POST & SCHELL, P.C.
ATTORNEYS AT LAW

17 North Second Street
12th Floor
Harrisburg, PA 17101-1601
717-731-1970 Main
717-731-1985 Main Fax
www.postschell.com

Devin Ryan

dryan@postschell.com
717-612-6052 Direct
717-731-1985 Direct Fax
File #: 158814

November 14, 2014

VIA HAND DELIVERY

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

Re: Process Evaluation Report for Program Year Five of PPL Electric Utilities Corporation's Act 129 Plan - Docket No. M-2012-2334388

Dear Secretary Chiavetta:

Enclosed for filing on behalf of PPL Electric Utilities Corporation ("PPL Electric") is the Program Year 5 Process Evaluation Report of PPL Electric's Act 129 Plan. A copy of the Process Evaluation Report will also be provided to the Act 129 Statewide Evaluator. In addition, PPL Electric will post its Process Evaluation Report on its ePower website.

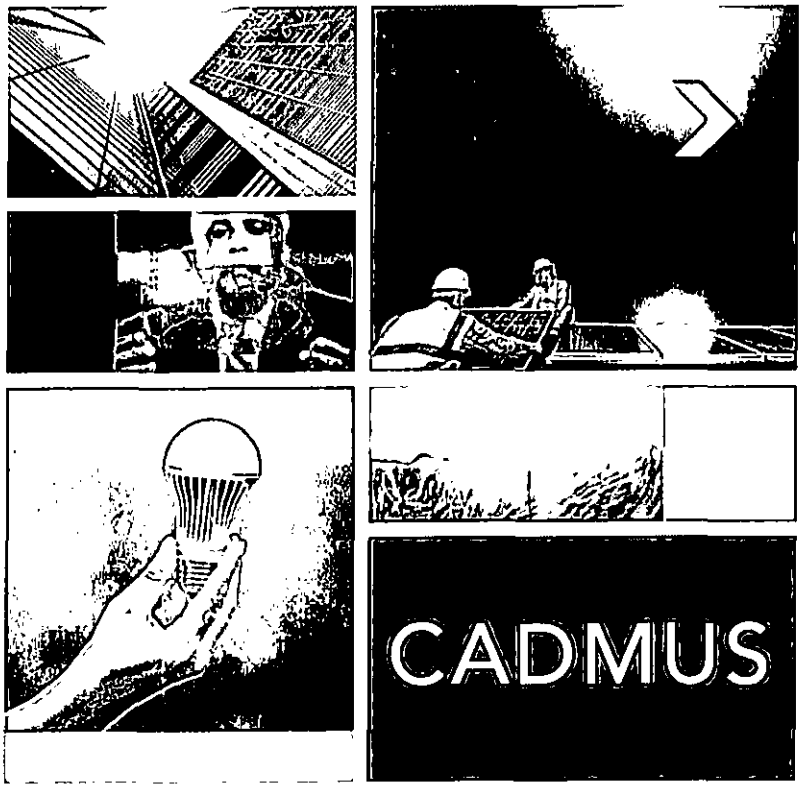
If you have any questions concerning this matter, please do not hesitate to contact me.

Respectfully submitted,

Devin Ryan

DTR/jl
Enclosure

cc: Richard F. Spellman (*GDS Associates, Inc., Act 129 Statewide Evaluator*)



Process Evaluation Report

PPL Electric

EE&C Plan, Program Year Five

November 13, 2014

Prepared for:
PPL Electric Utilities

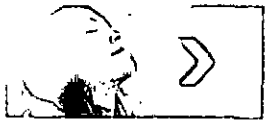
The Cadmus Group, Inc.
An Employee-Owned Company · www.cadmusgroup.com

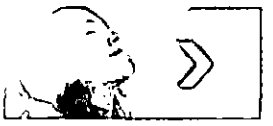
CADMUS [redacted]

Prepared by:
Anne West
Hope Lobkowicz
Kristie Rupper
and The Cadmus Team

Cadmus: Energy Services Division

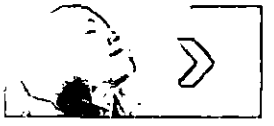
Table of Contents





Acronyms

Phase II Verified	Verified/ *Ex Post* Cumulative Program/Portfolio Phase II Inception to Date
Phase II Reported	Reported/ *Ex Ante* Cumulative Program/Portfolio Phase II Inception to Date
Phase II+CO	Cumulative Program/Portfolio Phase II Inception to Date including Carry Over Savings from Phase I
AMI	Advanced Metering Infrastructure
ASHP	Air Source Heat Pump
BPI	*Building Performance Institute*
C&I	Commercial and Industrial
CFL	Compact Fluorescent Lamp
CHP	Combined Heat and Power
CSP	Conservation Service Provider or Curtailment Service Provider
DHP	Ductless Heat Pump
DOE	U.S. Department of Energy
DR	Demand Response
EDC	Electric Distribution Company
EE&C	Energy Efficiency and Conservation
EISA	Energy Information and Security Act of 2007
EM&V	Evaluation, Measurement, and Verification
GNI	Government, Nonprofit, and Institutional
HERS	Home Energy Rating System
HPwES	Home Performance with ENERGY STAR
HPWH	Heat Pump Water Heater
HSPF	Heating Seasonal Performance Factor
HVAC	Heating, Ventilating, and Air Conditioning
ISR	In-Service Rate
KAM	Key Account Manager
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-Emitting Diode
LEEP	Low-Income Energy Efficiency Program (PECO)
LIEEP	Low Income Energy Efficiency Program (Duquesne Light)
LIURP	Low-Income Usage Reduction Program
M&V	Measurement and Verification
MW	Megawatt
MWh	Megawatt-hour
NEEM	Northwest Energy Efficient Manufactured
NTG	Net-to-Gross
PUC	Pennsylvania Public Utility Commission
PY5	Program Year 2013, from June 1, 2013, to May 31, 2014
PY6	Program Year 2014, from June 1, 2014, to May 31, 2015



PY7	Program Year 2015, from June 1, 2015, to May 31, 2016
PY8	Program Year 2016, from June 1, 2016, to May 31, 2017
PYX QX	Program Year X, Quarter X
PYTD	Program Year to Date
QA/QC	Quality Assurance/Quality Control
RAP	Resource Action Programs
RTS	Residential Thermal Storage
SEER	Seasonal Energy Efficiency Rating
SWE	Statewide Evaluator
TRC	Total Resource Cost
TRM	Technical Reference Manual
USP	Universal Services Program
VFD	Variable Frequency Drive
WRAP	Winter Relief Assistance Program

Introduction

Cadmus evaluated PPL Electric's portfolio of energy-efficiency programs, as described in its Phase II Energy Efficiency and Conservation (EE&C) Plan, in its fifth program year (PY5) under Pennsylvania Act 129. Phase II of Act 129 covers June 2013 through May 2016. PY5 covers June 2013 through May 2014. The findings from the impact evaluation for PY5, including savings by program, and the cost-effectiveness evaluation are publicly available in the document titled "*PY5 Final Annual Report*."

This report focuses on the process evaluation of PPL Electric's PY5 portfolio. It identifies opportunities and offers recommendations to improve the effectiveness of these components—design and implementation, enrollment processes, marketing and outreach, quality assurance, and other elements—for all of PPL Electric's energy-efficiency programs.

Process Evaluation Methodology

Process evaluation activities varied by program in PY5. The main activities that Cadmus conducted were:

- Participant and nonparticipant telephone surveys
- Program literature review and benchmarking
- Database and records review for quality assurance and quality control (QA/QC)
- Shelf-stocking study for residential lighting
- Stakeholder interviews
- Trade ally surveys and interviews
- Process map review

Table 1 lists the evaluation activities conducted for each program in PY5 (in alphabetical order by program name). A full description of the survey methodology is contained in **Appendix A** of this process evaluation report and the sample attrition is contained in **Appendix B** of this report.

Table 1. Process Evaluation Activities by Program

Program	Process Evaluation Activity						
	Participant Survey	Nonparticipant Survey	Benchmarking Research	QA/QC Review	Stakeholder Interview	Trade Ally Interview	Process Map Review
Appliance Recycling (ARP)	X	X	X	X	X	-	X
Custom Incentive	X	-	X	X	X	-	X
Energy Efficiency Behavior & Education	-	-	X	-	X	-	X
E-Power Wise	-	-	X	X	X	X	X

Program	Process Evaluation Activity						
	Participant Survey	Nonparticipant Survey	Benchmarking Research	QA/QC Review	Stakeholder Interview	Trade Ally Interview	Process Map Review
Low Income Energy Efficiency Behavior & Education	-	-	X	-	X	-	X
Master Metered Low-Income Multifamily Housing	X	-	X	X	X	-	X
Prescriptive Equipment	X	-	X	X	X	X	X
Residential Home Comfort	X	-	X	X	X		X
Residential Retail	X	X	X	X	X		X
School Benchmarking [2]	X	-	-	X	X	-	X
Student and Parent Education	X	-	X	X	X	-	X
WRAP	-	-	X	X	X	-	X
Continuous Energy Improvement[1]	-	-	-	-	-	-	-

[1] No evaluation activities completed for PY5 but an evaluation will be completed for PY6.

[2] Evaluation activities will be completed and reported in PY6.

Organization of this Report

This report includes findings across all programs in the portfolio-wide assessment. (Conclusions and recommendations are located in **Appendix A** of the impact report titled "*PY5 Annual Report.*") This section examines the portfolio's overall achievement and planned savings for each program. It also explores participant feedback, marketing and outreach, energy-efficiency attitudes and behaviors, and participant decision-making across programs.

