurance that Commission-approved TRM Protocols or Interim Protocols were followed. Interim Protocols include both measures that will be included in future TRM updates or CMPs that are not suitable for the TRM pursuant to the 2009 TRM Order.
4. A desk audit of the sample population pulled from the entire population of participants comprising the Claimed Savings Database. This desk audit confirmed that the engineering

verification performed by the PPL evaluator team of the Claimed Savings of randomly selected sample participants was performed according to accepted measurement protocols.

5. A review of the sample selection process and the underlying statistics used to attain the specified and approved levels of confidence and precision of the verified results.

6.2.3.7.2.1 Efficient Equipment Program

The Efficient Equipment (*EE*) Program consisted of prescriptive rebates offered to all sectors. The savings for the entire program were reported as 8,074MWh and 0.87MW, of which 84MWh and 0.01MW (1.0% and 1.1% respectively) were attributed to non-residential sectors. PPL provided a database in July 2010 that reported total savings of 8,005MWh and 0.79MW, of which 84MWh and 0.01MW were attributed to non-residential sectors. The discrepancies between the provided database and the Annual Report are results of inconsistent definitions of a PY1 project, namely work packages submitted by May 31, 2010, as opposed to projects installed by May 31, 2010. This issue has been identified and will be monitored for future reports. A final database consistent with the Annual Report was provided in October 2010.

The desk audit of the *EE Program* included a demonstration of EEMIS. The CSP submitted applications throughout the program year in batches called work packages. These are approved by EEMIS operators and officially entered into the database. The approval date signifies that rebate checks will be processed and paid. Project information was followed through the application submission to CSP database to EEMIS database for several projects and found to be consistent. One observation made was that PPL does not have a separate rate class for Government and Institutional facilities. Identification of these facilities depends on self-verification on the application form. If not provided, facilities default to rate class identification. Therefore, savings for the Government and Institutional sector are potentially understated.

The desk audit of the *EE Program* also showed that reported savings calculations were inconsistent with the TRM. The development of EEMIS preceded establishment of some current TRM protocols and utilized planning estimates instead. Due to changes required in programming and program administration, EEMIS could not be updated to adjust for updated TRM protocols. For PY1, the evaluator made adjustments to correct for planning estimates through the realization rate. For future reports, systemic changes such as adjusting for planning estimates in the database must be documented on the ex-ante side independent of realization rates. Additional discussion of the evaluator's adjustments can be found in the Evaluation Audit section.

6.2.3.7.2.2 Appliance Recycling Program

The Appliance Recycling Program consisted of rebates offered to all sectors with a focus on the residential sector. The savings for the entire program were reported as 9,069MWh and 1.37 MW, of which 111MWh and 0.02MW were attributed to non-residential sectors. PPL provided a database in July 2010 that reported savings consistent with the Annual Report. A final database provided in October 2010 was also consistent with the Annual Report. It was noted that projects reported as "commercial" savings could more accurately be called residential measures under commercial master meters. Further audit of this program is detailed under the residential section.

6.2.3.7.2.3 Custom Incentives Program

The Custom Incentives Program (CI) consisted of projects implementing unique measures not offered elsewhere in PPL's plan. The program reported savings of 39MWh and 0.003MW. PPL provided a database in July 2010 that reported total savings of 13,378MWh and 2.44MW. This discrepancy is attributed to projects in progress being reported. A final database consistent with the Annual Report was provided in October 2010. Only one project was completed under the *CI Program*. Normally, this project would have qualified under the *EE Program*, which had not launched at the time of project completion. For verification purposes, this project is addressed under the *EE Program* audit activities.

6.2.3.7.2.4 Renewables Program

The *Renewables Program* consisted of projects implementing ground source heat pumps. The program reported savings of 1,591MWh and 0.13MW, of which 98MWh and 0.01MW were attributed to non-residential sectors. PPL provided a database in July 2010 that reported total savings of 1,661MWh and 0.14MW. This discrepancy is attributed to (1) inconsistent definitions of a PY1 project, namely work packages submitted by May 31, 2010, as opposed to projects installed by May 31, 2010, and (2) measures initially submitted as commercial but identified as residential. These issues have been identified and will be monitored for future reports. A final database consistent with the Annual Report was provided in October 2010.

6.2.3.7.3 Audit of Program Evaluation, Measurement and Verification Methodology

Gross impacts for demand and energy were verified by PPL through different approaches for TRM and Custom measures. The *Audit Plan* and Implementation Order require the EDCs to obtain the Commission's approval for TRM and CMPs. The SWE team conducted an audit of the evaluation performed by PPL based on the approved protocols. The audit of the EM&V methodology included the following:

1. Due diligence review of the program tracking data and supporting documentation to validate the "frozen" population used for the evaluation.
2. Sampling and review of several projects to validate the engineering methods and level of rigor employed by the PPL evaluators. Several minor discrepancies and inadequacies were found in the data collection methods used for on-site verification of installation quantity, operating conditions and system loading conditions, validation of baseline selection and verification of persistence.
3. A total of 28 ride-alongs and independent site inspections were conducted to audit the evaluation methods used by the PPL evaluators to generate ex-post savings estimates. Observations made during ride-alongs indicate that ex-post savings evaluated by the PPL evaluators incorporate two levels of adjustments. First, the ex-ante savings were adjusted for differences between planning assumptions and TRM revisions. Second, adjustments were made for actual on-site observations of installation rates and discrepancies in equipment type and specifications.

The SWE team noted several inadequacies in the EM&V methodology used by the PPL Evaluation team.

1. The EM&V process should start with a "frozen" population of ex-ante savings. TRM revisions, updates and QA/QC identified retroactive errors should be applied to all projects in the population as ex-ante revisions. All systemic revisions such as equipment baseline efficiency assumptions, equivalent full load hour (EFLH) values by region, changes to equipment configuration assumptions in the TRM equations etc. should be revised for all projects in the population before the ex-ante savings are "frozen."[79]
2. EM&V sampling should be conducted at the program level using the selected confidence and precision from the *Audit Plan*, and stratification by savings weights and measure type should be applied. Stratification by sector type, e.g. Small C&I and Large C&I, is also recommended to ensure homogeneity of the population and sample pool.[80]
3. Government and Low-Income sectors have individual targets and should not be combined with other sectors for realization rate calculations and sampling.

6.2.3.7.4 Audit of Program Sampling

The SWE team's audit activities on program sampling methods yielded the following results:

1. PPL's target for the non-residential programs was 90/10 confidence and precision at the program level. The selected confidence and precision is appropriate. The samples selected were verified by PPL using more than one method (telephone surveys, site visits and records review). The SWE team observed that PPL, however, did not have a dedicated sample for on-site inspections. The site inspections were a subset of the projects reviewed by telephone surveys and due diligence desk audits. For future evaluations, PPL should have a dedicated site inspection sample with clearly defined selection criteria.[81]
2. A total of 55 site inspections were planned by the PPL evaluators. However, a large number of the measures installed at these sites were refrigerators, clothes washers, and other small appliances typically found in residential buildings. Because these types of measures were verified by the telephone surveys for the residential sector, PPL halted site verifications for the same measures in commercial settings. The SWE team does not agree with this approach. A certain level of verification is necessary for residential appliances installed in commercial settings. The installation rates, equipment types and specifications should be verified on a statistically valid sample pool and the verification activities should include an adequate number of on-site inspections. If necessary, the level of sampling precision can be relaxed to reduce sample sizes assuming the level of anticipated variance is low.[82]

[79] PPL has indicated that populations are mutually exclusive from one quarter to the next. PPL has agreed to report savings using an additional column labeled "TRM Adjusted" to distinguish systemic changes from realization rate changes until EEMIS is fully reprogrammed.

[80] PPL clarified in memo sent to the SWE team on October 28, 2010, that stratification was conducted by measure groups to achieve 90/10 for each measure group. Samples were also stratified by size and expected uncertainty.

[81] PPL has indicated that a nested sampling approach was used to conduct desk reviews, surveys and on-site inspections. Although not all sampled projects received site inspections, the large projects with high uncertainty were selected on-site verification.

[82] PPL notes that sampling by measure group was completed, but not all groups received site visits for a variety of reasons. In the commercial sector, there were no Motors and VFDs installed. Only six lighting projects were

3. The SWE team also noted that six of the 55 samples selected for review were non-residential lighting participants, but not one of the six agreed to site visits. As a result, the non-residential lighting projects were not verified by the PPL evaluators. Future evaluations should actively recruit non-residential lighting projects for evaluation and PPL should modify the program rules to require participants to allow M&V site inspections for verification of savings and incentive.
4. For PY1, measures with interim protocols not approved by the SWE team were included in the "frozen" ex-ante population. The measures accounted for 57MWh of the ex-ante savings claimed by the non residential programs. The SWE team reviewed the PPL databases and the values were found to be accurate. PPL has classified these savings as "Unverified Ex-Post" savings as required by the SWE, since an approved protocol is not yet in place.
5. The SWE team conducted a detailed review of the sampling algorithms and stratification methods used by the PPL evaluators and noted that the Prescriptive project population was not stratified further by measure type. Although TRM approved measures share an extensive level of completed research and analysis on their savings and they use deemed and partially deemed variables, the nature and complexity of the equipment energy consumption profiles varies significantly by measure type. The *Audit Plan* requires that EDC evaluators stratify the project population by measure type. If the population cannot be stratified into multiple measure types, broad measure types such as lighting and non-lighting should be used to divide the population into sub groups and ensure the sample selected has a good mix of measures and is representative of the population.
6. Several activities were conducted by the PPL evaluators for the Renewable Program for QA/QC, impact and process evaluations. Participant surveys were conducted in combination with on-site inspections. The population size for the Renewable Program was 384 participants of which 56 received on site inspections, 61 received records verification and desk audits, and 63 received telephone survey verification of measures. The SWE team conducted a diligent review of the sampling algorithms and the targeted 90/10 confidence and precision was met for the Renewable program.

6.2.3.7.5 Audit of Realization Rate Calculations

The PPL evaluators have calculated realization rates using a weighted average method for all non-residential programs. The realization rate is calculated by dividing the sum of the ex-post savings by the sum of the ex-ante savings. The ex-ante savings were calculated using a "frozen" population as required by the SWE team. However, systemic changes like TRM revisions and QA/QC results were incorporated in the ex-post analysis and not in the "frozen" ex-ante population. [83] PPL has agreed to report savings using an additional column labeled "TRM Adjusted" to distinguish systemic changes from realization rate changes until EEMIS is fully reprogrammed.

processed but did not agree to a site visit. PPL has indicated that future evaluation efforts will focus on actively recruiting customers and program evaluation requirements will be included on application forms and other program manuals. A sample of residential measures in commercial settings will be evaluated in future cycles.

[83] PPL notes that its methods were consistent with ex-ante and ex-post definitions presented in the glossary. After discussion, PPL and SWE recognize that clarification is needed for these definitions and will be updated.

The realization rates for each measure and project in the sample pool incorporated installation rates as verified through on-site inspections and survey data. The desk audits and telephone surveys also yielded an adjusted size value for installations and revealed that few non-residential projects were inaccurately reported and were actually residential installations. The SWE team conducted a meticulous audit of PPL's tracking databases and verified that these savings were accurately reallocated by the PPL evaluation team.

Relative precision values associated with the mean estimate of the realization rates were not provided by PPL. EDCs are required to demonstrate compliance with the *Audit Plan* and report relative precision estimates at the program level.

6.2.3.7.6 Evaluation Audit: Observations and Recommendations

The audit of the C&I portion of PPL's Annual Report confirmed the reported results with some minor qualifications. Several observations by the SWE team may serve to improve the process of reporting in future years. A sample of five small C&I projects sampled by the PPL evaluators was reviewed by the SWE team. The sample included three programmable thermostat measures, and two air source heat pump measures. Ex-ante reported values were based on the 2009 TRM. The ex-post verified values were based on the current updated TRM. The energy realization rate was 106% while the demand realization was 293%.

The SWE team noted that programmable thermostats are being treated as deemed measures even though they are not in the revised TRM. The database extract provided by PPL shows identical ex-ante reported and ex-post verified values for programmable thermostats with a resulting realization rate of over 159%. There are no ex-post demand verified values reported. Programmable controllers should be treated as unverified ex-post savings

6.3 Cost-Effectiveness Assessment

The figures listed in cost tables of the EDCs' annual reports to the PA PUC were examined to ensure accuracy of expenditure subtotals within individual program summary tables and accuracy in cumulative portfolio tables. Spot checking was also performed between cost figures indicated in report tables versus cost figures indicated in EDC provided cost databases. Finally, the mapping performed by EDCs to translate their internal cost categories to those specified in the Annual Report was reviewed.

Please note that for PY1, the SWE team waived the reporting requirement for the TRC cost-effectiveness test due to pending TWG discussions. Therefore, the cost data represented below may not reflect all of the costs and benefits associated with the PY1 programs and may be revised in future reports based on resolutions reached during future TWG discussions.

6.3.1 Allegheny

Allegheny provided a cost database from which to compare against cost figures in the Annual Report summary tables. The cost database provided a breakdown of costs by program, portfolio and Allegheny internal cost categories. Cost roll-ups were provided at the program level, sector level (residential or commercial) and at the portfolio level. The internal Allegheny cost categories provided in the cost database matched the SWE cost categories so no mapping was required.

The cost subtotals within individual commercial program summary cost tables in the final report showed no discrepancies. Cost figures in the Annual Report cost summary tables matched the cost figures reported in the provided cost database in all spot checking instances.

6.3.2 Duquesne

Duquesne did not report energy savings for any C&I programs therefore no associated cost data was provided.

6.3.3 Met-Ed

FirstEnergy provided a detailed accounting database of all program costs across the three utilities, which was compared against the cost figures in the annual reports. Cost figures were presented uniformly throughout all three annual reports, which facilitated comparisons with the cost database. The cost database provided clear separation of costs from the three utilities. Subtotals in the cost database were provided by SWE cost category, program roll-up and portfolio roll-up. A dedicated worksheet was provided that showed a clear mapping between FirstEnergy cost categories and SWE cost categories.

The individual program cost summary tables for commercial programs in the annual reports were examined and contained no subtotal errors. The cost figures in individual commercial program summary tables were compared against their cost database counterparts and no discrepancies were found. The cumulative portfolio cost tables in the annual reports (Table 1-10) were compared against the FirstEnergy cost database and no discrepancies were found.

The mapping of FirstEnergy cost categories to SWE cost categories was reviewed and no irregularities were found. FirstEnergy provided rolled-up costs that originated from their internal accounting charge codes, transitioned to FirstEnergy cost categories and finally transitioned to the SWE cost categories. The transitions were logical and easily tracked.

6.3.4 PECO

PECO provided a copy of their program cost database for Smart Equipment C&I and Smart Equipment Government and Non-profit, from which the cost figures in the Annual Report could be compared against. Examination of the cost figures in the Annual Report tables on their own revealed no sub-total discrepancies. However, comparison of the cost figure in the tables of the Annual Report (Table 4-13, Table 4-14) versus the program cost database revealed discrepancies. Smart Equipment C&I showed a total annual cost of $1,660,077 in the Annual Report versus $1,902,027 indicated in the cost savings database. Smart Equipment Government and Non-profit showed an annual cost of $972,645 in the Annual Report versus $761,572 in the cost database. The total of both programs tracked more closely; $2,632,722 in the Annual Report versus $2,663,599 in the cost database.

The SWE team reviewed these issues with PECO and its contractors to identify the source of the discrepancies noted above. The discrepancies were attributed to a late correction made to an implementation contractor invoice that occurred after the Annual Report was finalized. The correct cost figures will be presented in the next quarterly report. These issues are symptomatic of the rapid roll-out of programs. Processes are now in place to preclude similar issues in future reports.