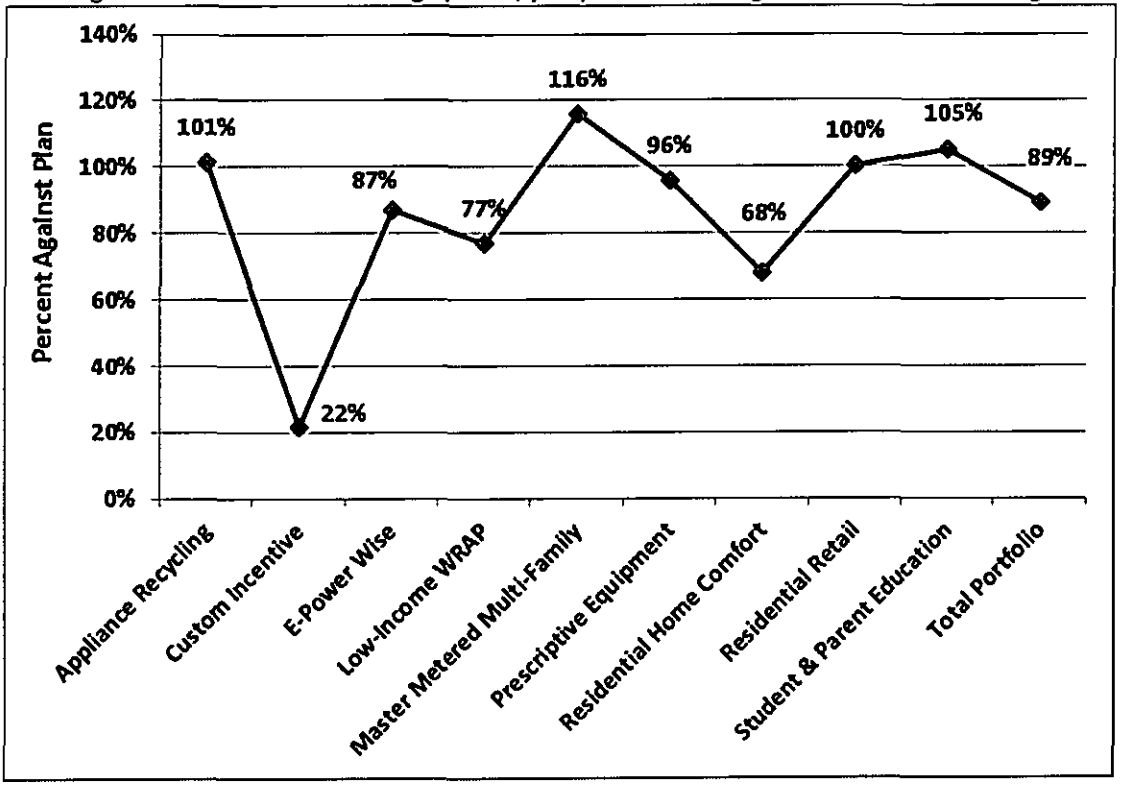
Each program is assessed in more detail in the individual chapters that follow the portfolio-wide assessment. Program chapters contain a summary of the program's achievements against planned savings and a summary of findings from the program-specific evaluation activities. Chapters are organized according to impact on the overall portfolio (contribution of energy savings), beginning with the largest program and ending with smallest.

Portfolio-Wide Assessment

In PY5, PPL Electric's portfolio of EE&C programs achieved 90% of its planned energy savings of 224,533 MWh/year, and it is well-positioned to reach its three-year Phase II compliance target of 821,702 MWh/year in 2016.[1]

Most programs achieved over 85% of their PY5 planned energy savings, with Appliance Recycling, Master Metered Low-Income Multifamily Housing, and Student and Parent Energy-Efficiency Education programs exceeding their planned savings (**Figure 1**). Three programs—Custom Incentive, Low-Income Winter Relief Assistance Program (WRAP), and Residential Home Comfort—achieved fewer savings than planned. In this report, Cadmus explores how PPL Electric can adjust program delivery where necessary to ensure that programs are able to ramp up to meet Phase II compliance targets. At the same time, we note that some programs have sufficient projects in the PY6 queue to meet targets, and others have already instituted changes to increase participation.

Figure 1. Verified Gross Savings (MWh/year) as a Percentage of Planned PY5 Savings



[1] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania PUC on April 7, 2014,

Portfolio-Wide Findings and Conclusions

This section presents the key results from Cadmus' process evaluation activities at a portfolio level for several components. The conclusions drawn from the process evaluation are displayed in bold blue text, followed by a discussion of the supporting findings. Recommendations identify opportunities for improving the specific processes and outcomes. Recommendations can be found in **Appendix A, Table A-1** of the impact report titled, "*PY5 Annual Report.*" The components discussed below reflect participant experience; energy-efficiency knowledge, actions, and purchasing patterns; marketing and outreach; willingness to pay for LEDs; and barriers to energy efficiency.

Marketing and Outreach

PPL Electric's flexible approach to program marketing is aligned with program plans to intentionally control the pace of each program. This approach seemed to work well for many programs, but others that achieved fewer savings than the planning targets may benefit from increased outreach and are examined on a case-by-case basis.

PPL Electric program staff reported limited marketing in PY5 for most programs, with the objective of balancing program momentum with the risk of oversubscription. For example, PPL Electric developed a flexible marketing plan for the Appliance Recycling Program in PY5 so that staff could adjust marketing based on the program's progress, scaling back advertising if participation was on track to surpass goals but redeploying it if participation dropped too sharply. This worked well for the program, which achieved 101% of its PY5 energy savings.

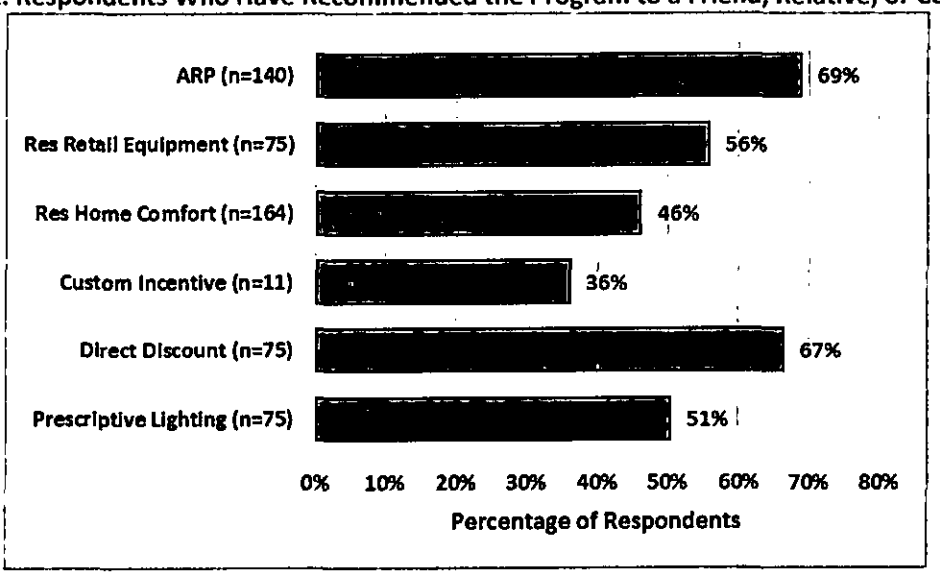
The Prescriptive Equipment, E-Power Wise, Residential Retail, and Residential Home Comfort programs conducted limited marketing. The Prescriptive Equipment and Residential Retail programs successfully met their planned savings for PY5, due mainly to each program's lighting components (upstream lighting discounts for Residential Retail and downstream rebates for commercial customers for Prescriptive Equipment). Other measures within these programs had lower-than-anticipated participation rates, indicating low awareness of other rebate opportunities in the market.

The Custom Incentive Program achieved fewer savings in PY5 than planned, but the program appears to be on track to meet Phase II planned savings based on the size and number of projects currently in the planning and development phase. If the program falls behind, PPL Electric may be able to improve outreach to ensure there are enough projects in the queue to achieve the total Phase II planned savings for the program.

It is likely that awareness of PPL Electric's Phase II offerings will grow over time through word of mouth and therefore may not need much more marketing investment (although this could vary by measure or program). A small percentage of respondents said they learned of the program from a friend, relative, or colleague this year, yet over half of all respondents said they recommended the program to a friend, relative, or colleague (see **Figure 2**). This indicates that the number of participants hearing about the

opportunities for PPL Electric rebates and incentives through nontraditional marketing channels could increase in PY6 and PY7.