Since there were discrepancies between the cost figures in the Annual Report versus the cost database, the exact mapping between PECO cost categories and SWE cost categories was difficult to identify. The following matching of cost categories was made by matching cost figures from the Annual Report to the cost database as closely as possible for the Smart Equipment C&I and Government & Non-profit programs. The SWE cost category incentive to participants accommodated the PECO cost category "01 – Incentive". The SWE marketing cost category accommodated the PECO cost category "04 – Promotion Campaign". The SWE administration cost category accommodated the PECO cost category "02 – Implementation Contractor". The SWE management category accommodated all other PECO cost categories: Supplemental Labor, Legal, Pension & Benefits, Filing Costs, M&V, Internal labor, IT enablement costs, tracking database, Call Center and BSC IT Costs.

6.3.5 PPL

PPL provided a detailed accounting database that included a breakdown of all program costs, program roll-up cost tables, a portfolio roll-up cost table and a clear mapping between PPL cost categories to SWE cost categories. The cost tables that appear in the final report have identical counterparts in the cost database, providing full transparency on how the Annual Report cost tables were created. All figures in the cost database contain references and cell formulas so that each figure was able to be tracked by its individual cost components.

The cost subtotals within individual program summary cost tables in the final report showed no discrepancies. Spot checks on cost figures in the Annual Report cost tables versus their counterparts found in the cost database also revealed no discrepancies. The mapping of PPL cost categories to SWE cost categories was reviewed and no irregularities were found.

6.3.6 Penelec

Penelec was combined with Met-Ed and PennPower. See Section 6.3.3.

6.3.7 PennPower

PennPower was combined with Met-Ed and Penelec. See Section 6.3.3.

6.4 Identification of Best Practices

Chapter 6 of the July 2006 National Action Plan for Energy Efficiency[84] (NAPEE) report provides 55 pages of discussion for best practices for energy efficiency program design, implementation and evaluation. During PY1, the EDCs and the SWE team have implemented several of the best practices that are listed in this NAPEE Report, as indicated in Table 6-35 below. On a going forward basis, the EDCs and the SWE team will continue to look for opportunities to improve the efficiency and effectiveness of the Act 129 programs.

[84] The National Action Plan for Energy Efficiency is private-public initiative undertaken by the U.S. Environmental Protection Agency.

Table 6-35: Best Practices Implemented in PY1 by EDCs or Statewide Evaluator- Table 1 of 2

Making Energy Efficiency a Resource	
Conduct a potential study	X
Outline program potential	X
Review and tailor measure packages to appropriate market segments	X
Developing an Energy Efficiency Plan	
Offer programs for all key customer classes	X
Align goals with funding	X
Use Benefit/Cost tests that are consistent with long-term planning	X
Consider building codes and appliance standards when designing programs	X
Consider efficiency investments to alleviate transmission and distribution constraints.	
Create a roadmap of key program components, milestones, and explicit energy use reduction goals.	X

Table 6-36: Best Practices Implemented in PY1 by EDCs or Statewide Evaluator - Table 2 of 2

Designing and Delivering Energy Efficiency Programs	
Conduct a market assessment	X
Solicit Stakeholder input	X
Listen to customer and trade ally needs	X
Use utility channels and brands	X
Promote both energy and non-energy benefits of EE products and practices to customers	X
Coordinate with other utilities and TPAs	X
Leverage the Energy Star program	X
Keep participation simple	X
Keep funding consistent	X
Invest in education ,training and research	X
Leverage manufacturer and retailer resources through cooperative promotions	X
Leverage state and federal tax credits	X
Build on ESCO and other financing program options	
Consider outsourcing some programs to other organizations that specialize in program design and implementation	X
Use successful program approaches and adapt to local conditions to accelerate program design & implementation.	X
Determine the right incentives	X
Invest in training the service industry (contractors etc)	X
Evolve to more comprehensive programs and change measures to adapt to changing markets and technologies	X
Pilot new program concepts	X
Ensuring Energy Efficiency Investments Deliver Results	
Budget plan and initiate evaluation from the onset, formalize and document evaluation plans and processes.	X
Develop program and project tracking systems	X
Conduct process evaluations	X
Conduct impact evaluations	X
Communicate evaluation results	X

6.5 Technical Reference Manual Recommendations

The SWE in collaboration with the EDCs and their EM&V contractors convened the TWG to identify and develop protocols for measures not in the 2010 TRM but needed by the EDCs for PY1 and PY2 EM&V activities. Teams were formed with the EDCs and the SWE to review existing protocols, and to develop new and upgraded protocols that were common among the EDC teams that were formed. In this collaborative process, 31 new measures were developed and approved by the SWE and an additional 13 are currently under review to be added to the 2011 TRM update.

6.5.1 Background

The SWE continues to evaluate and process potential improvements to the TRM and to develop CMPs. The SWE team has several contractual obligations, including reviewing the TRM information and savings values and developing recommendations for possible revisions and additions.[85] The review of the existing information in the TRM is necessary to ensure that deemed savings values and savings protocols are as accurate, reliable, and current with industry standards as possible. The review and approval process for new measures is necessary to facilitate the needs of the EDCs as they develop and roll out programs so that they may get credit for energy and demand savings. This work has been an unexpectedly large component of the SWE's work to date. Several challenges became apparent from the onset, including technical problems with the 2009 TRM and the large number of new measures that the EDCs wished to implement that had no approved M&V Protocols.

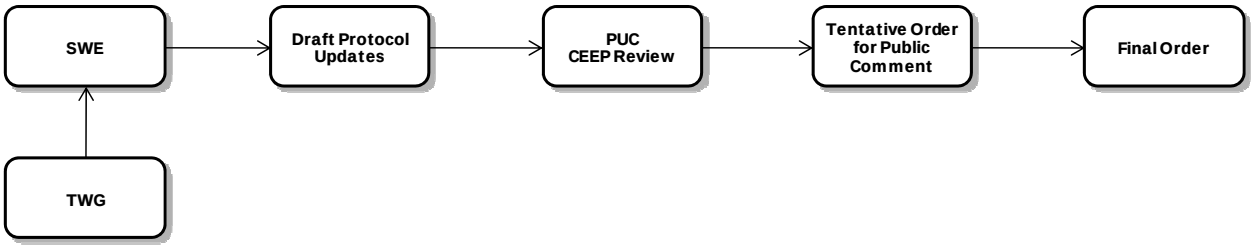
The 2009 TRM Order provided the initially approved methodologies for measuring savings for Act 129. The Order adopted the 2009 TRM to provide Commission-approved protocols across the state for quantifying the performance of EDC-sponsored programs and for uniformly measuring the attainment of mandated energy and demand reduction targets. The Commission stated in the TRM Order that there are two general categories of measures. These are standard measures suitable for the TRM (i.e. with deemed and partially deemed algorithms supporting savings calculations) and custom measures that are not yet defined in the TRM, or which require site-specific protocols and/or EM&V plans.

Relative to the first category, the Commission noted that the TRM is intended only "for standard measures that warrant standard energy efficiency calculation methods and assumptions" and that it "intends to add new standard measures to the TRM as commonly accepted savings calculations become available". In collaborations between the SWE team and the EDCs, the Commission also stated that the potential additions to the TRM will be considered in the "regular TRM update process". In the *Audit Plan* prepared and issued by the SWE in December 2009, the process of developing these protocols and attaining approval was described as shown in Figure 6-1, which shows the TWG chaired by the SWE as central to this process.[86]

[85] See page 34 of the PA PUC's April 21, 2009 RFP for the Statewide Evaluator for the description of the SWE's responsibilities relating to providing recommendations for possible revisions and additions to the TRM.

[86] The review process for custom measure protocols was subsequently revised by the SWE (in consultation with the PA PUC staff and the EDCs) on November 24, 2010.

Figure 6-1: TRM Annual Review and Update Process



The SWE recognized the urgency of both making changes to the 2009 TRM in the first annual update and for creating a mechanism that would allow the EDCs to implement measures on an "interim" basis prior to formal approval by the Commission in an updated TRM. To do otherwise may have delayed the implementation of measures and impact the ability of the EDCs to attain savings.

The SWE, immediately upon its contract approval, noted that several important C&I M&V Protocols were either technically incorrect or based on out of date research from New Jersey between 1995 and 1999. In addition, due to the structure of the 2009 TRM, a large number of lighting projects would have needed to be treated as custom measures and would need to have approved CMPs to measure hours of use which were not specified in the TRM. The SWE, in collaboration with the EDCs, spent several months in the fall and winter of 2009 developing the improvements to the TRM subsequently adopted by the Commission. These improvements eliminated the need to use CMPs for many C&I projects by developing stipulated values for savings and hours of use for lighting, motors, VFDs and simple chiller applications. Although some elements of the TRM became more complex, the need to measure many projects was eliminated and the TRM became a better tool that could be used to verify real savings with less effort.

In order to allow the EDCs to claim savings for measures that did not yet have an approved TRM protocol the SWE, with approval from CEEP, developed the Interim Protocol Approval Process. In this process the SWE, in collaboration with the EDCs, has evaluated 44 new commercial and residential TRM protocols that allow the EDCs to claim savings for these measures. In comparison, the 2009 TRM consisted of only 25 general categories of measures.

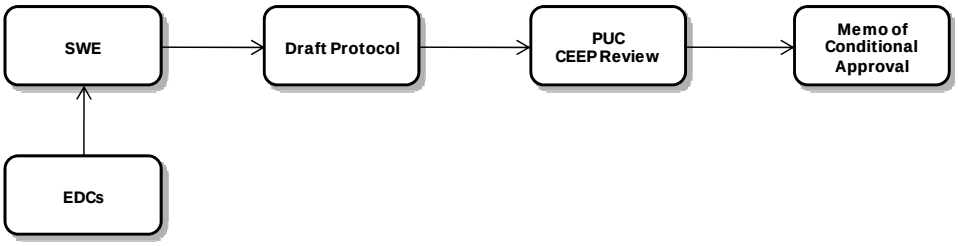
6.5.2 Interim Measures Review and Approval

The SWE, at the request of the EDCs and in concurrence with CEEP, has been collecting and analyzing proposed M&V and savings protocols for measures submitted by the EDCs that are not currently addressed in the TRM but are suitable for deemed or partially deemed savings. The primary benefit of expanding the TRM to include additional measures is that it simplifies the M&V process and thus reduces M&V costs to the EDCs. To expedite the review process, the EDCs have prioritized the proposed measures based on immediate need with existing and near term program roll-outs.

To assist in the analysis, the SWE team reviewed and provided to the EDCs numerous TRMs from other states in an effort to find reasonable, proven protocols that have been tested in other markets. From

this analysis, the SWE team and the EDCs have identified a number of deemed and partially deemed savings protocols for measures that will assist the EDCs in their M&V efforts in PY1 and PY2. Figure 6-2: Interim Measures Review and Approval Process below depicts the process for the development, review and approval of protocols. This process is also explained in detail in the *Audit Plan* developed by the SWE.

Figure 6-2: Interim Measures Review and Approval Process



The TRM TWG was reconvened in June 2010 to work collaboratively with the EDCs to develop protocols that they could use in the M&V process for PY2 and beyond. Through the working group, the EDCs have developed, and the SWE has approved, 23 residential and 21 commercial protocols. Table 6-37 summarizes the residential protocols completed and under review that will be included in the TRM update for 2011. Table 6-38 summarizes the commercial savings protocols completed and under review that will be included in the TRM update for 2011.

Table 6-37: Residential Protocols for TRM

Status	HVAC	HOME ELECTRONICS	LIGHTING	APPLIANCES	WATER HEATING
COMPLETE	• Programmable Thermostat • Furnace Filter • Room AC Retirement • Attic/Ceiling Insulation • Ductless Mini Splits • Whole House Fans • Reflective Roof	• Computer • Fax • Monitor • Smart Strip • ENERGY STAR TVs	• Low-Income Kit • LED Nightlight • Electroluminescent Nightlight	• Refrigerator Replacement • Clothes Dryer	• Water Heater • Solar High Efficiency Electric WH • ENERGY STAR Heat Pump WH • Faucet Aerator • Insulation, Pipe • Low Flow Showerhead

Table 6-38: Commercial Protocols for TRM

Status	LIGHTING	LIGHTING CONTROLS	REFRIGERATION	OFFICE APPLIANCES	HVAC
COMPLETE	• Ceramic Metal Halide Lights* • Cold Cathode Fluorescent Lights* • Compact Fluorescent Lights* • Induction Lights* • LED Exit Sign* • LED Lights • LED Signs	• Photocell	• Anti-Sweat Heat Controls • Evaporator Case Fans: Reach-in/Walk-in • HE Refrigerator, HE Freezer • LED Refrigerator Case Lighting • Beverage Machine Controls • HE Ice Makers	• Computer • Copier • Fax • Monitor	• Chillers* • Insulation, Ceiling • Insulation, Wall

Note:
* Adjustment made to TRM in June 2010.

6.5.3 Technical Reference Manual 2011 Update

Over the course of PY1, the SWE has worked closely with the EDCs and their EM&V contractors to correct deficiencies in the 2010 TRM, identify and develop additional protocols suitable for the TRM and develop a process and forum for developing protocols for measures not suited to the TRM (Custom Measures). The following sections summarize the activities and accomplishments of the Technical Working Group (TWG) comprised of the SWE team, the EDCs and their EM&V contractors.

Please note that each EDC and the PA PUC staff have had the opportunity to comment on any SWE recommended revision to the TRM included in this Annual Report during the review of the Draft Annual Report submitted on October 15, 2010. Additionally, any proposed TRM revisions will undergo the traditional annual update Commission process, which includes a public comment period prior to a Commission decision. The SWE recognizes the importance of due process and the public vetting of possible changes to the TRM and welcomes comments on recommendations for TRM updates.

6.5.4 Technical Working Group

The SWE serves as chair on the TWG to resolve technical issues, improve M&V protocols, and provide clarity for implementers and evaluators. The TWG has convened several times in person and regularly through teleconferences to tackle interim TRM measures, CMPs, and updates to the 2011 TRM.

During the fall of 2010 the TWG addressed issues concerning potential updates to the 2011 TRM. The SWE solicited comments from the EDCs and the PA PUC staff to identify specific areas of improvement. The TWG has discussed these issues in detail and proposed preliminary solutions. The TWG submitted drafts of the proposed solutions by October 12, 2010, and reviewed all changes by October 18, 2010. An additional teleconference was scheduled to discuss initial drafts. Final draft changes of each issue, incorporating teleconference comments, were used to red-line the TRM for the 2011 TRM Update draft.

The areas of improvement to the TRM are categorized in major categories: lighting Appendix C, lighting baseline, lighting hours, lighting other, motors and drives, HVAC, definitions.

1. Appendix C issues include providing additional guidance on usage of Appendix C (procedure for exceptional cases, use of cut sheets, use of third-party vendor inventory forms), correcting isolated fixture codes in the Standard Wattage Table, updating TRM language to better support Appendix C, and clarifying eligibility requirements for lighting fixtures.
2. Baseline issues include developing a standard methodology for baseline verification, modifying assumptions based on outdated research, and using ASHRAE methodologies for determining baseline condition for new construction projects.
3. Hours of use issues include clarifying appropriate use of stipulated values and logging, developing usage group tables, expanding building type table, and clarifying requirements for “other” category.
4. Other lighting issues include savings calculation methodology for controls technologies.

5. Motors and drives issues include defining applicability of VFD protocols to specific HVAC and pump applications, evaluating impact of new motors standards, and clarifying stipulated coincidence factors for duplex motor sets.
6. HVAC issues include defining baseline for ground source heat pumps (GSHP), groundwater source heat pumps, and chillers.
7. Definition issues include clarifying "baseline", "new construction", "retrofit", "early retirement", "replace on burnout", "ex-ante", "ex-post", and "realization rate".

6.5.4.1 Appliance Recycling Technical Reference Manual Revisions

The SWE team has reviewed data on the Appliance Recycling programs from each of the seven EDCs database reports and vendor invoices. The SWE has also reviewed information from JACO, the vendor responsible for picking up and tracking recycled appliances for each of the Pennsylvania EDCs. Although the current TRM allows for annual savings of 1,728kWh for recycled refrigerators and freezers; it became apparent that the appliances being recycled from Pennsylvania homes have somewhat lower values reported for kWh consumption.

The SWE has recommended that best practice would be to utilize one homogenized data set to determine a fair average for kWh savings for recycled appliances. The SWE was able to obtain actual kWh usage data for program participants from all EDCs (PPL, Duquesne, Allegheny, PECO and FirstEnergy). The "JACO Databases" provide the age, size and type of refrigerators and freezers that are collected for the EDCs. The kWh usage values recorded in the database are derived from the Home Energy Magazine that collects manufacturer's data using the U.S. Department of Energy protocols. It is very important to note that this kWh consumption value recorded in the database does not represent the kWh savings per appliance at the time of pick-up because a degradation factor has not been applied. The SWE team then examined other sources of data for the kWh savings for removed appliances, and these other data sources are explained later in this section.

Because the manufacturer's annual kWh consumption data was recorded in less than 50% of appliance collections and because it is not reflective of savings when an older appliance is removed, it was not used to calculate an average.

To determine a more accurate annual kWh consumption value that is reflective of the kWh and kW savings for an older appliance at the time of removal, the SWE used the available age, size and unit type data in the "JACO Databases" and applied the Energy Star Retirement Calculator usage values to each unit collected based on its individual characteristics (age, size, type). Two hundred and three incomplete or erroneous records, from a total 18,479 records (1%) were removed from the sample prior to calculating the average annual kWh consumption.[87] The combined average refrigerator and freezer annual kWh consumption for Pennsylvania, based on all available PA EDC appliance recycling databases

[87] Energy Star Refrigerator Retirement Calculator, accessed 10/15/2011 at http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator.

from JACO, is 1,659kWh.[88] It is the recommendation of the SWE that all of the EDCs subject to the Act 129 obligations use this figure when calculating savings for recycled refrigerators and freezers in future program years.

6.5.4.2 CFL Technical Reference Manual Revisions

The SWE team has reviewed data on CFL installations gathered from (1) on-site SWE team inspections for PY1 on 63 randomly selected low-income homes and (2) from data collected by the EDCs. The data reviewed by the SWE team indicates that many CFLs have been installed in sockets having low hours-of-use. The current June 2010 TRM assumes that CFLs installed support an average of three hours of use per day. Due to the concern that many bulbs are being installed in sockets with low hours of use that may support a shift in average daily use, the SWE team reviewed several residential lighting hours of use studies and is recommending that the TRM be revised to allow 1.9 hours of use for each CFL installed. The 1.9 average daily hours of use for all bulbs is based upon a large scale comprehensive residential lighting metering study of 1,200 randomly selected households completed in 2010, as well as a September 2010 US Department of Energy Report listing up to date data and recommendations on hours of use for CFL bulbs in residential households.[89]

The SWE team selected the California study as the source for the most comprehensive and latest hours-of-use study currently completed in the United States. Presented below are the other CFL hours of use data reviewed by the SWE team for this Annual Report. These other studies were useful, but not as comprehensive and detailed as the California study that examined CFL use in 1,200 randomly selected homes. The results of the study completed in California appear to be free of hours-of-use anomalies that have been identified in the Maine (e.g. basement) and Massachusetts studies (e.g. Hallways). These anomalies are caused by the small sample sizes for some locations. Some samples in the Maine study are based on less than 12 light loggers.

[88] Savings value derived from the JACO Appliance Collection Databases received from all EDCs (Allegheny, PPL, PECO, Duquesne and FirstEnergy).

[89] KEMA, Inc., Final Evaluation Report: Upstream Lighting Program, Volume 1, Oakland, California, and paper presented at 2010 ACEEE Summer Study titled "I Know What You Lit Last Summer: Results from California's Residential Lighting Metering Study.

[90] KEMA (2010) *Results from California's Residential Lighting Metering Study*

[91] Efficiency Maine (by NMR and RLW), April 2007, Process and Impact Evaluation of the Efficiency Maine Lighting Program", Table 5-36, pp.96-103.

[92] Massachusetts DOER (by Optimal Energy and VEIC), October 2009, "Massachusetts Statewide Technical Reference Manual for Estimating Savings from energy Efficiency Measures, pg. 17.

Table 6-39: Proposed TRM CFL Revisions

Room/Location	California (2010)	Maine (2007)	Massachusetts TRM (2009)	NEEP (2009)[93]	Bonneville (1996)[94]	WI Focus on Energy (2009)[95]
All exterior	3.9	5.5	2.9	-	-	2.8
All interior	1.7	-	-	-	-	2.8
Bathroom	1.4	1.0	0.7	2	1.7	-
Bedroom	1.7	1.3	1.1	2	1.3	-
Dining	1.9	8.7*	1.4	3	-	-
Garage	1.2	1.1*	1.3	2	-	-
Hall	1.2	1.3*	6.3	2	-	-
Kitchen	2.5	4.4	4.0	3	3.9	-
Living	2.3	3.7	3.0	3	3.1	-
Office	1.6	3.4*	3.1	3	-	-
Basement	-	2.4*	1.3	2	-	-
Other	1.4	-	2.7	2	-	-

(*) Hours-of-use data collected from locations with less than 12 total sockets in the sample.

Notes:
1. The California study is the most comprehensive hours-of-use data available.
2. The Maine study, although similar for some locations, is limited by the small amount of data collected. Data marked with an asterisk (*) was collected from locations with less than twelve total sockets in the sample. The "Dining" location data is based on only one light logger. Due to its small size, the Maine study data lacks consistency between various types of CFL distribution and season.
3. The NEEP study recorded an average three hours-of-use for kitchen, office, family, living and dining rooms; the study recorded an average two hours-of-use per day for all "other" – the average hours-of-use was determined by dividing the total hours for the category by the number of lighting sockets logged.
4. All results in table are rounded to one decimal place.

The U.S. Department of Energy also issued a report in September 2010 which examined the market profile of ENERGY STAR CFLs. The following is an excerpt from page 24 of the report[96]:

> **How many hours per day are CFLs in use?**
>
> Two independent studies (one national and one in California) found that the typical residential lamp is used approximately 1.9 hours per day. Because of the similarity between the distribution of CFLs and fixtures as a whole, daily usage of CFLs is similar to

[93] NMR, January 2009, "Residential Lighting Markdown Impact Evaluation, Pg. 50, accessed 10/14/10 at http://www.env.state.ma.us/dpu/docs/electric/09-64/12409nstrd2ae.pdf

[94] L. Tribwell and D. Lerman, Tacoma Public Utilities (funded by Bonneville Power Administration), "Baseline Residential Lighting Energy Use Study", Table 3-2.

[95] Focus on Energy, 2009, "2009 CFL Savings Analysis", Accessed 10/14/10 at http://www.focusonenergy.com/files/Document_Management_System/Evaluation/2009cflsavingsanalysis__evaluationreport.pdf

[96] U.S. Department of Energy, "ENERGY STAR CFL Market Profile: Data Trends and Market Insights." Prepared for The United States Department of Energy by D&R International, Ltd., September 2010.

that of typical household sockets, approximately 1.9 hours per day. Given that previous estimates may have used values of 3 hours per day or more, a measured use at 1.9 hours per day would indicate that annual savings estimates may be lower than previously estimated. Lifetime energy savings, which are a factor of the lifetime of the lamp, do not depend on daily use.

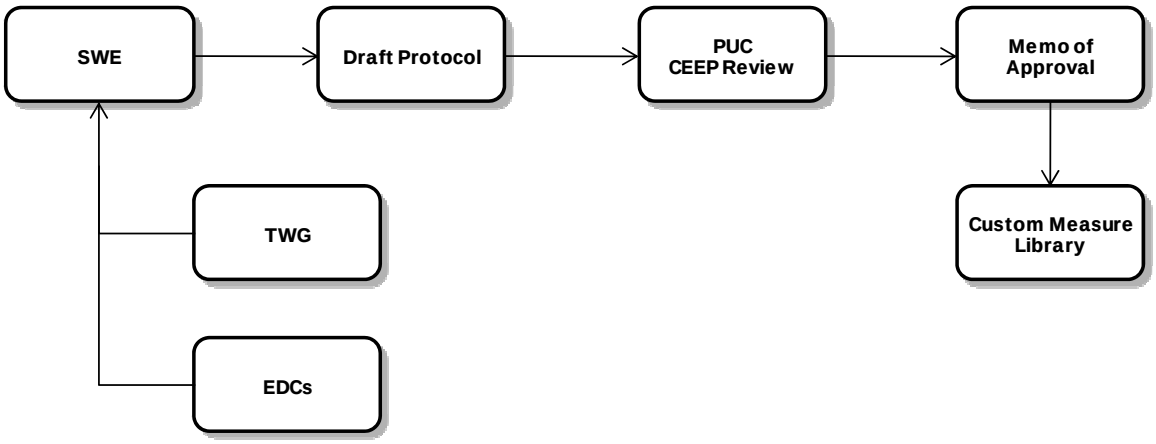
Table 12| Daily Lighting Use by Room

Room	**Hours of Use per Day**		
	U.S. 2002 (All Sockets)	**California 2009 (All Sockets)**	**California 2009 (CFLs Only)**
Overall	**1.9**	**1.9**	**1.9**
Kitchen	3	2.4	2.5
Dining Room	2.5	1.7	1.9
Living/Family Room	2.2	2.3	2.3
Exterior	2.1	3.8	3.9
Bathroom	1.8	1.3	1.4
Home Office	1.7	1.3	1.6
Garage	1.5	1.8	1.2
Hall	1.5	1.3	1.2
Bedroom	1.1	1.5	1.7
Closet	1.1	Not Reported	Not Reported
Other	0.8	1.5	1.4

6.5.5 Commercial and Industrial Measure Development and Review

The SWE, in its *Audit Plan*, laid out a process for review and approval of CMPs shown below. The goal is to work collaboratively with the EDCs to address needs they may have, often for their large C&I customers. These are usually complex energy efficiency projects requiring measurement of multiple key indicators of energy use and savings.

Figure 6-3: Custom Measure Review and Approval Process



In April, the SWE prepared a sample CMP for Motors and Drives that did not fall into the standard categories for the motors and drives incorporated into the 2010 TRM. This has served as a template for the development of other protocols and illustrates the degree of rigor that is appropriate.

The custom measures that have been or are currently being processed are shown in Table 6-40.[97] Sixteen custom measure protocols have been reviewed and approved as of December 15, 2010.

Table 6-40**: Custom Measure Protocols, December 15, 2010**

No.	CMP Name		EDC	Status
1	Motors and VFDs	C/I	NA	APPROVED
2	Conservation Voltage Reduction - Energy Savings Protocol	C/I	PECO	APPROVED
3	Schools for Energy Efficiency	C/I	PECO	APPROVED
4	(Intentionally Left Blank)			
5	HVAC Tune Up	C/I	PPL	Pending SWE Response
6	(Intentionally Left Blank)			
7	Compressed Air	C/I	PPL	Pending EDC Response
8	Commercial Refrigeration Efficiency Improvement	C/I	PPL	APPROVED
9	Roof Improvements v1 (includes Worksheet)	C/I	PECO	APPROVED
10	Chiller Plant Optimization v7.	C/I	PECO	Pending EDC Response
11	Compressed Air System Upgrades v4 + Data Sheet	C/I	PECO	Pending EDC Response
12	Process Drive System Modifications v7	C/I	PECO	APPROVED
13	Lighting Circuit Power Controller v6	C/I	PECO	APPROVED
14	C/I Tune Up (Refrigeration Charge)	C/I	FIRST ENERGY	Interim TRM

[97] This table is current as of December 15, 2010. Note, some rows in this table were intentionally left blank when submitted custom measure protocols were subsequently withdrawn by an EDC.

15	Motors and Drives (Small)	C/I	FIRST ENERGY	Pending EDC Response
16	Process Cooling-Industrial	C/I	PPL	APPROVED
17	Economizer2	C/I	FIRST ENERGY	Pending EDC Response
18	Ventilation Modification	C/I	PECO	Pending EDC Response
19	Power Conditioning	C/I	PECO	Removed
20	Coincident Peak Determination	C/I	PECO	Pending EDC Response
21	Solar PV	C/I and Res	PPL	APPROVED
22	(Intentionally Left Blank)			
23	Small Measure (Temporary)	C/I	PPL	APPROVED (Temporary)
24	(Intentionally Left Blank)			
25	Small Measure Population	C/I	FIRST ENERGY	Pending SWE Response
26	Hotel/Guest Room Occupancy	C/I	PECO	Pending EDC Response
27	EMS	C/I	PECO	Pending EDC Response
28	Lighting Control Time Clocks	C/I	PPL	APPROVED
29	(Intentionally Left Blank)			
30	(Intentionally Left Blank)			
31	(Intentionally Left Blank)			
32	Commercial Refrg Controls FE	C/I	FIRST ENERGY	Pending SWE Response
33	Conservation Voltage Reduction (CVR)	C/I	PECO	Pending SWE Response
34	Low Income Usage Reduction Program (WRAP)	RES	PPL	APPROVED
35	Opower	RES	PPL	APPROVED
36	ePower Wise	RES	PPL	Pending EDC Response
37	LEEP	RES	PECO	APPROVED
38	Conservation Voltage Reduction - Demand Savings Protocol	C/I	PECO	Pending SWE Response
39	Residential LED Lighting	RES	PECO	APPROVED
40	LED Lighting for Non Standard Equipment	C/I	PPL	APPROVED
41	Industrial Refrigeration Plant Improvement	C/I	PPL	Pending SWE Response
42	Industrial Process	C/I	PPL	Pending SWE Response
43	Airside Economizers	C/I	First Energy	Pending SWE Response

6.5.6 Custom Measure Initiative – Expanded Description

Several of the CMPs are worth additional discussion.

1. Conservation Voltage Control (CVR), Substation Level: PECO has sponsored CVR at the substation level and has reduced voltage at the treated substations by a fixed amount. PECO conducted an experiment between February and May of 2010 to determine the effect of voltage reduction. The SWE has worked with PECO over several months to ensure the reliability of the data and calculations which developed a system level CVR Factor defining the change in energy versus the change in voltage. This CVR Factor is used to measure savings based on load and the change in voltage from a historic baseline after backing out line losses. PECO anticipates that it will maintain a voltage drop of about 0.8%. With a CVR Factor of approximately 1, load will be reduced by CVR by approximately 0.8% as well. For this protocol, PECO will only quantify energy. Although another study was performed during this summer and showed significantly higher CVR Factors, this data was not considered adequate to predict CVR Factors for demand during the peak 100 hours at this time.
2. Small Motors and Drives: FirstEnergy has suggested that small motors and drives cannot be effectively measured using a standard participant level protocol. The 2009 TRM Order indicates that savings should be measured using the TRM or CMPs. In this case the SWE and FirstEnergy have been discussing a population based CMP that would avoid the need to develop load curves for individual types of motor and drive use at the customer level. On the advice of CEEP and in keeping with sound statistical practices, this pilot population-based M&V approach requires the definition of homogeneous populations whose variation in use has been minimized.
3. CMP HVAC Tune Up: PPL originally proposed this CMP which did not facilitate transparency to the methodology used to estimate the "claimed savings" which are the Gross Impact. The reliability of the protocol cannot be accessed without proper disclosure of the methods of measurement, despite processes for evaluating the estimated savings after the fact. PPL is currently addressing the SWE comments on this protocol which seeks to quantify operations and maintenance improvements. An approved protocol followed by statistical sampling to verify the application of the protocol and the savings is fundamental to quality assurance and verification of the savings by the SWE.
4. Behavior, Schools Energy Efficiency: PECO has put forward a CMP that is founded on behavior modification of both students and operations and maintenance staff. The proposed protocol is an Option C of the IPMVP baseline methodology that credits the program with all savings that occur after the baseline period, including capital investments. Discussions among the SWE team and PECO produced a methodology to determine savings that are not directly caused by the program but were captured by the protocol originally proposed by PECO. The SWE team then approved this protocol in November 2010.