Figure 2. Respondents Who Have Recommended the Program to a Friend, Relative, or Colleague

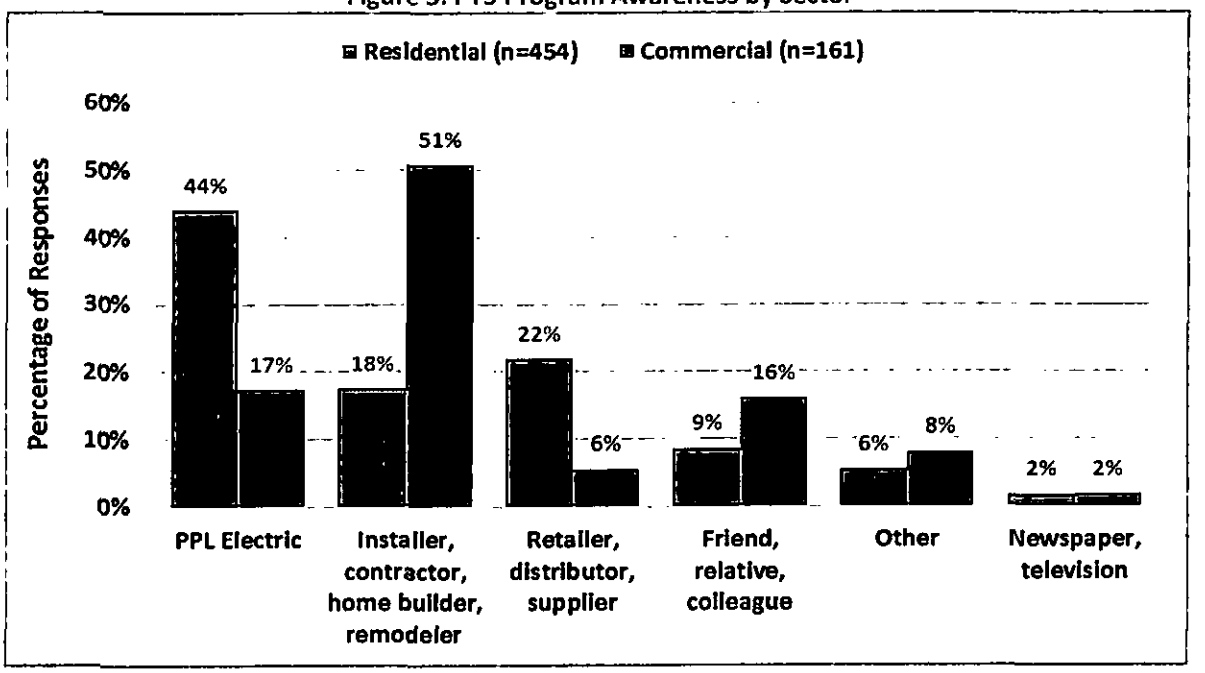


Source: Survey Question, "Since receiving your rebate, have you recommended the program to any friends, relatives, or colleagues.

Commercial survey respondents were more likely to learn about the program from an installer or contractor than from PPL Electric, suggesting that PPL Electric's efforts to engage trade allies are effective. However, this seems limited to lighting. Improvements in non-lighting trade ally engagement would likely boost participation for other prescriptive measures.
Although residential participants most often learned about the program from PPL Electric, the most common for commercial participants was from an installer or contractor, as shown in Figure 3. (A complete list of the methods by which participants heard about the program is contained in **Appendix C**.)

However, most of the participation in the Prescriptive Equipment Program was for lighting rebates, suggesting that PPL Electric could do more to recruit participants for non-lighting measures or support trade allies to do so.

Figure 3. PY5 Program Awareness by Sector



Source: Survey Question, "How did you learn about the program? Was it from PPL Electric, from a contractor or retailer, from a friend or family member or some other way?" Residential participant data aggregated from surveys for the following programs: Appliance Recycling, Residential Retail, Residential Home Comfort (all components). Commercial participant data aggregated from surveys for the following programs: Custom Incentive and Prescriptive Equipment (all components).

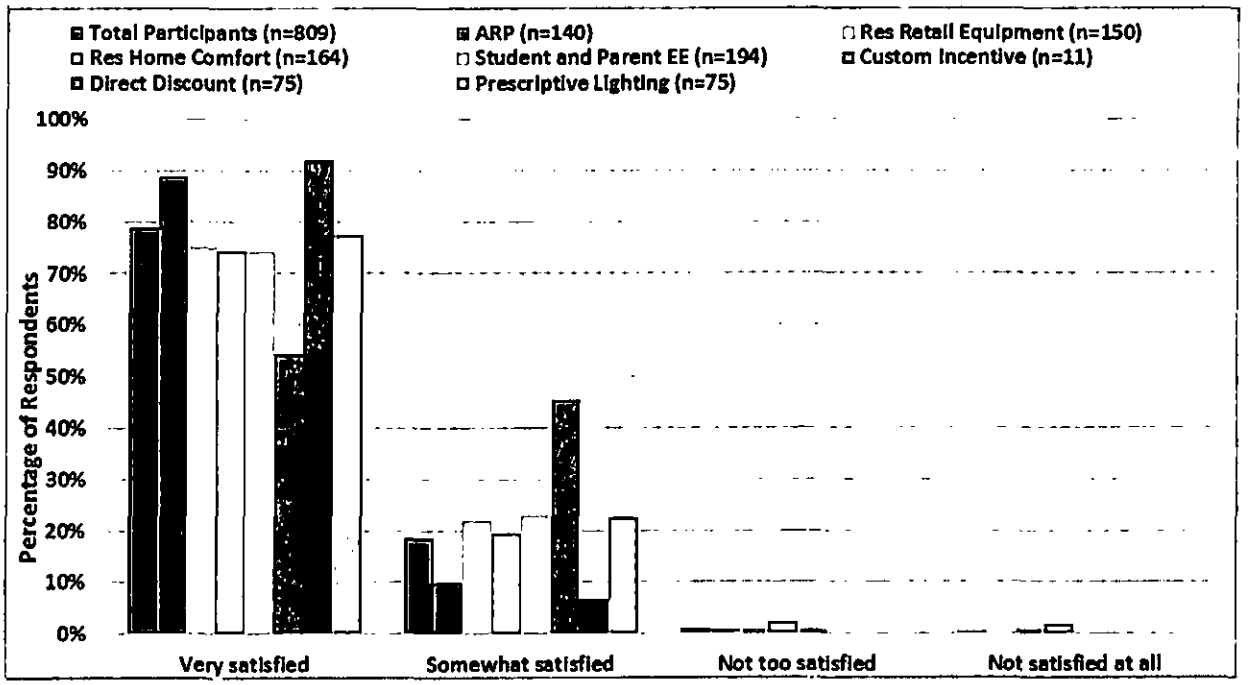
Participant Experience

Participants were highly satisfied with the PY5 programs and over half recommended the program to a friend, relative, or colleague.

For all programs in PY5, 94% of survey respondents rated their satisfaction as *very* or *somewhat satisfied* (**Figure 4**). Overall satisfaction results are similar to PY4, which reported 90% on a different but comparable scale for a majority of programs.

In PY5, Cadmus replaced the 10-point rating scale used in PY4 to a four-point word scale, in which participants were asked to rate their satisfaction as *very satisfied, somewhat satisfied, not too satisfied,* or *not satisfied at all.* To compare the results of PY4 to PY5, we treated ratings of 8, 9, or 10 in PY4 as equivalent to the *very* or *somewhat satisfied* in PY5.

Figure 4. Overall Program Satisfaction in PY5



Source: Survey question, "Thinking about your overall experience with the program, how would you rate your satisfaction?"

Although a lower proportion of survey respondents in the Custom Incentive Program said they were *very satisfied* with the program, none said they were *not too satisfied* or *not satisfied at all.* Some projects in the Custom Incentive Program are complex, evolve slowly over time, and involve multiple iterations of calculations, which makes the overall process slightly more complicated than other programs.

We asked respondents if they had recommended the program to a friend, relative, or colleague, and over half of the survey respondents (57%) said they had recommended the program.

Reasons for Dissatisfaction

Cadmus asked survey respondents about their experiences with specific aspects of the program. Although the vast majority reported high satisfaction with their overall program experience, a small number of respondents indicated they were dissatisfied with some aspect of the program. Their reasons are explored in greater detail in the program-specific chapters of this report.

In general, participants' reasons for reporting dissatisfaction were:

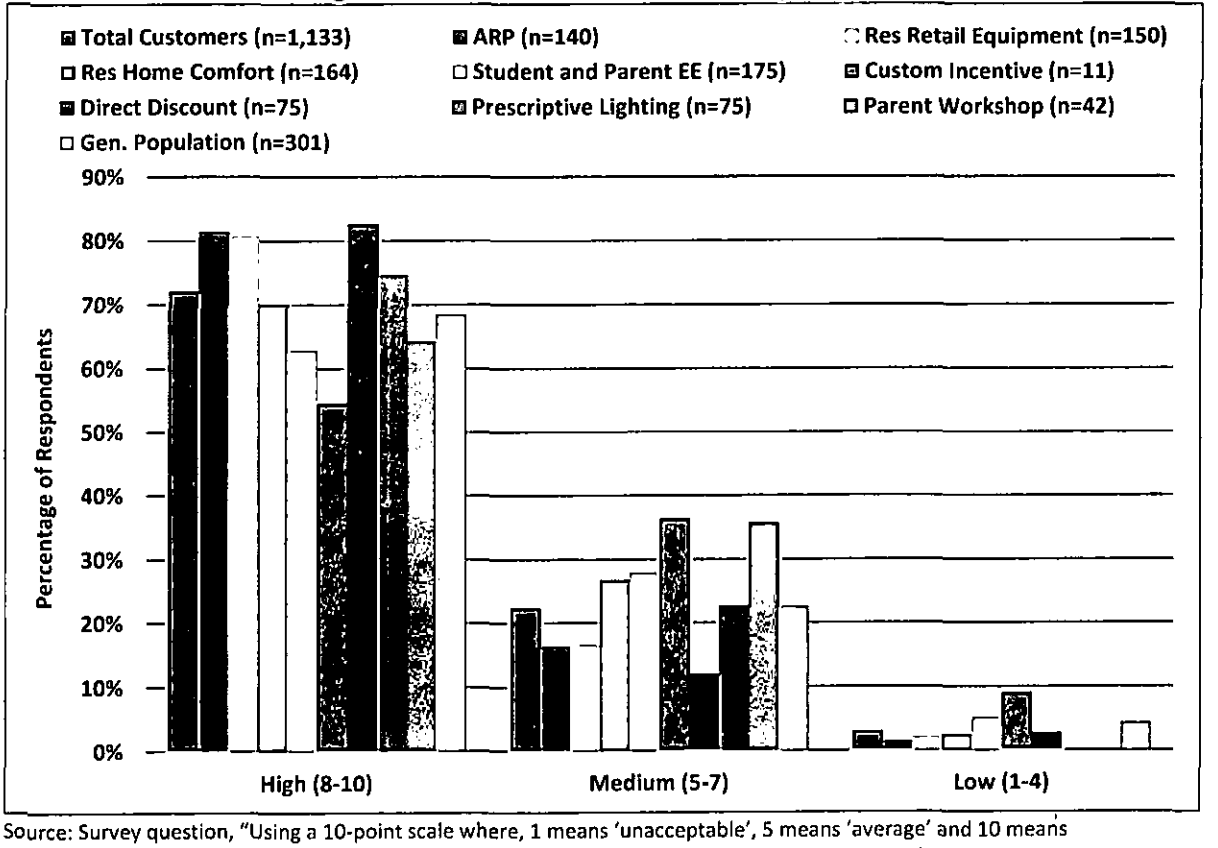
- ***Application.*** Paperwork took too long to complete, there was too much of it, or it took too long to receive approval for application.
- ***Rebates.*** Rebates were too low or took too long to receive.
- ***Equipment.*** The purchased or installed equipment was unsatisfactory.
- ***Benefits.*** The participant did not see any energy-saving benefits.

- ***Program partners and trade allies.*** Participants had poor experiences with implementers or contractors or had difficulty finding contractors.
- ***Energy-efficiency kits.*** LEDs were not included in the energy-efficiency kit (delivered through the Student and Parent Energy Efficiency Program).

Most program participants were* very satisfied *with PPL Electric and almost half said their opinion of PPL Electric improved* significantly *or* somewhat *as a result of their participation.

Cadmus asked survey respondents about their overall satisfaction with PPL Electric as an electric service provider and if their experiences with the programs had changed their opinion of PPL Electric. As illustrated in **Figure 5**, the majority of respondents across all programs rated their satisfaction with PPL Electric as an 8, 9, or 10 on a scale of 1 to 10. Seventy-two percent of respondents rated PPL Electric as an 8 or higher in PY5. This is slightly lower than in PY4 when 77% of all survey respondents rated their satisfaction with PPL Electric as 8 or higher.

Figure 5. Satisfaction with PPL Electric by Program



Source: Survey question, "Using a 10-point scale where, 1 means 'unacceptable', 5 means 'average' and 10 means 'outstanding', using any number from 1 to 10, how do you rate PPL Electric overall as a provider of electric service to your organization/home?"

Seventy-three percent of PY5 Act 129 program participants rated PPL Electric an 8, 9, or 10 as a provider of electric service compared to 68% of general population survey respondents. It is unclear if Act 129 program participants' satisfaction with the program influenced their satisfaction with PPL Electric as a provider of electric service.

Compared to participants in other programs, a higher proportion of Custom Incentive Program participants rated PPL Electric lower than other programs. All but one of the respondents who rated PPL Electric lower than an 8 rated it as a 7. One respondent expressed dissatisfaction with the way the implementer handled the measurement and verification (M&V) portion of the project. PPL Electric is aware of these concerns and is actively addressing them.

Forty-nine percent of all survey respondents in PY5 reported that their opinion either *improved significantly* or *improved somewhat* as a result of participating in a PPL Electric rebate program. This is an increase over PY4 where only 34% gave these ratings. Almost half (48%) reported that their opinion of PPL Electric *had not changed* as a result of the program, a decrease in PY5 from the 61% in PY4. Only 2% reported that their opinion either *decreased significantly* or *decreased somewhat*. (One percent said they did not know.)

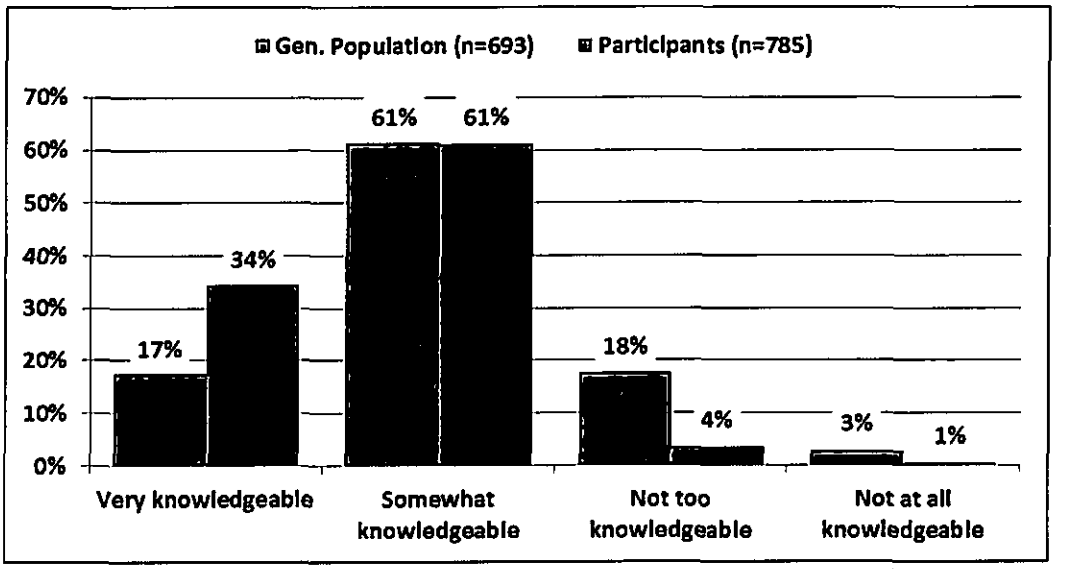
Energy-Efficiency Knowledge, Actions, and Purchasing Patterns

Participants in PPL Electric's programs view themselves as more knowledgeable about energy efficiency than the general population.

Cadmus asked all survey respondents to rate their general knowledge about how to save energy at home or their place of business. When provided with a four-point word scale of *very, somewhat, not too,* or *not at all knowledgeable*, the majority of respondents across all programs and segments and in the general population survey viewed themselves as *somewhat knowledgeable*.

However, we found statistically significant differences between customers who had participated in a PPL Electric program and general population customers—participants were significantly more likely to *rank themselves as very knowledgeable* (p-value <.01), *while general population respondents were* significantly more likely to view themselves as *not too knowledgeable* (p-value <.01). This difference occurred across both residential and nonresidential segments. **Figure 6** shows the responses by ranking.

Figure 6. Customer Knowledge of Energy Efficiency: General Population vs. Program Participants



Source: "How would you rate your current knowledge about how to save energy in your home/business? Would you say you are..." Participant data aggregated from surveys for the following programs: Appliance Recycling, Residential Retail, Residential Home Comfort (all components), Student and Parent Energy Efficiency (classroom and workshop participants), Custom Incentive, Prescriptive Equipment (standard and direct discount paths). General population data aggregated from residential and small business surveys.

One possible explanation for this difference is that people who are more knowledgeable are more likely to participate in a rebate program. Alternatively, the rebate programs may be educating the customers or, at the very least, helping customers feel more empowered about their choices to save energy, thus increasing the rating they give of their own knowledge. An example of the evidence pointing to the latter is that a strong majority of participants (78% residential and 85% nonresidential) reported that, upon learning about the rebate program, the information they received also increased their understanding about energy efficiency.[2]

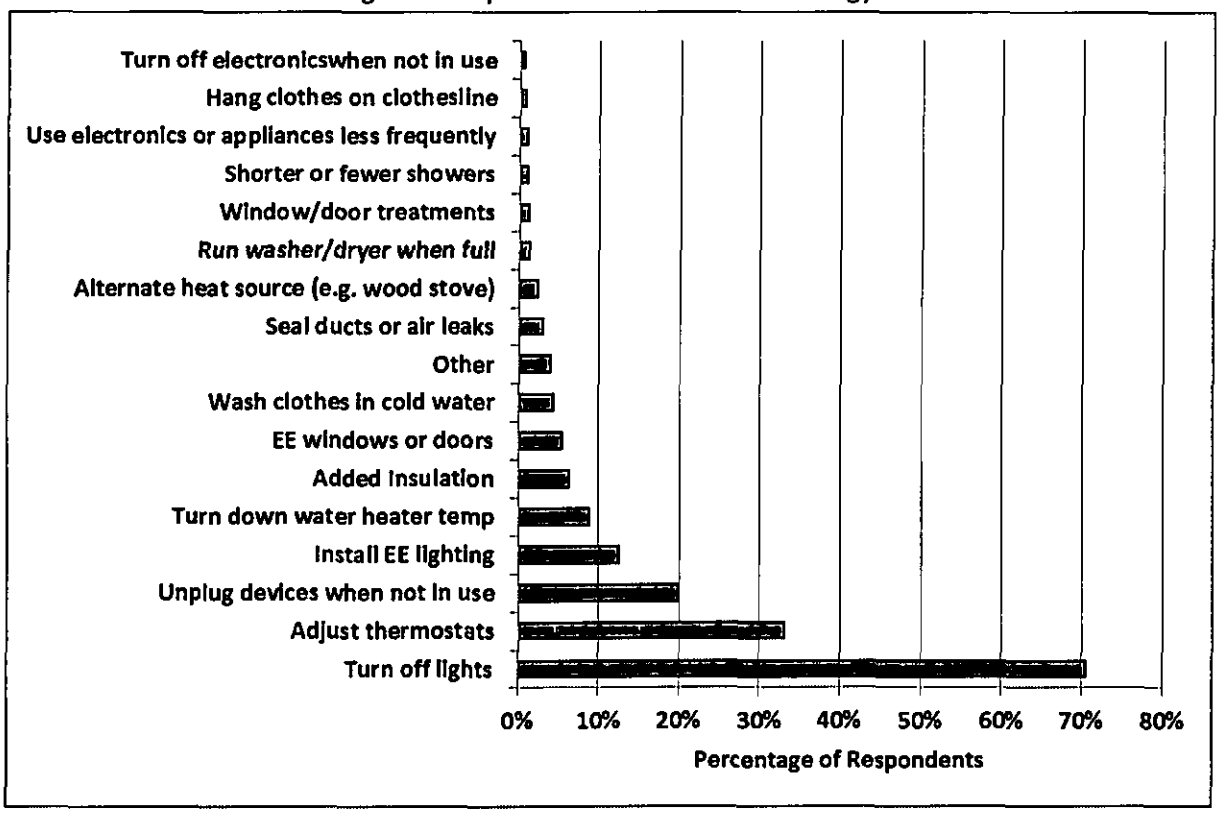
However, these participants do not typically look to PPL Electric as a source of information on ways to save energy. Just 16% of residential program participants reported doing so, slightly higher than the 10% of the general population respondents. Business customers were more likely to seek information from PPL Electric; 32% of all nonresidential participants cited PPL Electric as a resource for energy efficiency information, which was the most common response.