6.6 Total Resource Cost Test Manual Recommendations

The SWE team waived the requirement of reporting TRC cost-effectiveness results for PY1. This was based on the fact that many unresolved issues still existed at the time the EDCs' annual reports were due. Future reports will require a cost-effectiveness summary of each EDC's portfolio. The TRC calculations will be based on the TRC Test Manual and resolutions reached during future TWG meetings.

Below are some of the TRC issues that the EDCs have requested to be addressed in future meetings:

- Creation of a database for deemed customer costs or incremental measure costs as applicable;
- Resolution on cost issues associated with fuel switching measures;
- Clarity on the application of the Bureau of Labor Statistics (BLS) factor used to escalate energy and capacity rates associated with avoided cost calculations;
- Clarity on the application of PJM Forwards and Base Residual Options (BRO);
- Resolution on the application of TRC calculation to Demand Response programs;
- Clarity on the frequency of conducting cost-effectiveness evaluations and reporting results;
- Clarity on the timing of TRC reports, e.g., when to freeze data and inputs;
- Resolution on the basis of TRC benefits – reported savings or verified savings;
- Resolution on basis of TRC costs – actual costs or committed costs;
- Resolution of the definition of incentives in TRC for energy efficiency measures, e.g., what constitutes an "incentive" and which payments to customers are treated as a "program cost" versus costs included in the "incremental cost" cost category;
- Resolution on the treatment of payments to demand response CSPs and treatment of customer incentives for demand response measures;
- Direction on determining the measure life for Demand Response programs, such as direct load control and load curtailment;
- Direction on the determination of baseline equipment for setting incremental costs and custom rebates;
- Direction on net-to-gross adjustments applications and any adjustments to TRC ratios;
- Resolution on the requirement for annual updates of EDC avoided cost forecasts (15 years);
- Direction on the inclusion or exclusion of customer avoided operating & maintenance costs in the TRC calculation;
- Clarification of whether avoided costs used to create the benefit/cost ratios in the approved EE&C plans are the avoided costs that should be used in post program implementation benefit/cost analyses;
- The TRC TWG should discuss the issues/problems associated with interim TRC assessments, and make recommendations relative to the periodicity of TRC assessments;
- The TRC TWG should discuss the methodology for developing net-to-gross (NTG) ratio information and determine how the NTG ratio should be utilized;
- The TRC TWG should discuss whether a catalog should be developed with standard incremental costs for energy efficiency measures;
- The TRC TWG should discuss if there are any opportunities/benefits related to improved consistency in economic assumptions across the seven EDCs.

6.7 Proposed Revisions to Electric Distribution Company Energy Efficiency and Conservation Plan Review

Allegheny, PECO and PPL have requested Commission approval to revise their EE&C plans. Summaries of requested revisions are summarized below. This section also provides the recommendations of the SWE team for each proposed EE&C Plan modification.

Table 6-41: Summary of EE&C Plan Amendments and SWE Recommendations – Allegheny

Allegheny					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
1	Allegheny's alternative EE&C/DR Plan removes the following Smart Meter enabled programs: *Residential Efficiency Rewards Rate, Pay Ahead Smart Service Rate, Hourly Pricing Option Rate, Programmable Controllable Thermostat (PCT) Demand Response Rate.* As a result, program budgets for remaining programs have been revised.	The Public Utilities Commission (PUC) cited concerns related to Allegheny Power's reliance on the rapid deployment of smart meters in its initial EE&C/DR Plan and has encouraged Allegheny Power to develop an alternative plan that is "less reliant" on smart meters.	Due to changes in program make up and budget, the alternative EE&C/DR Plan causes a shift in the allocation from residential to non-residential programs. *Residential: 43% to 36%* *Residential, Low Income: 14% to 13%* *Small C&I: 21% to 27%* *Large C&I: 16% to 18%* *Government/Non-Profit: 6% to 5%*	<u>All Programs COMBINED</u>: 2009 (Original): 24,626 MWh ; 3.8 MW 2009-2013 (Original): 649,059 MWh ; 204.3 MW 2009 (Revised): 12,940 MWh ; 2.5 MW 2009-2013 (Revised): 640,732 MWh ; 198.8 MW	In order to address the concerns raised by the PA PUC Staff, the SWE Team recommends approval of the proposed modification to remove several Smart Meter enabled programs. The resulting transfer of funds from the residential classification to C&I needs further review.
2	Allegheny proposed revised 2009-2013 program budget and program savings estimates for the Residential Energy Star and High Efficiency Appliance Program	The EE&C/DR Plan estimates for the Residential Energy Star & High Efficiency Appliance Program were revised based on the experience gained from offering programs to PA customers, in an effort to maximize effectiveness in meeting the targets and requirements of Act 129.	2009 budget increased from $1.5 million to $1.7 million. Incentives decreased (short-term) from $298,611 to $225,951. Non-Incentive costs increased from $1.23 million to $1.49 million. Proposed *2009-2013 Budget increases from $16.56 million to $16.57 million. Incentives increase from $5.44 million to $6.02 million. Non-incentive costs decrease from $11.12 million to $10.56 million.*	2009 (Original): 3,062 MWh ; 1.0 MW 2009-2013 (Original): 59,001 MWh ; 19.9 MW 2009 (Revised): 2,013 MWh ; 0.5 MW 2009-2013 (Revised): 51,233 MWh ; 12.7 MW	The SWE Team recommends approval of this proposed modification.
3	Allegheny proposed revised 2009-2013 program budget and program savings estimates for the CFL Rewards Program.	The EE&C/DR Plan estimates for the CFL Rewards Program were revised based on the experience gained from offering programs to PA customers, in an effort to maximize effectiveness in meeting the targets and requirements of Act 129.	2009 budget increased from $511,448 to $808,614. Incentives decreased from $89,513 to $20,140. Non-Incentive costs increased from $421,935 to $788,474. Proposed *2009-2013 budget decreases from $3.3 million to $3.2 million. Incentives decrease from $1.5 million to $1.2 million. Non-incentive costs increase from $1.8 million to $2.0 million.*	2009 (Original): 7,002 MWh ; 0.0 MW 2009-2013 (Original): 124,859 MWh ; 0.3 MW 2009 (Revised): 1,508 MWh ; 0.1 MW 2009-2013 (Revised): 87,958 MWh ; 4.8 MW	The SWE Team recommends approval of this proposed modification.
4	Allegheny proposes consolidating the "Check Up" and "Comprehensive" audit	Consolidating the two audit measures will simplify program design and	2009 budget decreased from $1.44 million to $1.1 million.	2009 (Original): 1,872 MWh ; 0.2 MW	This change needs further review. The SWE Team

Allegheny					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
	measures included in the Home Performance Program into a single "In Home" audit measure. In conjunction with a revised estimate of program participation, the program budget is decreased.	administration.	Incentives decreased from $232,810 to $38,495. Non-Incentive0020costs decreased from $1,210,479 to $1,061,565.Proposed *2009-2013 budget decreases from $14.48 million to $9.64 million. Incentives decrease from $6.54 million to $3.73 million. Non-incentive costs decrease from $7.94 million to $6.27 million.*	2009-2013 (Original): 59,685 MWh ; 6.4 MW 2009 (Revised): 496 MWh ; 0.0 MW 2009-2013 (Revised): 48,471 MWh ; 4.4 MW	recommends that the PA PUC, SWE and Allegheny staff have a teleconference to discuss the merits of this proposed change. The SWE Team needs to understand if this program can still be successful and cost effective if incentives are reduced from $233,000 to $38,000
5	Allegheny is replacing the incentive for the installation of new efficient HVAC units with an incentive for the maintenance of existing HVAC units in the residential HVAC/Home Appliance Program.	The changes to providing an incentive for maintenance activities provides the opportunity for more customers to participate due to the much lower cost of performing maintenance as opposed to the higher cost of new installations.	2009 budget increased from $468,809 to $773,467. Incentives decreased from $60,948 to $0. Non-Incentive costs increased from $407,861 to $773,467. Proposed *2009-2013 budget decreases from $3.57 million to $3.21 million. Incentives decrease from $1.8 million to $974,506. Non-incentive costs increase from $1.77 million to $2.24 million.*	2009 (Original): 163 MWh ; 0.2 MW 2009-2013 (Original): 5,107 MWh ; 5.5 MW 2009 (Revised): 0 MWh ; 0.0 MW 2009-2013 (Revised): 12,641 MWh ; 4.0 MW	Proposed modification to budget needs further review. The SWE Team recommends the approval of adding HVAC Maintenance to the existing program, but does not recommend eliminated incentives for new HVAC replacement. *With the revised changes, the cumulative TRC for this program is calculated to change from 1.0 to 0.8.*
6	Allegheny proposes adding a new Domestic Water Heating measure to the Residential HVAC/Whole Home Appliance Efficiency Program.	Provides the opportunity for more customers to participate in the program and supports additional energy and demand savings not already included in Allegheny Power's EE&C/DR Plan.	See revisions to Residential HVAC/Home Appliance program	See revisions to Residential HVAC/Home Appliance program	The SWE Team recommends approval of the addition for domestic water heating measures pending further clarification of actual eligible measures, costs, and savings, and a review of the cost effectiveness of each measure added.
7	Allegheny is removing the Low Income Room AC Replacement Program as a stand-alone program.	Room AC Replacement is already included in the Low Income Home Performance Check Up with Appliance Replacement Program and the removal of this stand alone program removes duplicity of this measure in Allegheny	2009 budget for all low income programs decreased from $998,929 to $863,140. Incentives decreased from $562,391 to $426,565. Non-Incentive costs increased slightly from $436,538	Residential Low Income Sector: 2009 (Original): 979 MWh ; 0.2 MW 2009-2013 (Original): 17,791 MWh ; 2.8 MW	The SWE Team recommends approval for this proposed modification.

Allegheny					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
		Power's EE&C/DR Plan.	to $436,575. Proposed *2009-2013 budget decreases from $13.54 million to $12.22 million. Incentives decrease from $10.54 million to $9.67 million. Non-incentive costs decrease from $3 million to $2.56 million.*	2009 (Revised): 754 MWh ; 0.2 MW 2009-2013 (Revised): 15,019 MWh ; 3.2 MW	
8	Alleghenyis replacing the incentive for the installation of new efficient HVAC units with an incentive for the maintenance of existing HVAC units in the C&I HVAC Program.	The changes to providing an incentive for maintenance activities provides the opportunity for more customers to participate due to the much lower cost of performing maintenance as opposed to the higher cost of new installations.	2009 budget increased from $396,647 to $1.14 million. Incentives decreased from $31,091 to $0. Non-Incentive costs increased from $365,556 to 1.14 million. Proposed *2009-2013 budget decreases from $2.24 million to $2.20 million. Incentives decrease from $928,884 to $172,669. Non-incentive costs increase from $1.31 million to $2.03 million.*	2009 (Original): 142 MWh ; 0.1 MW 2009-2013 (Original): 4,503 MWh ; 2.5 MW 2009 (Revised): 0 MWh ; 0.0 MW 2009-2013 (Revised): 3,665 MWh ; 3.8 MW	Proposed modification to budget needs further review. The SWE Team recommends the approval of adding HVAC Maintenance to the existing program, but does not recommend eliminating incentives for new HVAC replacement. *With the revised changes, the cumulative TRC for this program is calculated to change from 1.5 to 0.5*
9	Allegheny is expanding the eligible lighting measures included as part of the Commercial Lighting/Products Program. Allegheny also proposes to expand the budget for this program.	Provides the opportunity for more customers to participate in the program and supports additional energy and demand savings not already included in Allegheny Power's EE&C/DR Plan.	2009 budget increased from $859,872 to $1.39 million. Incentives decreased from $447,177 to $278,221. Non-Incentive costs increased from $412,695 to 1.11 million. Proposed *2009-2013 budget increases from $12.46 million to $15.3 million. Incentives increase from $10.83 to $11.89 million. Non-incentive costs increase from $1.63 million to $3.44 million.*	2009 (Original): 8,166 MWh ; 1.8 MW 2009-2013 (Original): 203,148 MWh ; 42.7 MW 2009 (Revised): 5,973 MWh ; 1.2 MW 2009-2013 (Revised): 256,837 MWh ; 51.6 MW	The SWE Team recommends approval of additional lighting measures to the Commercial Lighting/ Products Program. An increased budget that causes a shift of funds from the Residential classification to C&I needs further review.
10	Allegheny proposes adding a new Smart Strips measure to the Commercial Lighting/Products Efficiency Program.	Provides the opportunity for more customers to participate in the program and supports additional energy and demand savings not already included in	see increases to Commercial Products Program	See increases to Commercial Products Program	The SWE Team recommends approval of Smart Strip measures to the Commercial Lighting/ Products Program. An

Allegheny					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
		Allegheny Power's EE&C/DR Plan.			increased budget that causes a shift of funds from the Residential classification to C&I needs further review.
11	Allegheny proposes to expand the Custom Technology Applications Program to provide the opportunity for more customer projects. The result is an increased program budget.	Program implementation and management to date supports the opportunity for additional customer projects to be completed than originally projected.	2009 budget increased from $342,807 to $1.04 million. Incentives were $0 in both the original and revised plan. Proposed *2009-2013 budget increases from $4.20 million to $7.35 million. Incentives increase from $2.68 to $4.43 million. Non-incentive costs increase from $1.52 million to $2.92 million.*	2009 (Original): 0 MWh ; 0.0 MW 2009-2013 (Original): 8,525 MWh ; 2.2 MW 2009 (Revised): 0 MWh ; 0.0 MW 2009-2013 (Revised): 19,910 MWh ; 3.5 MW	The proposed modification results in a transfer of funds from the residential classification to the C&I classification. The proposed modification needs further review.
12	Allegheny proposes to expand the Custom Applications Program to provide the opportunity for more customer projects. The result is an increased program budget.	Program implementation and management to date supports the opportunity for additional customer projects to be completed than originally projected.	2009 budget increased from $340,523 to $1.04 million. Incentives were $0 in both the original and revised plan. Proposed *2009-2013 budget increases from $6.28 million to $10.78 million. Incentives increase from $4.94 to $8.4 million. Non-incentive costs increase from $1.34 million to $2.38 million.*	2009 (Original): 0 MWh ; 0.0 MW 2009-2013 (Original): 60,115 MWh ; 11.8 MW 2009 (Revised): 0 MWh ; 0.0 MW 2009-2013 (Revised): 74,261 MWh ; 14.6 MW	The proposed modification results in a transfer of funds from the residential classification to the C&I classification. The proposed modification needs further review.
13	Allegheny is removing the C&I Drives Program and instead providing the opportunity to install energy efficient drives through the current custom programs.	Allegheny Power plans to provide for C&I Drives through the existing custom program due to the requirement for custom measurement and verification protocols. Handling energy efficient drives and custom measure and verification protocols through the custom programs leverages existing processes and streamlines program administration.	See revisions to Custom Programs	See revisions to Custom Programs	The SWE Team recommends approval of the proposed modification.
14	Allegheny proposed revised 2009-2013 program budget, timelines, and program savings estimates for the Residential Critical Peak Rebate (CPR) Rate.	The EE&C/DR Plan estimates for the Residential Critical Peak Pricing Program were revised based on the experience gained from offering programs to PA customers, in an effort to maximize effectiveness in meeting the targets and	2009 budget remains at $0 Proposed *2009-2013 budget increases from $361,780 million to $1.49 million. Incentives increase from $0 to $610,830.*	2009 (Original): 0 MWh ; 0.0 MW 2009-2013 (Original): 1,903 MWh ; 9.5 MW	The SWE Team recommends approval of the proposed modification. *With the revised changes, the*

Allegheny					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
		requirements of Act 129.	*Non-incentive costs increase from $361,780 to $882,058.*	2009 (Revised): 0 MWh ; 0.0 MW 2009-2013 (Revised): 735 MWh ; 7.3 MW	*cumulative TRC for this program is calculated to change from 1.5 to 0.5.*
15	Allegheny proposed revised 2009-2013 program budget, timelines, and program savings estimates for the Time-of-Use with Critical Peak Pricing.	The EE&C/DR Plan estimates for the C&I Critical Peak Rebate Program were revised based on the experience gained from offering programs to PA customers, in an effort to maximize effectiveness in meeting the targets and requirements of Act 129.	2009 budget remains at $0 Proposed *2009-2013 budget increases from $437,898 million to $818,047. Incentives increase from $0 to $199,713. Non-incentive costs increase from $437,898 to $618,334.*	2009 (Original): 0 MWh ; 0.0 MW 2009-2013 (Original): 5,574 MWh ; 2.9 MW 2009 (Revised): 0 MWh ; 0.0 MW 2009-2013 (Revised): 4,112 MWh ; 7.4 MW	The SWE Team recommends approval of the proposed modification.
16	Allegheny proposed revised 2009-2013 program budget, timelines, and program savings estimates for the Customer Load Response Program. The revision updated the implementation timing of this programs and plan cost reallocations resulting from the change in the plan portfolio.	The EE&C/DR Plan estimates for the Customer Load Response Program were revised based on the experience gained from offering programs to PA customers, in an effort to maximize effectiveness in meeting the targets and requirements of Act 129.	2009 budget increased from $257,667 to $428,112. Incentives were $0 in both the original and revised plan. Proposed *2009-2013 budget decreases slightly from $2.48 million to $2.45 million. Incentives decrease from $1.13 to $908,250. Non-incentive costs increase from $1.35 million to $1.54 million.*	2009 (Original): 0 MWh ; 0.0 MW 2009-2013 (Original2,900 MWh; 29.0 MW 2009 (Revised): 0 MWh ; 0.0 MW 2009-2013 (Revised): 2,100 MWh ; 21.0 MW	The SWE Team recommends approval of the proposed modification. *With the revised changes, the cumulative TRC for this program is calculated to change from 1.3 to 0.5.*
17	Allegheny proposed revised 2009-2013 program budget estimates and timelines for the Customer Resource Demand Response Program. The revision updated the implementation timing of this programs and plan cost reallocations resulting from the change in the plan portfolio.	The EE&C/DR Plan estimates for the Customer Resource Demand Response Program were revised based on the experience gained from offering programs to PA customers, in an effort to maximize effectiveness in meeting the targets and requirements of Act 129.	2009 budget increased from $257,667 to $428,112. Incentives were $0 in both the original and revised plan. Proposed *2009-2013 budget increases from $2.78 million to $3.26 million. Incentives increase from $1.94 million to $2.15 million. Non-incentive costs increase from $843,443 to $1.11 million.*	Revised budgets and timelines do not result in any changes to projected cumulative energy savings in 2013. *(The revised timeline does slow down program start-up eliminating savings in 2010.)*	The SWE Team recommends approval of the proposed modification. *With the revised changes, the cumulative TRC for this program is calculated to change from 1.7 to 0.8.*

Allegheny					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
18	Allegheny proposed revised 2009-2013 program budget estimates and timelines for the Distributed Generation Program. The revision updated the implementation timing of this programs and plan cost reallocations resulting from the change in the plan portfolio.	The EE&C/DR Plan estimates for the Distributed Generation Program were revised based on the experience gained from offering programs to PA customers, in an effort to maximize effectiveness in meeting the targets and requirements of Act 129.	2009 budget increased from $51,533 to $86,863. Incentives were $0 in both the original and revised plan. Proposed *2009-2013 budget increases from $623,713 to $684,171. Incentives decrease from $379,718 to $372,750. Non-incentive costs increase from $243,995 to $311,421.*	Revised budgets and timelines do not result in any changes to projected cumulative energy savings in 2013. *(The revised timeline does slow down program start-up eliminating savings in 2010.)*	The SWE Team recommends approval of the proposed modification. *With the revised changes, the cumulative TRC for this program is calculated to change from 0.9 to 0.8.*
19	Allegheny proposed revised incentive levels for T8 lighting as well as revised budget, participation, and savings estimates for the Government/School/Non-Profit Lighting Efficiency Program	The EE&C/DR Plan estimates for the Government/School/Non-Profit Lighting Program were revised based on the experience gained from offering programs to PA customers, in an effort to maximize effectiveness in meeting the targets and requirements of Act 129.	2009 budget increased from $433,350 to $700,215. Incentives decreased from $130,501 to $92,130. Non-Incentive costs increased from $302,849 to $608,085. Proposed *2009-2013 budget decreases from $5.57 million to $5.06 million. Incentives decrease from $3.93 million to $3.38. Non-incentive costs increase from $1.64 million to $1.68 million.*	2009 (Original): 2,842 MWh ; 0.3 MW 2009-2013 (Original): 63,997 MWh ; 8.0 MW 2009 (Revised): 2,195 MWh ; 0.5 MW 2009-2013 (Revised): 59,091 MWh ; 13.5 MW	The SWE Team recommends approval of the proposed modification.

Table 6-42: Summary of EE&C Plan Amendments and SWE Recommendations – Duquesne

Duquesne					
#	**Summary of Proposed Modification**	**Rationale for Modification**	**Annual Budget Impact**	**Annual Energy and Demand Impact**	**SWE Team Assessment**
	No proposed modifications to EE&C Plans filed with the Commission as of October 15, 2010. Note: Duquesne made two proposals to change its programs by (1) adding freezers to its Refrigerator Recycling Program, and (2) adding seven measures not previously in its filed EE&C Plan.				

Table 6-43: Summary of EE&C Plan Amendments and SWE Recommendations – FirstEnergy (Met-Ed)

Met-Ed					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
	No proposed modifications to EE&C Plans filed with the Commission as of October 15, 2010.				

Table 6-44: Summary of EE&C Plan Amendments and SWE Recommendations – FirstEnergy (Penelec)

Penelec					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
	No proposed modifications to EE&C Plans filed with the Commission as of October 15, 2010.				

Table 6-45: Summary of EE&C Plan Amendments and SWE Recommendations – PennPower

PennPower					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
	No proposed modifications to EE&C Plans filed with the Commission as of October 15, 2010.				

Table 6-46: Summary of EE&C Plan Amendments and SWE Recommendations – PECO

PECO					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
1	PECO requests approval for making changes to incentive and per unit savings levels in the PECO Smart Home Rebates Program. Affected measures include: *Clothes Washers, Dishwashers, Refrigerators, Freezers, Windows, Dehumidifiers, heat pump water heaters, efficient storage water heaters, LED Lamps, and Room AC Units.* In addition, PECO proposes to remove	The recommended changes to the incentive levels more closely match the targeted 30%-50% of the incremental cost to purchase efficient equipment and correlate to the program participation levels PECO realized during the first program year..	The impact of PECO's proposed modifications to measure incentive levels on program budgets, if any, are not included in the revised EE&C Plan.	The impact of PECO's proposed modifications to measure per unit energy and/or demand savings on program savings, if any, are not included in the revised EE&C Plan.	The SWE Team recommends approval of the incentive level changes. SWE Team recommends the approval of the revisions to the savings assumptions for planning purposes only. All reported and verified savings must conform to TRM/Interim TRM protocols.

PECO					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
	programmable thermostats from their Smart Homes Rebate/Efficient Products offering.				
2	PECO requests approval for adding measures to the existing set of measures included as part of the PECO Smart Home Rebates Program. Additional measures are: *Ceiling Fan with Energy Star light fixture, Outdoor Energy Star light fixture, Ground Source Heat Pump Desuperheater, High Efficient Electric Water Heaters (.93 & .94 EF), Energy Star 5.0 Desktop Computer, Energy Star Computer Monitor, Smart Strips, Energy Star Office Equipment, LED Nightlight, and Electroluminescent Nightlight.*	The requested additional measures were not included in PECO's original EE&C Plan, but are approved in the TRM, have Interim TRM Protocols, or are under final review with the SWE. PECO requests that these measures be added to the Plan, as they are cost-effective and provide residential customers with additional opportunities to participation in the Smart Homes Rebates Program.	The addition of the proposed set of measures to the EE&C Plan will not impact the total cost of the programs as the incentives can be funded under the approved budget.	The impact of PECO's proposed additional measures on program savings, if any, are not included in the revised EE&C Plan.	SWE Team recommends the approval of additional measures to the Smart Homes Rebate Program for planning and implementation purposes only. All reported and verified savings must conform to TRM/Interim TRM protocols.
3	PECO will provide a limited number of low-income customers with an energy-efficient refrigerator, thus replacing and removing the customer's existing inefficient unit. This measure is limited to customer locations that have not received Low-Income Usage Reduction Program or LEEP Weatherization. The old unit will be recycled and disposed of in an environmentally friendly way.	At the time of PECO's original EE&C filing, the kWh savings were not approved for this program. The kWh savings for the program have now been reviewed and approved by the SWE for future inclusion in the TRM.	The additional of the proposed measure to the EE&C Plan will not impact the total cost of the program as the incentives can be funded under the approved budget.	The impact of PECO's proposed additional measures on program savings, if any, are not included in the revised EE&C Plan.	SWE Team recommends the approval of the low income refrigerator removal/replacement measure for planning and implementation purposes only. All reported and verified savings must conform to TRM/Interim TRM protocols.
4	PECO proposes to modify the Whole House Performance Program to include an initial pilot approach and transfer $1.8 million of the Whole House Performance Program's $3.3 million budget to the CFL Program	Pending the development of appropriate protocols for the Whole House Performance Program, PECO is proposing to modify the WHP program to include an initial pilot approach for 50 electric heated homes with a focus on PECO rate Residential Heat (RH) customers. The results of the pilot will be used to structure the future program. In view of the revised timing for WHP implementation, there is an opportunity to achieve savings more immediately by shifting of portion of its funding to the CFL Program.	$1.8 million will be shifted from the Whole House Performance Program budget to the CFL Program.	The energy/demand savings impact of shifting $1.8 million away from the Residential New Construction Program is not included in the revised EE&C Plan.	THE SWE Team recommends approval for the transfer of funds from the Whole House Performance Program to the CFL Rewards Program with one caveat. The SWE Team is considering a revision to hours of use per CFL bulb in various room locations. The SWE Team recommends that the 3 hours of use per day (per CFL) in the June 2010 TRM be modified to show a breakdown of daily hours of use by room type. The SWE Team

PECO					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
					will propose this breakdown in the upcoming filing with the PUC for TRM revisions. These revisions would likely result in lower total savings and lower benefit/cost ratios for the CFL program.
5	PECO proposes moving $1.7 million of the New Home Construction Program's $2.4 million budget to the CFL Program. The remaining $700,000 would be used to provide incentives to builders for installing high efficiency HVAC and appliances in residential new construction.	New home construction activity has slowed. 2009 building codes and standards have become more stringent since the initial filing of PECO's EE&C plan, making it more difficult to achieve incremental energy savings.	$1.7 million will be shifted from the Residential New Construction budget to the CFL Program.	The energy/demand savings impact of shifting $1.7 million away from the Residential New Construction Program is not included in the revised EE&C Plan.	THE SWE Team recommends approval for the transfer of funds from the Residential New Construction Program to the CFL Rewards Program.
6	As discussed above, PECO proposes to transfer $3.5 million into the CFL Program, with $1.7 million coming from the Residential New Construction Program and $1.8 million from the Whole House Performance Program.	The CFL Program has exceed the Plan's projected CFL sales and MWh savings.	The funding transfer will not impact the Energy Efficiency Program Charge (EEPC) or other rate classes as both the Residential New Construction Program and the WHP Program are utilized and funded by the residential customer class.	The additional $3.5 million transferred to the CFL program is expected to result in an additional 3.2 million discounted bulbs at retailers, 144,000 MWh energy savings and 8 MW demand reduction.	THE SWE Team recommends approval for the transfer of funds from the Residential Whole House Performance and New Construction Program to the CFL Rewards Program. The SWE Team recommends that the 3 hours of use per day (per CFL) in the June 2010 TRM be modified to show a breakdown of daily hours of use by room type. The SWE Team will propose this breakdown in the upcoming filing with the PUC for TRM revisions.
7	PECO proposes to reduce the rebate associated with a recycled room air conditioning unit in the PECO Smart Appliance Recycling Program from $25 to $10.	Based on a review by the SWE, the kWh savings associated with a recycled room AC unit changed from 1,147 kWh, which was utilized in PECO's approved EE&C Plan, to 353 kWh. The reduced incentive would better align with the approved kWh savings.	The impact of PECO's proposed modifications to measure incentive levels on program budgets, if any, are not included in the revised EE&C Plan.	The impact of PECO's proposed modifications to measure per unit energy and/or demand savings on program savings, if any, are not included in the revised EE&C Plan.	The SWE Team recommends approval of the incentive level changes.
8	PECO requests approval for adding measures to the existing set of measures included as part of the PECO Commercial/Industrial/Governmental/ Non-Profit Program. Additional	PECO's Conservation Service Provider's (KEMA) experience implementing energy efficiency programs in other jurisdictions has shown that adding the proposed set of measures extends the	The addition of the proposed set of measures to the EE&C Plan will not impact the total cost of the programs as the incentives can be funded under the approved	The impact of PECO's proposed additional measures on program savings, if any, are not included in the revised EE&C Plan.	SWE Team recommends the approval of additional measures to the PECO Commercial/ Industrial/ Governmental/ Non-Profit Program for planning and

PECO					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
	measures are: *Strip Curtains on Walk-In Coolers/Freezers, Anti-Sweat heater controls, EC motor for walk-in/reach-in coolers, evaporation fan controls, automatic door closers for walk-in coolers/freezers, refrigerated display case night covers, LED refrigerated case lighting, Energy Star solid/glass freezer doors, high efficiency ice makers, hot food holding cabinets, efficient vending machine and controls, and barrel wraps.*	reach of energy efficiency efforts and savings to grocery stores, food service establishments, small business customers, and non-profit institutions.	budget.		implementation purposes only. All reported and verified savings must conform to TRM/Interim TRM protocols.
9	PECO requests flexibility going forward to add additional measures to the EE&C plan that have kWh savings protocols and which have received preliminary approval by the SWE without the need for re-filing the EE&C plan. PECO will continue to pursue approval for any future budget allocations.	The requested increased flexibility will ensure that new measures for energy savings are provided to PECO's customers promptly after they are added to the TRM, while at the same time conserving Commission resources.	Proposed modification has no direct impact to approved program budget.	Proposed modification has no direct impact to approved program savings.	The SWE Team recommends approval of this proposed modification

Table 6-47: Summary of EE&C Plan Amendments and SWE Recommendations – PPL

PPL					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
1	PPL Electric proposes to allocate all CFL Program sales, savings, and costs to the residential customer sector instead of allocating 5% to the small C&I sector and 17% to the low-income sector (costs to the low-income sector would be paid by all residential customers).	(1) No longer necessary to allocate and/or track savings to low-income sector for compliance purposes. (2) It is not possible to calculate or verify savings in accordance with the Commission's TRM for CFLs purchased by C&I customers as part of the retail-discount CFL Program due to insufficient data collected at Point of Sale (POS).	PPL Electric's proposed modified approach shifts approximately $800,000 of projected costs from the small C&I customer sector to the residential sector. That is approximately a 1.3% increase in total projected cost for the residential sector and a 0.9% reduction in total projected cost for the small C&I sector compared to the approved EE&C Plan.	There is no impact on the projected total savings of the CFL Program or the entire EE&C Plan.	The SWE Team recommends approval of this proposed modification.
2	PPL Electric proposes to shift approximately $6.5 million from the	During the detailed design and implementation of its EE&C programs	While shifting between "common" and "direct" costs	There is no impact on the projected total savings of any	The SWE Team recommends approval of this proposed

PPL					
#	Summary of Proposed Modification	Rationale for Modification	Annual Budget Impact	Annual Energy and Demand Impact	SWE Team Assessment
	"direct program cost" category to the "common cost" category.	and development of program cost tracking systems and processes, PPL Electric identified several changes to the definitions of "common costs" and "direct program costs" compared to the assumptions in the EE&C Plan.	does not change the projected cost of the EE&C Plan as a whole, it does result in minor cost changes (less than 2.5% compared to the original EE&C Plan) between customer sectors and/or programs.	programs or the entire EE&C Plan. Shifting between common and direct cost categories does not impact the benefit-cost ratio of the portfolio and has a minor impact(improvement) on the benefit-cost ratio of some programs because of the lower direct cost of some programs (common costs are excluded from the cost-effectiveness test at the program level; common costs are only addressed at the portfolio level).	modification.