[2] Includes data from Appliance Recycling, Residential Retail, Residential Home Comfort (all components), Custom Incentive, and Prescriptive Equipment surveys.

A strong majority of customers said they take steps to save energy at home, reporting a wide range of behaviors but using only a few strategies consistently. For example, most people turn off lights. They may need more education about other low- or no-cost energy-saving solutions.

Ninety percent of all residential survey respondents reported that they took steps to save energy at home. This percentage was the same for participants in a PPL Electric program and in the general population. When asked an open-ended question about the steps they take, respondents provided a wide variety of answers ranging from no-cost energy-saving behaviors to installing new equipment and making home envelope improvements (**Figure 7**).

Figure 7. Steps Taken at Home to Save Energy



Source: "Do you take any steps to save energy at home on a regular basis?" (If yes),"What steps do you take?" Data aggregated from: Appliance Recycling, Residential Retail, and residential general population surveys. NOTE: Multiple responses were allowed, so percentages exceed 100%.

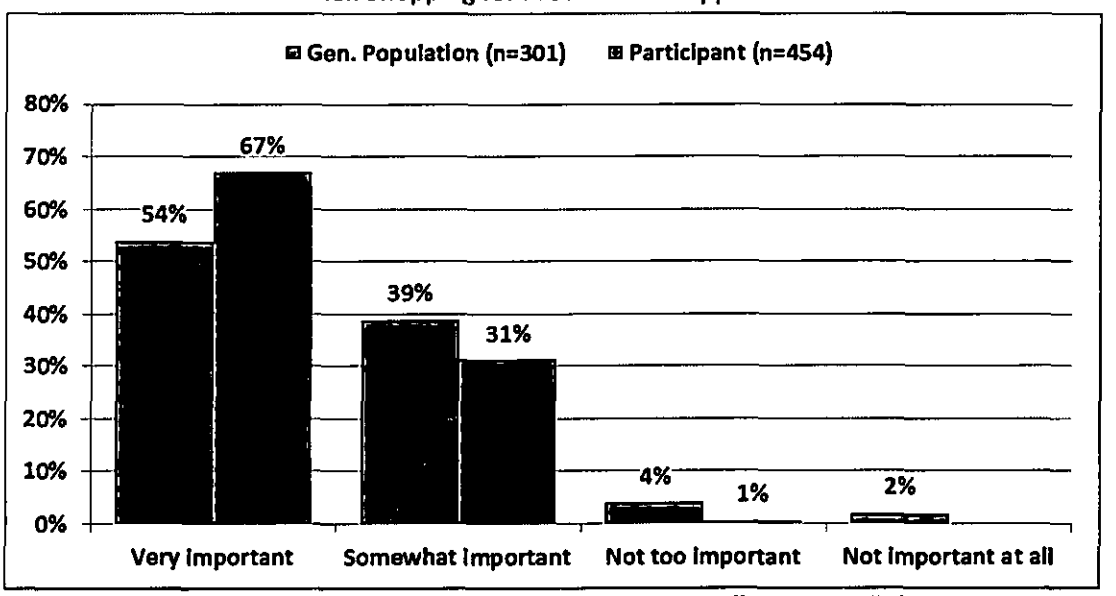
These responses indicate that most customers are knowledgeable about two main energy-saving behaviors—turning off lights when leaving the room and adjusting thermostats. Because few respondents mentioned other energy-saving behaviors, this indicates an opportunity for PPL Electric to increase customer awareness of (and subsequently influence) other easy, no- or low-cost actions to reduce their electric bills.

Residential customers put more emphasis on energy efficiency when making purchasing decisions than business customers do, especially after they participated in a PPL Electric rebate program.

Cadmus asked respondents how much energy efficiency factors into their decision to purchase new products and appliances for the home or for capital upgrades in a business. On a four-point word scale of *very, somewhat, not too,* or *not at all important,* 67% of residential program participants reported that energy efficiency was *very important* compared to only 47% of business participants. This difference is statistically significant (p-value <0.01).

Notably, there was also a statistically significant difference between residential program participants and the general residential population (**Figure 8**), but no difference between nonresidential participants and the general nonresidential population. For small businesses, 42% of the general population respondents reported that energy efficiency was *very important* compared to 40% of participants in PPL Electric's direct discount channel.

Figure 8. Importance of Energy Efficiency to Residential Customers When Shopping for Products and Appliances



Source: "When shopping for products or appliances, how much does energy efficiency typically factor into your decision? Would you say energy efficiency is..." Participant data aggregated from surveys for the following programs: Appliance Recycling, Residential Retail, Residential Home Comfort (all components). General population *data from the residential survey.*

Among nonresidential customers, there were large differences between programs, which indicates trends in purchasing may correlate with business size. Surveys with a sample of program participants found that nearly three-quarters (73%) of Custom Incentive Program participants, typically large business customers, said that energy efficiency was *very important.* Just 40% of direct discount survey respondents and 51% of standard prescriptive lighting respondents who took part in the Prescriptive Equipment Program said that energy efficiency was *very important.* (Although the standard path of the

Prescriptive Equipment program is open to customers of all business sizes, we found that participating businesses were quite small; 75% of the survey respondents had 25 employees or fewer).

All business customers responding to surveys reported cost as the primary barrier to making energy-efficiency upgrades, and some cited that PPL Electric could help overcome this challenge by providing more information about ways to save energy.

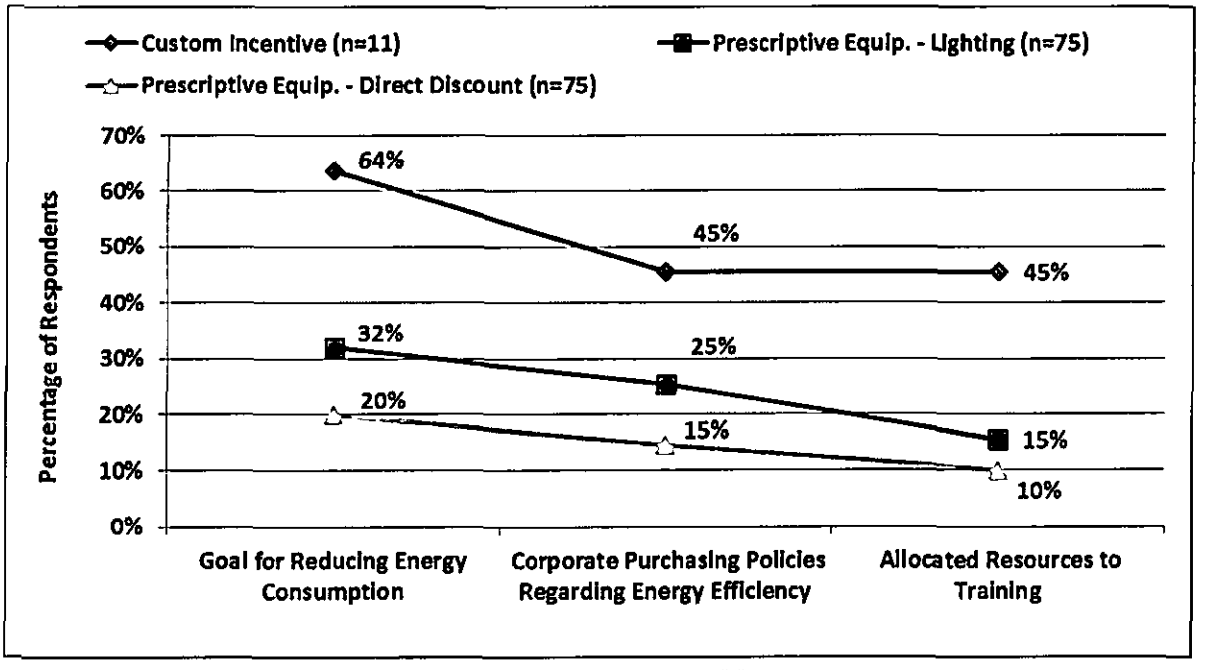
PPL Electric has an opportunity to influence business customers' corporate policies and energy management through training.

The surveys asked participants if their businesses have goals in place to reduce energy consumption, if corporate sustainability policies exist to guide purchases or procurements, and the extent of any previous energy management training. Custom Incentive Program respondents were more likely to have such policies at their organizations than respondents in the Prescriptive Equipment Program (both standard and direct discount paths), and they were also more likely to have dedicated resources to train staff on energy management. These types of policies and investments, which encourage businesses to pursue energy efficiency, were rarely cited by Prescriptive Equipment Program survey respondents.