7. Statewide Evaluator Findings and Recommendations

The SWE Team has carefully reviewed the annual reports and kWh and kW savings data for PY1 submitted by the seven EDCs that are subject to the provisions of Act 129. These seven EDCs implemented a total of 38 energy efficiency and demand response programs during PY1 that had verified kWh and kW savings. The seven EDCs plan to implement over 70 additional programs during PY2. This Annual Report from the SWE team to the PA PUC provides a detailed assessment of each EDC's progress with program implementation, expenditures and kWh and kW savings. This report also provides the following additional information:

- An analysis of each EDC's protocol for M&V of energy savings attributable to its plan;
- Identification of best practices;
- A review of TRM information and savings values with suggestions for possible revisions and additions;
- A review of the TRC Test Manual with suggestions for possible revisions and additions; and
- A review of any proposed revisions and updates to EDC Plans.

The SWE team would like to thank the program staff and evaluation contractors at each of the EDCs for their assistance over the past year in providing data and information to the SWE team about the costs, participants, and savings of the EDC programs that have been implemented. The SWE team also appreciates the responsiveness and cooperation we have received from the EDCs and their evaluation contractors, as well as the many suggestions we have received to improve and streamline SWE audit and reporting activities. We recognize the long hours that the EDCs' staffs have put in during PY1 to design and launch programs, and monitor their progress. The SWE team also sent a draft of this report to the EDCs and emphasized that it welcomed comments and suggestions from the EDCs and their evaluation contractors to improve this report. The SWE team would also like to thank the Staff of the PUC's CEEP Bureau for their assistance and support since the beginning of the SWE project in September 2009.

The SWE team completed numerous audit activities relating to the energy efficiency and demand response programs implemented by the EDCs during PY1. Several of these activities are listed below:

- Developed a customized checklist (plan) for audit activities for each program planned for implementation during PY1.
- Reviewed and verified the kWh and kW savings calculations submitted by the seven EDCs for PY1.
- Conducted on-site audits of energy efficiency measure installations at 63 homes participating in EDC residential low-income energy efficiency programs.
- Completed site visit reports (with findings and recommendations) for EDCs that implemented low-income energy efficiency programs during PY1.
- Conducted on-site audits of energy efficiency installations at 86 randomly selected businesses participating in C&I energy efficiency programs.
- Completed site visit reports (with findings and recommendations) for EDCs that implemented C&I energy efficiency programs during PY1.

- Checked and verified all data on energy efficiency measure installations for the residential appliance recycling programs and the residential efficient products program for a random sample of 150 participants for each of these programs.
- Checked and verified the number of CFL bulbs by wattage and incandescent equivalency distributed through residential lighting buy-down and giveaway programs.
- Checked and verified that the EDCs used correct deemed kWh and kW savings numbers from the TRM.
- Checked and verified that the EDCs used correct algorithms and inputs to estimate kWh and kW savings for partially deemed measures according to the TRM.
- Checked and verified that the EDCs used correct kWh and kW savings protocols for energy efficiency and demand response measures not included in the TRM.
- Reviewed and approved 31 interim measure savings protocols.
- Reviewed and approved CMPs – 12 approved, ten undergoing EDC revisions , and an additional 15 are in some stage of the approval process.

Important findings from the SWE audit activities of PY1 data and program operations include the following:

1) For all energy efficiency and demand response measures and/or programs, there needs to be a protocol to estimate kWh and kW savings to serve as a standard for measuring the performance of measures and programs that are eventually implemented.
2) Many of the issues identified by the SWE team have already been addressed and fixed by the EDCs.
3) The processes for developing a large number of "Custom" protocols for measures not defined in the TRM has resulted in unexpected and challenging technical negotiations. To facilitate practical solutions to this challenge the SWE team worked with CEEP and the EDCs to develop two classes of CMPs to make the process more efficient without unduly sacrificing accountability and the intent of Act 129 regulations. After consultation with CEEP staff and the EDCs, the SWE team issued guidelines for a streamlined review process for CMPs on November 24, 2010. These two new protocol classes included in the new review process as the following:
    a. Traditional M&V protocols for unique, non standard application that are technically specific as to the measurements required and don't require site-specific M&V plans.
    b. Guideline protocols that do require site-specific M&V plans because alone they are not specific enough to create a clear auditable requirement. These projects will have site-specific M&V plans on file with the SWE which the SWE will audit and approve as appropriate for auditing purposes.
4) The 63 on-site visits to Low-Income Program participants identified the following problematic issues:
    a. Incorrect CFL counts (program records did not match the number of CFLs actually installed);
    b. Installation of many CFLs in sockets with very low hours of use;

   c. Difficulty with accurately identifying which CFLs were installed by the EDC as part of the Act 129 program and which were installed as part of other initiatives; and
   d. Where Energy Efficiency Kits were provided, the installation rates for faucet aerators and night lights were very low.

5) At some of the EDCs, there exists inaccurate recording of the number of units in package measures resulting in extremely high, incorrect savings values in the EDCs' databases and tracking systems. These issues will no longer affect reported savings as Act 129 WRAP savings will be deemed values based on the most recent PA PUC approved savings for each LIURP job type from a prior period until such time as a billing analysis can be completed for Act 129 WRAP projects. PPL has submitted a Low-Income WRAP custom measure protocol for review by the SWE team.
   a. For example, at one EDC, attic installation was often recorded in square feet of coverage, instead of the default "1" for the package measure. This creates a large discrepancy, often as large as 100,000+ kWh. It will be essential to ensure that this discrepancy is remedied immediately. The EDC representative was unsure if it was an error with the user interface or the database.
   b. At this same EDC, for attic insulation measures, the contractors were recording these on the invoice multiple times for the various sections of the attic that were insulated. For example, the slope, flat section and knee wall could be recorded as three individual measures. In most cases these measure unit quantities default to "1" but in some cases three identical measures were recorded in the EDC's tracking system for each part of the attic blow-in task. This had the effect of tripling the deemed savings.
6) The SWE team was able to verify the PY1 reported gross energy and demand savings for only four out of the seven EDCs offering a residential Efficient Equipment Products Program or its equivalent. For the three EDCs in which savings numbers could not be matched at 100%, the SWE team calculations differed only slightly.
7) The SWE team was able to verify the reported gross energy and demand savings for five out of the six EDCs offering a Residential Appliance Recycling Program. For the one EDC where the SWE could not match savings numbers 100%, the SWE team calculations were only slightly different from the calculations of the EDC.
8) For the Residential Low-Income sector, the SWE team did find significant errors in the kWh and kW savings calculations for one of the EDCs. The EDC has corrected those errors.
9) The SWE team noted several areas for improvement in the EM&V methodology used by the EDC evaluation teams. These issues are highlighted for each EDC in Section 6 of this report.
10) The 2010 TRM needs to be updated to reflect actual program findings and more recent impact evaluation data for the following residential programs:
   a. Appliance recycling deemed savings values and
   b. Residential CFL hours of use and in-service rates[98].

[98] Of these total statewide verified savings in PY1, 74% of the MWh and 52% of MW savings are attributable to residential lighting programs, comprised primarily of CFL bulbs.

11) It appears that some residential contractors are over-installing CFLs in sockets with low hours of use. At one EDC service area, many houses received over 20 CFLs, giving rise to speculation that many of the CFLs had to be installed in low usage sockets such as closets, utility rooms and unfinished basements.
    a. In fixtures with multiple sockets (e.g., dining room, bathroom vanity) some customers had de-lamped the provided CFLs by twisting them enough to disable them. This may be an installation rate issue.
    b. According to one EDC's database, numerous participants received 20 or more CFL bulbs. The highest quantity of CFLs installed for one participant was 37.
12) The SWE team's review of the relative precision calculations associated with the realization rates revealed that FirstEnergy has not achieved 90/10 confidence and precision for the Penelec C&I programs. The resultant precision was 19% with a high variance in the sample pool. The SWE team also observed that the target sample size necessary for 90/10 confidence and precision at an assumed Coefficient of Variance (COV) of 0.5 was not achieved individually for each operating company of FirstEnergy.[99]
13) The 2010 TRM needs to be updated to provide the following C&I improvements:
    a. Add measures to facilitate savings quantification by EDCs;
    b. Clarify certain applications of the TRM for lighting and variable frequency drives;
    c. Add lighting products to Appendix C of the TRM;
    d. Clarify baselines and code issues where appropriate; and
    e. Clarify language in the TRM on requirements for C&I lighting projects for on-site data collection.
14) Updates need to be made to the *Audit Plan*'s Sampling and Uncertainty Protocol to clarify the following:
    a. Ratio estimation approach for EM&V inspections;
    b. Expected level of engineering rigor for EM&V inspections;
    c. The requirement of "frozen" ex-ante savings estimates in the realization rate calculations; and
    d. Stratification requirements by measure type.

7.1 Portfolio of Programs' Energy and Demand Savings Targets

As of the end of PY1 on May 31, 2010, the seven EDCs have saved over 278,700MWh and 22MW. These savings are attributable to over 38 EE&C programs implemented and evaluated in PY1. Of these PY1 verified savings, 74% of the MWh and 52% of MW savings were attributed to residential lighting programs, comprised primarily of CFL bulbs. The SWE team and the EDCs expect that the annual savings will only grow as additional programs are implemented, existing programs mature, and evaluation findings and best-practices are incorporated into program delivery. The following table provides a status update on each EDC's progress towards reaching their 2011 and 2013 savings targets. As shown in

[99] ADM, FirstEnergy's evaluator, noted that of the approximately forty sites evaluated for PY1 for all three FirstEnergy companies, the error bound was calculated to be <0.4. The PY1 evaluation data supports COV or error bound that is <0.5 for prescriptive lighting sites that comprised the entirety of the claimed savings for the C&I equipment programs.

this Table, the percent of the 2011 energy (kWh) savings target achieved by the end of PY1 ranges from 1.4% to 40%, and the percent of the 2013 energy (kWh) savings target achieved by the end of PY1 ranges from 0.5% to 13%.

Table 7-1: EDC Compliance Goal Progress as of the End of PY1[100] - Summary

	Allegheny	Duquesne	Met-Ed	Penelec	PennPower	PECO	PPL
% of 2011 Energy Savings Target Achieved	1.4%	19.0%	8.2%	8.9%	11.7%	40.0%	22.0%
% of 2013 Energy Savings Target Achieved	0.5%	6.0%	2.7%	3.0%	3.9%	13.0%	7.0%
% of 2013 Demand Reduction Target	0.3%	1.0%	1.0%	1.1%	0.9%	3.0%	2.0%

The percent of the 2013 electric demand (kW) savings target achieved by the end of PY1 ranges from 0.3% to 3%.

7.2 Cost-Effectiveness of Portfolios

For PY1, the SWE team waived the reporting requirements for the TRC cost-effectiveness test due to pending TWG discussions about the methodology and assumptions to use for calculating the TRC ratio. The PA PUC and the SWE team plan to convene one or more meetings of the TWG during the fall of 2010 and the winter of 2010/2011 to discuss and resolve all of these methodological and assumptions issues relating to the calculation of the TRC test. During early October 2010, the SWE team requested, via email, that all EDCs provide a list of the TRC-related issues they would like to discuss and resolve during the upcoming TWG meetings. Many of the EDCs have already provided responses to the SWE team. Section 6.6 of this Annual Report provides a list of the TRC issues that the EDCs have requested to be addressed in future meetings of a TRC Working Group.

7.3 Statewide Evaluator Recommendations

As noted in the Executive Summary, the SWE team sent a draft version of this report to the EDCs and emphasized that it was a draft report, and that comments and suggestions from the PA PUC Commissioners and staff, the EDCs and their evaluation contractors, the Energy Association and other interested parties were welcome. The SWE team, the PA PUC staff, the EDCs and the EDC evaluation contractors have worked hard to develop a solid foundation for the EM&V of the Act 129 energy efficiency and demand response programs. The SWE team anticipates that improvements will continue to be made to the Statewide Evaluation audit processes and appreciates the support and responsiveness of the EDCs and their evaluation contractors. The SWE team notes that the EDCs and their evaluation contractors have reviewed the recommendations that are listed below and have provided comments on these recommendations.

Based on the findings from the SWE audit activities, the SWE team makes the following recommendations to the PA PUC relating to the Act 129 energy efficiency and demand response programs:

[100] Percentage of compliance target achieved calculated using verified Cumulative Program/Portfolio Inception to Date values (or Preliminary verified value, if not available) divided by compliance target value.

7.3.1 Residential Sector Recommendations:

- The SWE team carefully reviewed each EDC's calculations of kWh and kW savings for their residential lighting program. Very few discrepancies were found during this review, and the differences uncovered amount to less than a 1% savings difference associated with the particular lighting program. Based on these findings, the SWE team does not recommend revisions to the reported PY1 verified savings for residential lighting programs; however, the Team recommends that each EDC take actions to ensure that errors identified during the review do not reoccur in subsequent program years.
- The SWE team has several contractual obligations, including reviewing the TRM information and savings values and developing recommendations for possible revisions and additions. The deemed savings estimates in the TRM for removal of residential refrigerators, freezers and room air conditioners should be updated to reflect the actual mix and age of appliances removed in PY1, and to reflect more recent impact evaluation data and studies that are now available. The SWE team recommends updating the deemed kWh savings estimate in the TRM for these appliances to reflect the actual mix and age of appliances removed in the EDC appliance recycling programs during PY1, and to reflect the latest ENERGY STAR calculator estimates of savings by model type, age and size.
- The TRM should have an additional measure for appliances (refrigerator, freezer or room air conditioner) that are removed and replaced with a new ENERGY STAR model. The SWE team found that over 30% of program participants in the refrigerator/freezer component of the recycling program planned on replacing the removed appliance with a new appliance. In such cases the annual kWh savings will be significantly lower.
- The deemed hours of use for residential CFLs listed in the TRM should be updated to reflect more comprehensive and accurate hours of use data gathered from existing studies or with light logger equipment.
- The PA PUC should consider providing guidance to EDCs restricting the installation of CFL bulbs through low-income direct installation programs in sockets with very low hours of use.
- The PA PUC should consider limiting the number of CFL bulbs that can be installed in a home through a "direct install" program. This will eliminate the issue of a contractor installing 37 CFLs in a single home.
- Either the EDCs as a group or the PA PUC should conduct a comprehensive study of the hours of use and installation rates of CFLs for the Act 129 residential lighting programs. The study should be as comprehensive as recent studies in other states.
- Either the EDCs as a group or the PA PUC should conduct a comprehensive study and impact evaluation of the savings from appliance removal and appliance replacement programs. The SWE team has found that kWh and kW savings data per unit removed vary considerably from state to state.
- Going forward, the baseline for CFL lighting should be revised to adjust for the impact of more efficient incandescent lighting starting in the year 2012. This baseline adjustment should be included in the next revision of the TRM, and should become effective according to the time schedule provided in the December 2007 Federal Energy Independence and Security Act (EISA).