In a follow-up question, a large number of respondents indicated interest in attending further energy management training. Nearly three-quarters (73%) of Custom Incentive Program participants, 21% of direct discount, and 34% of prescriptive lighting participants said *Yes* when asked if they would be interested in attending training offered by PPL Electric (building operator certification was cited as an example).

Figure 9 compares the percentage of respondents reporting corporate policies and investment in training.

Figure 9. Corporate Policies and Training among Nonresidential Program Participants



Sources: "Does your company have a goal for reducing energy consumption?," "Does your company have corporate policies regarding energy efficiency that are considered when purchasing new equipment?," and "Has your company allocated resources for training about energy management in the past year?"

Customers in older age groups were more knowledgeable about energy efficiency and more likely to engage in activities to save energy, while other demographic factors had no influence.

Cadmus examined a number of variables to explore potential correlation between energy-efficiency knowledge or behavior and demographic characteristics. We found age was a reliable predictor of three key respondent characteristics:

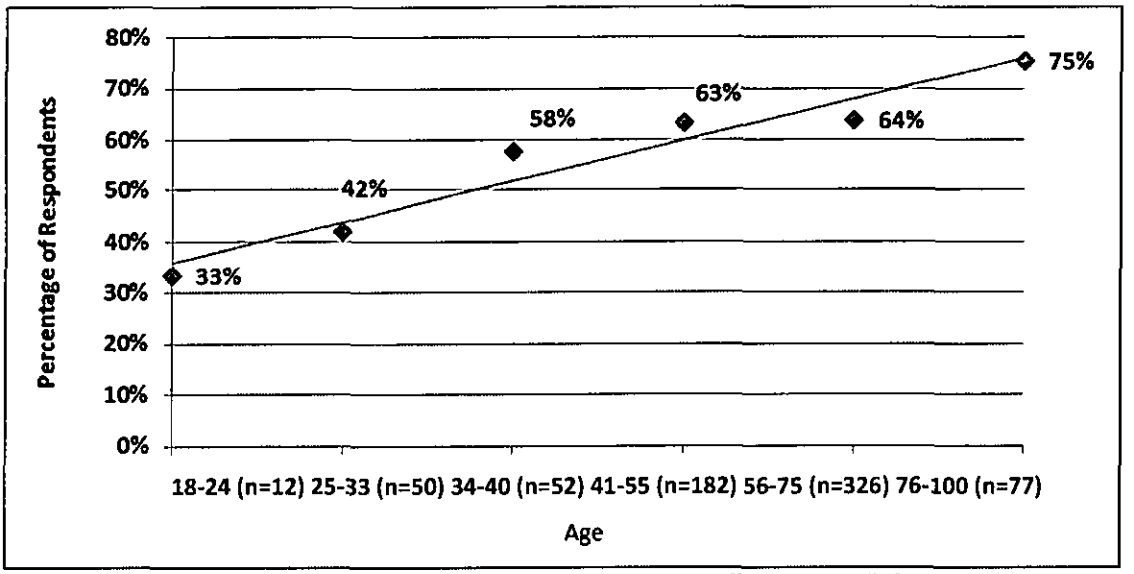
- Level of knowledgeable about energy efficiency,
- Whether the person took steps to save energy at home, and
- The importance of energy efficiency in product and appliance purchases.

According to a chi square test of independence, each one of these characteristics had a positive correlation with age at 95% confidence. In general, older age groups were more knowledgeable and took more actions to save energy.

For example, people who were 41 years old and older were more likely to say that they were *very knowledgeable* about ways to save energy at home than people in their 20s and 30s (32% and 11%, respectively). Similarly, people between 25 and 33 years old were the most likely group to say they were *not too knowledgeable*; 22% of this group ranked itself as *not too knowledgeable* compared to just 6% of people in other age groups, on average.

Ninety-three percent of people between 34 and 75 years old said they took steps to save energy at home compared to 83% of people younger than 34. The likelihood that a respondent viewed energy efficiency as *very important* when making a product or appliance purchase increased steadily with age, as shown in **Figure 10.**

Figure 10. Percentage of People Reporting Energy Efficiency is *Very Important* When Purchasing Products and Appliances, by Age Group



Source: "When shopping for products or appliances, how much does energy efficiency typically factor into your decision? Would you say energy efficiency is..." Data aggregated from: Appliance Recycling, Residential Retail, Residential Home Comfort (all components) and residential general population surveys (n=699).

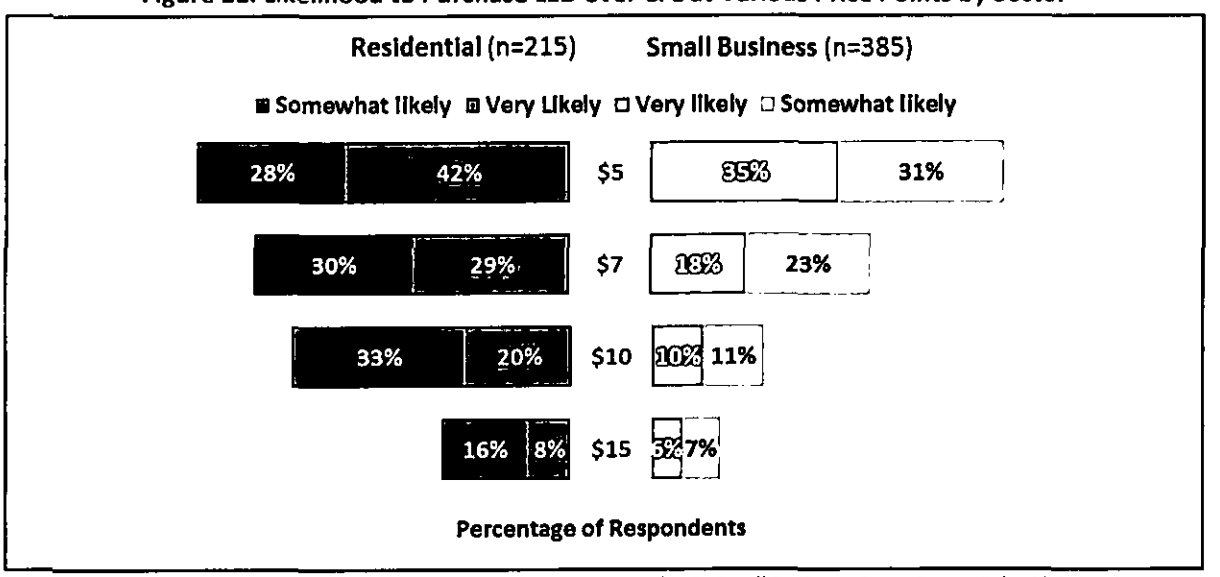
These findings were not related to the number of people living in each household, indicating age could be independently driving attitudes and behavior changes toward energy regardless of family size. Just as important may be the null hypothesis income and education, which are two other key variables often associated with energy efficiency and environmental stewardship. No correlation existed between these social characteristics and the questions we posed to assess energy-efficiency knowledge and behaviors.

Willingness to Pay for LEDs

Residential customers were more willing to purchase LEDs than small business customers at all price points except the cheapest.

When presented with hypothetical price scenarios of $15, $10, $7, and $5 for LED bulbs, residential customers said that they would be willing to buy an LED over a CFL more often than business customers, as indicated by a response of *very likely* or *somewhat likely*. This difference was statistically significant (p-value < .01) at every price point except $5, where the percentage of customers either *very likely* or *somewhat likely* to buy the bulb was similar for both groups (70% of residential customers and 66% of small business customers). **Figure 11** shows the percentages of residential and small business customers' willing to pay for LEDs at each price point.

Figure 11. Likelihood to Purchase LED over CFL at Various Price Points by Sector



Source: Residential Retail Lighting Survey, questions F12, F15, F16, and F17; Small Business Cross-Sector Sales Lighting Survey, questions A8, A9, A10, and A11. "If a typical LED cost $5/$7/$10/$15, how likely would you be to purchase the LED instead of a CFL? Would you say..."

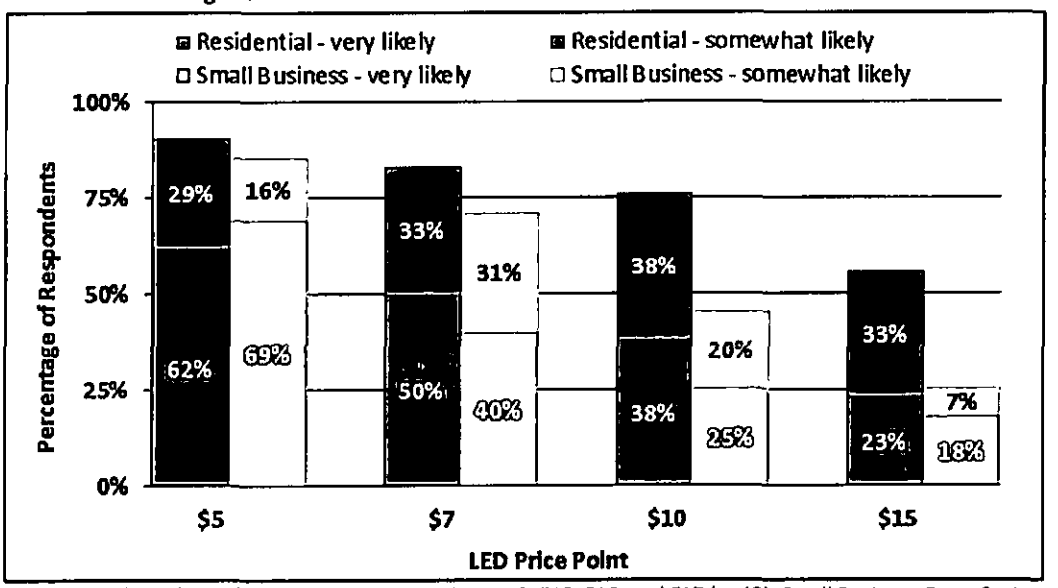
Customers in both segments were more willing to pay for an LED—at all price points—if they had previously purchased one.