7.3.2 Commercial and Industrial Sectors

- EDCs must develop QA/QC procedures for verification of baseline energy efficiency conditions for measures installed in C&I facilities.
- EDCs must ensure that the EDC evaluators are familiar with the requirements of the TRM and CMPs when the site verification of savings is conducted at C&I facilities. The EDCs have requested an improved process for timely and efficient review and approval of CMPs. After consultation with the CEEP Bureau staff and the EDCs, the SWE team issued guidelines for a streamlined CMP review process on November 24, 2010.
- Claimed savings should not be based on planning estimates for the purposes of calculating Realization Rates. Claimed savings (Gross Impact) should be based on the application of an approved protocol or on a protocol "in development" in the case of "Unverified Ex-Post Savings."
- EDCs must provide the SWE a "frozen database" of the population and savings which are part of the Gross Impacts reported by programs prior to sampling by the EDC evaluator for the purpose of verifying savings. Many EDCs provided databases to the SWE which did not initially correspond to the numbers reported in their Annual Reports.
- EM&V sampling should be conducted at the program level using the selected confidence and precisions levels from the *Audit Plan*. Stratification by savings weights and measure type should be applied. Stratification by sector type (e.g., Small C&I and Large C&I) is also recommended to ensure homogeneity of the population and the sample pool.
- Government and low-income sectors have individual targets and should not be combined with other sectors for realization rate calculations, determination of sample sizes, and sampling.

List of Acronyms

AC: Air Conditioner

ASHRAE: American Society of Heating, Refrigerating, and Air-Conditioning Engineers

BLS: Bureau of Labor Statistics

BRO: Base Residual Options

BSC:

CAP:

CFL: Compact Fluorescent Light

CI: Commercial and Industrial

C&I: Commercial and Industrial

CIPCE: Commercial and Industrial Performance Contracting/Equipment (A FirstEnergy C&I Program)

CMP: Custom Measure Protocol

CND: Cannot Determine

COV: Coefficient of Variance

CPIDT: Cumulative Program Inception to Date

CSP: Conservation Service Provider

CVR: Conservation Voltage Reduction

DR: Demand Response

DSA: Deemed Savings Adjustment

EE: Energy Efficiency

EE&C: Energy Efficiency and Conservation

EEMIS: Energy Efficiency Management Information System

EFLH: Equivalent Full Load Hour

EISA: Energy Independence and Security Act

EMS: Energy Management Systm

EM&V: Evaluation, Measurement and Verification

GNPLE: Governmental/Non Profit Lighting Efficiency

GSHP: Ground Source Heat Pump

G/S/NP: Government, School, Non-Profit

HE: High Efficiency

HVAC: Heating, Ventilating, and Air-Conditioning

IPMVP: International Performance Measurement and Verification Protocol

ISR: In-Service Rate

IT: Information Technology

kW: Kilowatt

kWh: Kilowatt-Hour

LED: Light Emitting Diode

LEEP: Low-Income Energy Efficiency Program

LIURP: Low-Income Usage Reduction Program

MD: Motors and Drives

M&V: Measurement and Verification

MW: Megawatt

MWh: Megawatt-hour

NAPEE: National Action Plan for Energy Efficiency

NEEP: Northeast Energy Efficiency Partnerships

NSLB: Non-Standard Lighting for Business (A FirstEnergy C&I Program)

NTG: Net-to-Gross

PCT: Programmable Controllable Thermostat

PV: Photovoltaic

PY1: Program Year 1 (June 1, 2009 – May 31, 2010)

PY2: Program Year 2 (June 1, 2010 – May 31, 2011)

PY3: Program Year 3 (June 1, 2011 – May 31, 2012)

PY4: Program Year 4 (June 1, 2012 – May 31, 2013)

PYTD: Program-Year-to-Date

QA/QC: Quality Assurance/Quality Control

REEP: Residential Efficient Equipment Program

RFP: Request for Proposal

RH: Residential Heat

SEER: Seasonal Energy Efficiency Ratio

SLB: Standard Lighting for Business (A FirstEnergy C&I Program)

SWE: Statewide Evaluator

TOU: Time of Use

TRC: Total Resource Cost

TRM: Technical Reference Manual

TWG: Technical Working Group

VFD: Variable Frequency Drive

VOI: Value of Information

WH: Water Heater

Glossary of Terms[101]

– A –

Avoided Cost: In the context of energy efficiency, these are the costs that are avoided by the implementation of an energy efficiency measure, program, or practice. Such costs are used in benefit-cost analyses of energy efficiency measures and programs. Because efficiency activity reduces the need for electric generation, these costs include those associated with the cost of electric generation, transmission, distribution, and reliability. Typically, costs associated with avoided energy and capacity are calculated. Other costs avoided by the efficiency activity can also be included, among them the value of avoided emissions not already embedded in the generation cost, impact of the demand reduction on the overall market price for electricity, avoided fuel or water, etc. For natural gas efficiency programs, avoided costs include components of the production, transportation, storage, and service that are variable to the amount of natural gas delivered to customers.

– B –

Baseline: Conditions, including energy consumption and related emissions, that would have occurred without implementation of the subject measure or project. Baseline conditions are sometimes referred to as "business-as-usual" conditions and are used to calculate program related efficiency or emissions savings. Baselines can be defined as either project-specific baselines or performance standard baselines (e.g., building codes).

Baseline Data: The period of time selected as representative of the operations of the area of focus before the energy efficiency activity takes place.

Benefit-Cost (B/C) Ratio: The mathematical relationship between the benefits and costs associated with the implementation of energy efficiency measures, programs, practices, or emissions reductions. The benefits and costs are typically expressed in dollars. The B/C ratio is the ratio of the discounted total benefits of the program to the discounted total costs over the expected useful life of the energy efficiency measure. The B/C gives an indication of the rate of return of this program to the utility and its ratepayers. A B/C ratio above one indicates that the program is beneficial to the utility and its ratepayers on a total resource cost basis. The explicit formulae for use in Pennsylvania are set forth in the Appendix to the TRC Order.[102] Also see *Benefit-Cost Test*.

Benefit-Cost Test: Also called *Cost-Effectiveness Test*. The methodology used to compare the benefits of an investment with the costs. For programs evaluated under Act 129, the Total Resource Cost Test is the required benefit-cost test as issued in the *Implementation of Act 129 of 2009 – Total Resource Cost Test (TRC) Order* (Docket No. M-2009-2108601).

[101] Definitions are provided as guidance and if in conflict with Commission orders or directives, Commission orders or directives prevail.

[102] *Implementation of Act 129 of 2009 – Total Resource Cost Test (TRC) Order*. Docket No. M-2009-2108601. Issued June 18, 2009 by the Pennsylvania Public Utility Commission.

Bias: The extent to which a measurement or sampling or analytic method systematically underestimates or overestimates a value. Some examples of types of bias include engineering model bias; meter bias; sensor bias; inadequate or inappropriate estimate of what would have happened absent a program or measure installation; a sample that is unrepresentative of a population; and selection of other variables in an analysis that are too correlated with the savings variable (or each other) in explaining the dependent variable (such as consumption).

– C –

Coefficient of Variation (CV): The mean (average) of a sample, divided by its standard error.

Coincident Demand: The demand of a device, circuit, or building that occurs a the same time as the peak demand of a utility's system load or at the same time as some other peak of interest, such as a building or facility peak demand. The peak or interest should be specified (e.g., "demand coincident with the utility system peak").

Coincidence Factor: The ratio, expressed as a numerical value or as a percentage, of the simultaneous maximum demand within a specified period of a group of electrical appliances or consumers within a specified period, to the sum of their individual maximum demands within the same period.

Confidence: An indication of how close, expressed as a probability, the true value of the quantity in question is within a specified distance to the estimate of the value. Confidence is the likelihood that the evaluation has captured the true value of a variable within a certain estimated range. Also see *Precision*.

Correlation: For a set of observations, such as for participants in an energy efficiency program, the extent to which high values for one variable are associated with high values of another variable for the same participant. For example, facility size and energy consumption usually have a high positive correlation.

Cost-Benefit and Cost-Effectiveness Analysis: Analysis that compares the benefits associated with a program or measure's outputs or outcomes with the costs (resources expended) to produce them. Cost-benefit analysis is typically conducted to determine the relationship of the program's benefits and costs, as a ratio, once the decision has been made to implement or design the program; programs with benefit-cost ratios greater than 1.0 provide overall ratepayer benefits. Cost-effectiveness analysis is generally undertaken to compare one program or program approach to other approaches, or options for the use of funds, to determine the relationship among the options. The terms are often interchanged in evaluation discussions.

Cost-Effectiveness: An indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice. In the energy efficiency field, the present value of the estimated benefits produced by an energy efficiency program is compared to the estimated total costs to determine if the proposed investment or measure is desirable from a variety of perspectives (e.g. whether the estimated benefits exceed the estimated costs from a societal perspective).

Cost-Effectiveness Test: See Benefit-Cost Test.

Cumulative Energy Savings: The summation of energy savings from multiple projects or programs over a specified period of time, incorporating the multi-year energy savings that each project or program produces.

Cumulative to Date: Beginning June 1, 2009 through the end of the current quarter (i.e., August 31, November 30, February 28/29, May 31).

Custom Program: An energy efficiency program intended to provide efficiency solutions to unique situations not amenable to common or prescriptive solutions. Each custom project is examined for its individual characteristics, savings opportunities, efficiency solutions, and often, customer incentives. Under Act 129, these programs fall outside of the jurisdiction of the Pennsylvania Technical Resource Manual and thus the Measurement and Verification protocols for each should be approved by the Statewide Evaluation Team.

– D –

Deemed Savings: An estimate of energy or demand savings for a single unit of an installed energy efficiency measure that (a) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose and (b) is applicable to the situation being evaluated. Individual parameters or calculation methods can also be deemed. Deemed savings for measures implemented under Act 129 are stipulated in the Pennsylvania Technical Resource Manual, which undergoes an annual review and update process, and the Interim TRM Measures, which are subject to interim approval by the Statewide Evaluation Team.

Defensibility: The ability of evaluation results to stand up to scientific scrutiny. Defensibility is based on assessments by experts of the evaluation's validity, reliability, and accuracy. Under Act 129, it is the role of the Statewide Evaluator to determine the defensibility of the verified savings estimates reported by each of the Electric Distribution Companies.

Delta Watts: The difference in the wattage between existing or baseline equipment and its more efficient replacement or installation at a specific time, expressed in watts or kilowatts.

Demand: The time rate of energy flow. Demand usually refers to the amount of electric energy used by a customer or piece of equipment at a specific time, expressed in kilowatts (kW - equals kWh/h) but can also refer to natural gas usage at a point in time, usually as Btu/hr, kBtu/hr, therms/day or ccf/day.

Demand Reduction: See *Demand Savings*.

Demand Response (DR): The reduction of customer energy usage at times of peak usage in order to help system reliability, to reflect market conditions and pricing, or to support infrastructure optimization or deferral of additional infrastructure. Demand response programs may include contractually obligated or voluntary curtailment, direct load control, and pricing strategies.

Demand Savings: The reduction in electric or gas demand from the baseline to the demand associated with the higher efficiency equipment or installation. This term is usually applied to billing demand to calculate cost savings or to peak demand for equipment sizing purposes.

Demand Side Management (DSM): Strategies used to manage energy demand including energy efficiency, load management, fuel substitution and load building.

– E –

Effective useful life (EUL): An estimate of the median number of years that efficiency measures installed under a program are still in place and operable. For measures implemented under Act 129, it is required that the EUL or 15 years, whichever is less, be used to determine measure assessments.

Electric Distribution Company (EDC): In reference to Act 129, one of the seven EDCs with at least 100,000 customers required to adopt a plan to reduce energy and demand consumption within its service territory in accordance with 66 Pa. C.S. § 2608. The seven EDCs include: Allegheny Power, Duquesne Light, Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, PECO Energy Company, and PPL Electric Utilities.

Electric Distribution Company Evaluation Costs: Expenses incurred by the EDC pertaining to evaluation, measurement and verification activities. This includes such expenses as: contractors, metering equipment, evaluation software, etc.

Electric Distribution Company Implementation Costs: Expenses incurred by the EDC pertaining to the implementation of Act 129 programs approved in their respective Energy Efficiency and Conservation (EE&C) Plans. This includes such expenses as: payments to CSPs, marketing expenses, etc.

Electric Distribution Company Incentive Costs: Payments paid by the EDC to a customer participating in an Energy Efficiency and Conservation (EE&C) Program approved by the Commission. This may include rebates for the purchase of energy efficiency qualifying equipment, cash payments for recycling secondary appliances, etc.

Energy Conservation: Term used to reflect doing with less of a service in order to save energy. The term is often unintentionally used instead of energy efficiency.

Energy Efficiency: The use of less energy to provide the same or an improved level of service to the energy consumer; or the use of less energy to perform the same function.

Energy Efficiency Measure: An installed piece of equipment or system, or modification of equipment, systems, or operations on end-use customer facilities that reduce the total amount of electrical or gas energy and capacity that would otherwise have been needed to deliver an equivalent or improved level of end-use service.

Energy Savings: Reduction in electricity use (kWh) or in fossil fuel use in thermal unit(s).

Estimated for Projects in Progress: Estimate of reported gross energy and demand savings for energy efficiency and demand response projects currently being installed, but not yet complete at time of the report.

Evaluation: The conduct of any of a wide range of assessment studies and other activities aimed at determining the effects of a program, understanding or documenting program performance, program or program-related markets and market operations, program-induced changes in energy efficiency markets, levels of demand or energy savings, or program cost-effectiveness. Market assessment, monitoring and evaluation (M&E), and measurement and verification (M&V) are aspects of evaluation.

Ex-Ante Savings Estimate: Forecasted savings used for program and portfolio planning purposes.

Ex-Post Savings Estimate: Savings estimate reported by an evaluator after the energy impact evaluation has been completed.

– F –

Free Driver: A program non-participant who has adopted a particular efficiency measure or practice as a result of the evaluated program. Also see Spillover.

Free Rider: A program participant who would have implemented the program measure or practice in the absence of the program. Free riders can be 1) total, in which the participant's activity would have completely replicated the program measure; 2) partial, in which the participant's activity would have partially replicated the program measure; or 3) deferred, in which the participant's activity would have completely replicated the program measure, but at a future time than the program's timeframe.

Free Ridership Rate: The percent of savings attributable to free riders.

– G –

Gross Impact: See *Gross Savings*.

Gross Savings: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated.

Gross kW: Expected demand reduction based on a comparison of standard or replaced equipment, and equipment installed through an energy efficiency program.

Gross kWh: Expected kWh reduction based on a comparison of standard or replaced equipment, and equipment installed through an energy efficiency program.

– H –

– I –

Impact Evaluation: An evaluation of the program-specific directly induced quantitative changes (e.g. kWh, kW, and therms) attributable to an energy efficiency program.

Incremental Cost: The difference between the cost of existing or baseline equipment or service and the cost of alternative energy efficient equipment or service.

Incremental Energy Savings: The difference between the amount of energy savings acquired in a project or a program in one period and the amount of energy savings acquired by that project or program in a prior period.

Incremental Quarterly Participants: The difference between the number of program participants acquired in a program in one period and the number of participants acquired by that program in a prior period.

Incremental Quarterly Reported Gross Impact: The difference between the amount of reported gross impact of a program in one period and the amount of reported gross impact of that program in a prior period.

– J –

– K –

Kilowatt (kW): A measure of the rate of power used during a preset time period (e.g. minutes, hours, days or months) equal to 1,000 watts. In the abbreviation, the W is capitalized because the unit was named to honor one of Scotland's great inventors, James Watt, who coined the term "horsepower".

Kilowatt-Hour (kWh): A common unit of electric energy; one kilowatt-hour is numerically equal to 1,000 watts used for one hour.

– L –

Lifetime kW: The expected demand savings over the lifetime of an installed measure, calculated by multiplying the annual peak kW reduction associated with a measure by the expected lifetime of that measure. It is expressed in units of kW-years.

Lifetime MWh: The expected electrical energy savings over the lifetime of an installed measure, calculated by multiplying the annual MWh reduction associated with a measure by the expected lifetime of that measure.