The surveys asked if respondents had previously purchased LEDs. This factor had a large impact on the likelihood to purchase LED bulbs at various price points; results showed that customers who had experience with LEDs were willing to pay more.

Purchasers of LEDs were more likely to purchase an LED over a CFL than non-purchasers of LEDs, regardless of price points. Residential purchasers were, on average, 31.5% more likely to purchase an LED over a CFL than non-purchasers. Small business purchasers were 25% more likely. Differences were statistically significant at every price point, for both residential and small business customer (p-value <.05). The next two figures show the likelihood of purchasing an LED at various price points for

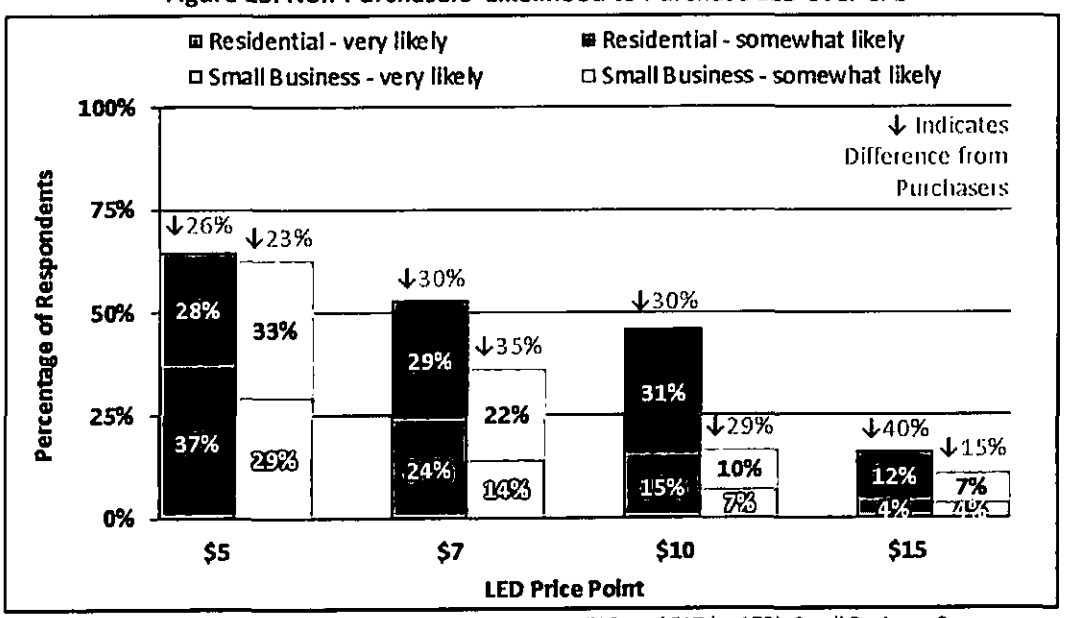
purchasers (**Figure 12**) and non-purchasers (**Figure 13**). **Figure 13** contains an additional data point in grey to illustrate the percentage drop between purchasers and non-purchasers in their willingness to pay at various price points.

Figure 12. Purchasers' Likelihood to Purchase LED over CFL

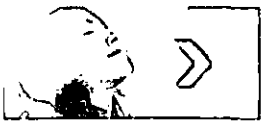


Source: Residential Retail Lighting Survey, questions F12, F15, F16, and F17 (n=42); Small Business Cross-Sector Sales Lighting Survey, questions A8, A9, A10, and A11 (n=55). "If a typical LED cost $5/$7/$10/$15, how likely would you be to purchase the LED instead of a CFL? Would you say..."

Figure 13. Non-Purchasers' Likelihood to Purchase LED over CFL



Source: Residential Retail Lighting Survey, questions F12, F15, F16, and F17 (n=173); Small Business Cross-Sector Sales Lighting Survey, questions A8, A9, A10, and A11 (n=330). "If a typical LED cost $5/$7/$10/$15, how likely would you be to purchase the LED instead of a CFL? Would you say..."



Comparison with Baseline Study Willingness to Pay Data

In the 2014 Pennsylvania statewide residential baseline study,[3] researchers asked residential customers a series of questions about willingness to pay for various energy-efficient technologies including LEDs. The study's methodology was different than the Cadmus survey methods. Our survey asked customers about willingness to pay for bulbs at price points of $15, $10, $7, and $5, with the hypothetical scenario of purchasing the LED over a CFL. The Statewide Evaluator (SWE) survey asked customers about their willingness to pay for the *incremental cost* above a standard replacement bulb, without specifying what the bulb was. They asked customers their likelihood to purchase the bulb if the bulb costs $19 more, $14 more, $10 more, and $5 more. They also asked this question on a scale of zero to 10. By aggregating responses of 8, 9, and 10, we can roughly compare to the Cadmus word scale choice of *very likely*.

Due to the significant differences in methods and questions, it is hard to draw conclusive comparisons between the two results. However, it is worth noting some general trends. Respondents in the SWE study seem much more likely to pay for LEDs at a high cost. For example, 20% of the respondents were *very likely* (as measured by a response of 8, 9, or 10) to purchase an LED at the most expensive scenario—costing $19 more than the standard replacement bulb. Twenty-nine percent (29%) were very likely to purchase the LED if it cost $14 more. In Cadmus' survey, just 8% of respondents reported they would be *very likely* to purchase an LED that cost $15.

Two possible explanations for these differences are:

- In the SWE survey, respondents were told that the LED lasted 19 years longer than the standard replacement and saved $3.50 per year. This information may have increased respondents' willingness to pay.
- Socially desirable biases may be stronger during in-person interviews than during phone interviews, leading respondents to over-report their willingness to pay for the energy-efficient technology.

PY5 Portfolio Recommendations Status

The table containing the status of each recommendation is included in **Appendix A** of the report titled *"PY5 Annual Report."*

[3] GDS Associates, April 2014. "Pennsylvania Statewide Act 129 Phase II Residential Baseline Study," Presented to the Pennsylvania Public Utility Commission.

Residential Retail Program

For the Residential Retail program, the PY5 process evaluation activities were these:

- Participant surveys (n=150)
- General residential surveys (n=300)
- Program staff and implementer interviews (n=2)
- Program literature review and benchmarking
- Database and QA/QC review of records
- Process map review

Achievements Against Plan

In PY5, the program achieved 100% of its planned MWh/year savings,[4] 56% of its planned MW savings, 104% of its annual bulb-sales target, and 77% of its annual equipment units target (**Table 2**).

Overall, the Residential Retail Program met its PY5 planned MWh/year savings, achieved fewer of its planned MW reduction, and reached its bulb-sales target but achieved fewer of its equipment-participation target. At the end of PY5 (May 31, 2014), the Residential Retail Program had achieved:

- 39% of its 229,275 MWh/year three-year planned savings
- 22% of its 39.89 MW three-year planned demand reduction
- 32% of its 5,905,000 three-year bulb-sales target
- 59% of its three-year equipment participation target of 15,730 units

Table 2. Residential Retail Program Savings

	PY5 Verified Savings	PY5 Planned Savings	Percentage of PY5 Planned Savings	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/yr	90,314	90,054	100%	229,275	39%
MW	8.92	16	56%	39.89	22%

PPL Electric revised the three-year program plan and eliminated TVs and smart strips (included as "equipment"). They also revised the target of 9,500 ENERGY STAR® refrigerators and changed it to 600 ENERGY STAR "Most Efficient" refrigerators. Therefore, the PY5 target of 12,110 units was changed to 1,800 units for PY6 and PY7.

[4] *Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania PUC on April 7, 2014, Table E6, pp.51*

Program Delivery

The Residential Retail Program offers rebates and upstream incentives for energy-efficiency products sold in retail stores and offers smart strips through a direct install giveaway program. The program's implementer, Ecova, manages this program. They work directly with manufacturers and retail stores and operate a call and rebate processing center for program participants.

The program involves the following components:

Residential Lighting

- The lighting component of the program offers discounted CFLs, LEDs, and specialty CFLs in PY5, and it will transition to discounting only LEDs by PY6. PPL Electric offers upstream incentives to manufacturers, which in turn enable retailers to discount bulbs for customers.
- The lighting component of this program also involves CFL and LED giveaway events, and it distributes information about energy-efficient lighting and brochures online and at participating retailers and community events.
- The implementer makes CFL recycling bins and recycling educational materials available throughout the PPL Electric territory at retailers that discount CFLs. PPL Electric posts these CFL-recycling locations on its website.

Residential Efficient Equipment Measure Rebates

- The efficient equipment component of the Residential Retail Program provides rebates for energy-efficient refrigerators and heat pump water heaters (HPWHs). Customers must submit a mail-in rebate application.

Residential Efficient Equipment Midstream Incentives

- The program offered free smart strips to end-use customers in PY5 but will eliminate this measure once the initial inventory is depleted.
- The program offered midstream incentives to retailers for energy-efficient televisions in PY5 but eliminated this measure in January 2014.

Cadmus developed a process flow map that diagrams the program's roles, responsibilities, and activities (see **Figure 15**, **Figure 16**, and **Figure 17** at the end of this chapter). The first chart shows the process by which customers become aware of the program. The next two charts show the roles and responsibilities involved in carrying out the program, from the point at which the customer participates to the verification of savings.