Lifetime Supply Costs: The net present value of avoided supply costs associated with savings net of changes in energy use that would have happened in the absence of the program over the life of the energy efficiency measure factoring in persistence of savings. Avoided supply costs include: reduction in transmission, distribution, generation, and capacity costs valued at marginal cost for the periods when there is a consumption reduction.[103]

[103] *Implementation of Act 129 of 2009 – Total Resource Cost Test (TRC) Order*. Docket No. M-2009-2108601. Issued June 18, 2009 by the Pennsylvania Public Utility Commission.

Load Factor: A percentage indicating the difference between the amount of electricity or natural gas a consumer used during a given time span and the amount that would have been used if the usage had stayed at the consumer's highest demand level during the whole time. The term also is used to mean the percentage of capacity of an energy facility, such as a power plant or gas pipeline that is utilized in a given period of time.

Load Management: Steps taken to reduce power demand at peak load times or to shift some of it to off-peak times. Load management may coincide with peak hours, peak days or peak seasons. Load management may be pursued by persuading consumers to modify behavior or by using equipment that regulates some electric consumption. This may lead to complete elimination of electric use during the period of interest (load shedding) and/or to an increase in electric demand in the off-peak hours as a result of shifting electric usage to that period (load shifting).

– M –

Market Assessment: An analysis that provides an assessment of how and how well a specific market or market segment is functioning with respect to the definition of well-functioning markets or with respect to other specific policy objectives. Generally includes a characterization or description of the specific market or market segments, including a description of the types and number of buyers and sellers in the market, the key factors that influence the market, the type and number of transactions that occur on an annual basis, and the extent to which market participants consider energy efficiency as an important part of these transactions. This analysis may also include an assessment of whether a market has been sufficiently transformed to justify a reduction or elimination of specific program interventions. Market assessment can be blended with strategic planning analysis to produce recommended program designs or budgets. One particular kind of market assessment effort is a baseline study, or the characterization of a market before the commencement of a specific intervention in the market, for the purpose of guiding the intervention and/or assessing its effectiveness later.

Measurement and Verification (M&V): A subset of program impact evaluation that is associated with the documentation of energy savings at individual sites or projects using one or more methods that can involve measurements, engineering calculations, statistical analyses, and/or computer simulation modeling.

Measurement Error: In the evaluation context, a reflection of the extent to which the observations conducted in the study deviate from the true value of the variable being observed. The error can be random (equal around the mean) or systematic (indicating bias).

Megawatt (MW): A unit for measuring electricity equal to 1,000 kilowatts or one million watts. Utility companies, power generating plants and very large users of electricity are the primary users of the term.

Megawatt-Hour (MWh): A unit of electric energy; a Megawatt-hour is numerically equal to 1,000,000 watts used for one hour.

Metered Data: Data collected over time through a meter for a specific end use, energy-using system (e.g. lighting and HVAC), or location (e.g. floors of a building or a whole premise). Metered data may be collected over a variety of time intervals. Usually refers to electricity or gas data.

Metering: The collection of energy consumption data over time through the use of meters. These meters may collect information about an end-use, a circuit, a piece of equipment, or a whole building (or facility). Short-term metering generally refers to data collection for no more than a few weeks. End-use metering refers specifically to separate data collection for one or more end-uses in a facility, such as lighting, air conditioning or refrigeration. Spot metering is an instantaneous measurement (rather than over time) to determine equipment size or power draw.

Monitoring: The collection of relevant measurement data over time at a facility, including but not limited to energy consumption or emissions data (e.g. energy and water consumption, temperature, humidity, volume of emissions, hours of operation, etc.), for the purpose of savings analysis or to evaluate equipment or system performance.

– N –

Net Impact: See *Net Savings*.

Net Present Value: The NPV is the discounted value of the net benefits of this test over a specified period of time, i.e., the expected useful life of the energy efficiency measure. The NPV is a measure of the change in the total resource costs due to the program. An NPV above zero indicates that the program is a less expensive resource than the supply option upon which the marginal costs are based.[104]

Net Savings: The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of free drivers, free riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand.

Net-to-Gross Ratio (NTGR): A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts. The factor itself may be made up of a variety of factors that create differences between gross and net savings, commonly including free riders and spillover. Other adjustments may include a correction factor to account for errors within the project tracking data, breakage, and other factors that may be estimated which relate the gross savings to the net effect of the program. Can be applied separately to either energy or demand savings.

Non-Participant: Any consumer who was eligible but did not participate in the subject efficiency program in a given program year.

– O –

[104] *Implementation of Act 129 of 2009 – Total Resource Cost Test (TRC) Order*. Docket No. M-2009-2108601. Issued June 18, 2009 by the Pennsylvania Public Utility Commission.

Off-Peak Energy kWh Savings: The kWh reduction that occurs during a specified period of off-peak hours for energy savings. (e.g. Monday-Friday, 9 p.m. to 8 a.m. and all day on weekends and holidays).

On-Peak Energy kWh Savings: The kWh reduction that occurs during a specified period of on-peak hours for energy savings. (e.g. Monday-Friday, 8 a.m. to 9 p.m. and except holidays).

– P –

Participant: A utility customer partaking in an energy efficiency program.

Participant Costs: Costs incurred by a customer participating in an energy efficiency program. Typically these costs are represented as incremental costs, i.e., the costs incurred for the purchase, installation, and maintenance of energy efficiency equipment over standard or existing equipment.

Peak Demand: The maximum level of metered demand during a specified period, such as a billing month or a peak demand period.

Peak Load: The highest electrical demand within a particular period of time. Daily electric peaks on weekdays typically occur in late afternoon and early evening. Annual peaks typically occur on hot summer days.

Percent of Goal Anticipated: The reported gross savings anticipated as a percent of the 2011 or 2013 savings targets established per Act 129.

Portfolio: (a) A collection of similar programs addressing the same market (e.g. a portfolio of residential programs), technology (e.g. motor efficiency programs), or mechanisms (e.g. loan programs). (b) The set of all programs conducted by one or more organizations, such as a program administrator (and which could include programs that cover multiple markets, technologies, etc.).

Precision: The indication of the closeness of agreement among repeated measurements of the same physical quantity. It is also used to represent the degree to which an estimated result in social science (e.g. energy savings) would be replicated with repeated studies.

Preliminary Program Year to Date Net Impact: Net impacts reported in quarterly reports. These net impacts are preliminary in that they are based upon preliminary Realization Rates.

Preliminary Program Year to Date Verified Impact: Verified impacts reported in quarterly reports. These verified impacts are preliminary in that they are based upon preliminary Realization Rates.

Preliminary Realization Rate: Realization rates reported in quarter reports based upon the results of measurement and verification activities conducted on the sample to date. These results are preliminary because the sample to date is likely to have not met the required levels of confidence and precision.

Prescriptive Program: An energy efficiency program focused on measures that are one-for-one replacements of the existing equipment and for which fixed customer incentives can be developed based on the anticipated similar savings that will accrue from their installation.

Process Evaluation: A systematic assessment of an energy efficiency program for the purposes of documenting program operations at the time of the examination and identifying and recommending improvements to increase the program's efficiency or effectiveness for acquiring energy resources, while maintaining high levels of participant satisfaction.

Program Administrator (PA): Those entities that oversee public benefit funds in the implementation of energy efficiency programs. This generally includes regulated utilities, other organizations chosen to implement such programs, and state energy offices.

Program Year Energy Savings Target: Energy target established for the given program year as approved in the EDC Energy Efficiency and Conservation (EE&C) Plan.

Program Year Sample Participant Target: Estimated sample size for evaluation activities in the given program year.

Program Incentive: An incentive, generally monetary, that is offered to a customer through an energy efficiency program to encourage the customer to participate in the program. The incentive is intended to overcome one or more barriers that keep the customer from taking the energy efficiency activity on his own.

Program Participant: A consumer that received a service offered through an efficiency program in a given program year. The term "service" can be one or more of a wide variety of services, including financial rebates, technical assistance, product installations, training, energy efficiency information or other services, items, or conditions.

Program Year to Date (PYTD): Beginning June 1 of the current program year through the end of the current quarter (i.e., August 31, November 30, February 28/29, May 31).

Program Year to Date Net Impact: The total change in load that is attributable to an energy efficiency program from June 1 of the current program year through the end of the current quarter.

Program Year to Date Participants: The number of utility customers partaking in an energy efficiency program beginning June 1 of the current program year through the end of the current quarter.

Program Year to Date Reported Gross Impact: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated beginning June 1 of the current program year through the end of the current quarter.

Program Year to Date Sample Participants: Total participants sample beginning June 1 of the current program year through the end of the current quarter.

Program Year to Date Total Anticipated: The estimated gross impacts, including reported impacts and estimated impacts, beginning June 1 of the current program year through the end of the current quarter.

Project: An activity or course of action involving one or multiple energy efficiency measures, at a single facility or site.

– Q –

– R –

Realization Rate: The term is used in several contexts in the development of reported program savings. The primary applications include the ratio of project tracking system savings data (e.g. initial estimates of project savings) to savings 1) adjusted for data errors and 2) that incorporate evaluated or verified results of the tracked savings.

Rebate Program: An energy efficiency program in which the program administrator offers a financial incentive for the installation of energy-efficient equipment.

Rebound Effect: Also called Snap Back. A change in energy-using behavior that yields an increased level of service that is accompanied by an increase in energy use and occurs as a result of taking an energy efficiency action. The result of this effect is that the savings associated with the direct energy efficiency action is reduced by the resulting behavioral change.

Regression Analysis: Analysis of the relationship between a dependent variable (response variable) to specified independent variables (explanatory variables). The mathematical model of their relationship is the regression equation.

Regression Model: A mathematical model based on statistical analysis where the dependent variable is quantified based on its relationship to the independent variables which are said to determine its value. In so doing, the relationship between the variables is estimated statistically from the data used.

Reliability: The quality of a measurement process that would produce similar results on: (1) repeated observations of the same condition or event; or (2) multiple observations of the same condition or event by different observers.

Renewable Energy: Energy derived from resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include: biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

Reporting Period: The time following implementation of an energy efficiency activity during which results are to be determined.

Representative Sample: A sample that has approximately the same distribution of characteristics as the population from which it was drawn.

Rigor: The level of effort expended to minimize uncertainty due to factors such as sampling error and bias. The higher the level of rigor, the more confident one is that the results of the evaluation are both accurate and precise.

– S –

Sample: In program evaluation, a portion of the population selected to represent the whole. Differing evaluation approaches rely on simple or stratified (based on some characteristic of the population) samples.

Sample Design: The approach used to select the sample units.

Sampling Error: The error in estimating a parameter caused by the fact that in the sample at hand all the disturbances are not zero.

Simple Random Sample: A method for drawing a sample from a population such that all samples of a given size have equal probability of being drawn.

Snap Back: See Rebound Effect.

Simulation Model: An assembly of algorithms that calculates energy use based on engineering equations and user-defined parameters.

Spillover: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program. There can be participant and/or non-participant spillover. Participant spillover is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy saving practices after having participated in the efficiency program as a result of the program's influence. Non-participant spillover refers to energy savings that occur when a program non-participant installs energy efficiency measures or applies energy savings practices as a result as a result of a program's influence.

Spillover Rate: Estimate of energy savings attributable to spillover effects expressed as a percent of savings installed by participants through an energy efficiency program.

Standard Error: a measure of the variability in a data sample, how far a "typical" data point is from the mean of a sample. In a large sample, about 2/3 of observations lie within one standard error of the mean, and 95 percent of observations lie within two standard errors.

Statistically Adjusted Engineering (SAE) Models: A category of statistical analysis models that incorporates the engineering estimate of savings as a dependent variable. The regression coefficient in these models is the percentage of the engineering estimate of savings observed in changes in energy usage. For example, if the coefficient on the SAE term is 0.8, this means that the customers are on average realizing 80% of the savings from their engineering estimates.

Stipulated Values: See Deemed Savings.

Stratified Random Sampling: The population is divided into X units of subpopulations, called strata, that are non-overlapping and together comprise the entire population. A simple random sample is taken of each strata to create a sample based upon stratified random sampling.

Stratified Ratio Estimation: A sampling method that combines a stratified sample design with a ratio estimator to reduce the coefficient of variation by using the correlation of a known measure for the unit (e.g. expected energy savings) to stratify the population and allocate sample from strata for optimal sampling.

– T –

Takeback Effect: See Rebound Effect.

Total Resource Cost Test (TRC): A cost-effectiveness test that measures the net direct economic impact to the utility service territory, state, or region. The *Implementation of Act 129 of 2009 - Total Resource Cost Test (TRC) Order* issued on June 18, 2009 under Docket No. M-2009-2108601, details the method and assumptions to be used when calculated the TRC Test for Energy Efficiency and Conservation Portfolios implemented under Act 129. The results of the TRC test are to be expressed as both a net present value (NPV) and a benefit-cost ratio (B/C ratio). [105]

Total Resource Cost Test Benefits: Benefits calculated in the TRC test will include the avoided supply costs, such as the reduction in transmission, distribution, generation, and capacity costs valued at marginal cost for the periods when there is a consumption reduction. The PA TRC benefits will look at avoided supply costs such as the reduction in forecasted zonal wholesale electric generation prices, ancillary services, losses, generation capacity, transmission capacity, and distribution capacity. The avoided supply costs will be calculated using net program savings, savings net of changes in energy use that would have happened in the absence of the program. The persistence of savings over time will also be considered in the net savings. [106]

Total Resource Cost Test Costs: The costs calculated in the TRC test will include the costs of the various programs paid by an EDC (or a default service provider (DSP)) and the participating customers, and would reflect any net change in supply costs for the periods in which consumption is increased in the event of load shifting. Note that the TRC test should utilize the incremental costs of services and equipment. Thus, for example, equipment, installation, operation, and maintenance costs, cost of removal (less salvage value), and administrative costs, regardless of who pays for them, would be included.[107]

– U –

Uncertainty: The range or interval of doubt surrounding a measured or calculated value within which the true value is expected to fall with some degree of confidence.

[105] *Implementation of Act 129 of 2009 – Total Resource Cost Test (TRC) Order*. Docket No. M-2009-2108601. Issued June 18, 2009 by the Pennsylvania Public Utility Commission.
[106] *Ibid*.
[107] *Ibid*.

Upstream Program: A program that provides information and/or financial assistance to entities in the delivery chain of high-efficiency products at the retail, wholesale, or manufacturing level. Such a program is intended to yield lower retail prices for the products.

– V –

Verification: An independent assessment of the reliability (considering completeness and accuracy) of claimed energy savings or an emissions source inventory.

Verified Gross Impact: Calculated by applying the realization rate to reported gross impacts.

– W –

Watt: A unit of measure of electric power at a point in time, as capacity or demand. One watt of power maintained over time is equal to one joule per second. The watt is named after Scottish inventor James Watt and is capitalized when shortened to W and used with other abbreviations, as in kWh.

Watt-Hour: One watt of power expended for one hour. One thousandth of a kilowatt-hour.

Whole-Building Calibrated Simulation Approach: A savings measurement approach (defined in IPMVP Option D and ASHREA Guideline 14) that involves the use of an approved computer simulation program to develop a physical model of the building in order to determine energy and demand savings. The simulation program is used to model the energy used by the facility before and after the retrofit. The pre or post-retrofit models are developed by calibration with measured energy use and demand data and weather data.

Whole-Building Metered Approach: A savings measurement approach (defined in the IPMVP Option C and ASHRAE Guideline 14) that determines energy and demand savings through the use of whole-facility energy (end use) data, which may be measured by utility meters or data loggers. This approach may involve the use of monthly utility billing data or data gathered more frequently from a main meter.

– X –

– Y –

– Z –

Reference

Prepared by Paul Horowitz PAH Associations, facilitated by Northeast Energy Efficiency Partnership (NEEP). *Glossary of Terms Version 1.0*. A project of the Regional Evaluation, Measurement and Verification Forum; March 2009.