Program Changes and Outcomes

PPL Electric began to increase the number of LEDs offered through the upstream lighting component of the program in PY5—and to phase out discounts for CFLs—in preparation for the shift to discount only LEDs in PY6. Because of the higher cost of LEDs and in response to Cadmus' recommendation to increase

the incentive level on more expensive products, PPL Electric increased the per-bulb incentive for LED bulbs offered during PY5.

In the equipment component of the program, PPL Electric eliminated the midstream incentives for televisions, partly because of the difficulty in staying ahead of the natural market adoption and ensuring a high net-to-gross (NTG) ratio in such a rapidly-changing market.

Program Tracking

This section discusses the factors affecting the program's realization rates during PY5 and PPL Electric's systems and processes to track data and monitor the program.

Because Cadmus calculated savings for all residential lighting records, the *ex post* verified energy and demand savings are equal to the *ex ante* energy and demand savings, unless errors or omissions in the quantities of bulbs reported are discovered upon review of the implementer's data extracts. Therefore, the realization rate for PY5 is 100% for upstream lighting.

We did not find any errors in our sample of rebate forms or incorrect quantities in the energy efficiency management information system (or EEMIS, PPL Electric's tracking database). Therefore, we did not make any *ex post* adjustments to rebated measures in PY5.

We did make *ex post* adjustments to smart strips based on a verified installation rate of 91%.

Residential Retail Equipment Program Components

Marketing and Outreach

Cadmus asked survey respondents how they heard about the program. The majority of HPWH respondents (61%) heard about the program through retailers, and 11% of respondents said they learned about the program through a contactor. The remaining respondents heard about the program from PPL Electric, from a relative or friend, or some other source.

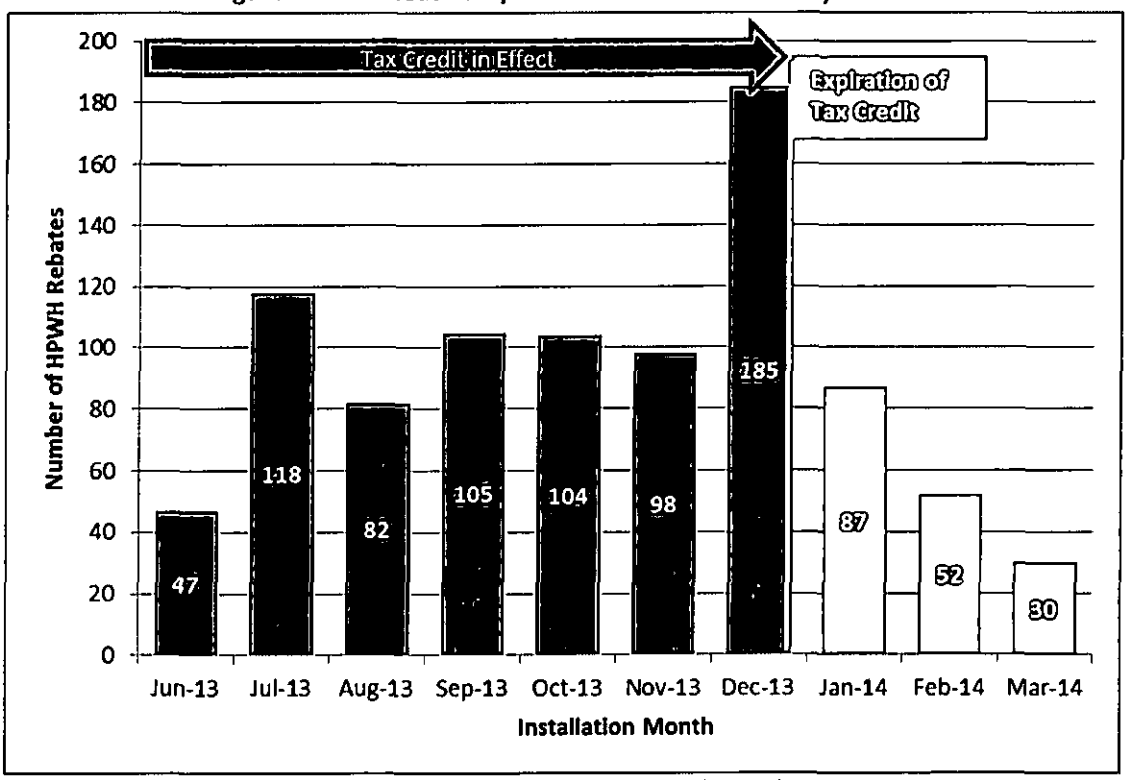
Tax Credit for Heat Pump Water Heaters

Most HPWH purchasers responding to the survey (87%; n=87) were aware of the federal tax credit, which was in effect until December 31, 2013.[5] Of these respondents, 24% said they were *very likely* to have purchased the unit without the federal tax credit, 43% said they were *somewhat likely,* and 25% said they were either *not too likely* or *not at all likely*. These data indicate that the federal tax credit had a moderate, but not strong, amount of influence on customers' purchase decisions. Over half (55%) of the respondents said they made their purchase *sooner* than they would have otherwise in order to take advantage of the federal tax credit before it expired.

[5] A federal tax credit of $300 was available for HPWHs placed in service between January 1, 2012, and December 31, 2013. Of the 908 HPWH rebates processed in PY5, 81% were installed prior to December 31, 2013, and thus were eligible for this credit.

An analysis of the monthly rebate data (provided in EEMIS) confirms that the expiration of the tax credit spurred HPWH purchases at the end of 2013. **Figure 14** shows the number of HPWHs rebated in PY5. Although it is likely that not all rebates for units installed in the early part of 2014 have been processed and recorded in EEMIS, data indicate that PY5 participation may have dropped since 2013.

Figure 14. PY5 Heat Pump Water Heaters Installed by Month



Source: EEMIS data from PY5; install dates run only through March due to lag in rebate processing.

Satisfaction

Satisfaction with the Residential Retail Program overall was high in PY5. Ninety-seven percent of all survey respondents reported they were *very satisfied* or *somewhat satisfied* with their overall experience. The most common source of dissatisfaction was the amount of time to receive the rebate. Thirty percent of participants reported waiting more than six weeks to receive a rebate check. This was only 20% for refrigerator purchasers.

Importance of the Rebate

The importance of receiving a rebate on purchase decisions was *very important* for 54% of HPWH purchasers but 16% for refrigerator purchasers. As expected, HPWH offers the largest rebate so these respondents were more influenced by the rebate than refrigerator respondents.

Upstream Lighting Program Component

Bulbs Purchased and Used

Although awareness of CFLs and LEDs was relatively similar among respondents, bulb purchases differed greatly. Of the 287 respondents who were aware of CFLs, 47% had purchased them in the past six months and 7% had received one or more CFLs for free (137 respondents). Of the 276 respondents aware of LEDs, just 23% had purchased them and 3% had received one or more LEDs for free (57 respondents).

Cadmus asked each respondent who purchased bulbs how many bulbs he or she had either purchased or received during the previous six months. Respondents reported purchasing between one and 55 CFLs (136 respondents) and between one and 50 LEDs (47 respondents).[6] The average number of bulbs per respondent was 8.2 CFLs and 6.4 LEDs.

Cadmus uses these numbers to estimate the number of households purchasing discounted bulbs (as a proxy for the number of participants) in the upstream lighting component of the Residential Retail Program by dividing the total number of discounted bulbs by these metrics. In PY5, based on this method, Cadmus estimated that the 1,891,862 discounted bulbs were purchased by 235,014 households.

Satisfaction with CFLs and LEDs

Respondents who used LEDs were significantly more satisfied with their bulbs than CFL users.[7] Of the respondents who had used LEDs, 69% were *very satisfied*, and 22% were *somewhat satisfied*. Of the respondents who had used CFLs, just 47% said they were *very satisfied* with them, and 38% were *somewhat satisfied.*

Only 12% of the 296 customers responding to the survey who were aware of either CFLs or LEDs (or both) knew that PPL Electric provides funding to reduce the price of these bulbs. However, 30% of these 296 respondents had seen PPL Electric educational materials about the energy-saving benefits of these bulbs.

Willingness to Pay: LEDs

Respondents answered questions about the price they were willing to pay for LEDs. We assessed this at various price points that were less expensive than the base case of $15. We provided these scenarios to

---

[6] Cadmus excluded from the calculation of installation rates any respondents who said more bulbs were installed than they said they had purchased. In addition, we excluded from our calculations (of both installation rates and bulbs-per-participant averages) data from two respondents who purchased 60 and 150 LEDs and said none were installed. (The respondent who said he or she purchased 150 LEDs indicated these were seasonal lights, suggesting they were not general-service bulbs.)

[7] *The difference between the respondents who were very satisfied with LEDs and those who were very satisfied* with CFLs is statistically significant at 90% confidence, $p < .01$.

LED purchasers who did not recall the price they paid, as well as to respondents aware of LEDs but who had *not* purchased any in the past six months. Just over half of these respondents (53%) reported they would be likely to buy a bulb that cost $10. Over two-thirds (70%) said they would be likely to buy the LED if it cost $5.

Replacement Type

Most respondents said the next time a bulb burns out they would replace it with the same kind of bulb. If a CFL bulb burns out, 85% of respondents said they are *very* or *somewhat likely* to replace it with another CFL. If a LED bulb burns out, 90% of respondents said they are *very* or *somewhat likely* to replace it with another LED.

Bulb Recycling

Of the 77 respondents who had disposed of any CFLs in the past year, 58% said they threw them in the trash, 22% said they recycled or took them to a hazardous waste center, and only 8% said they brought them to a retail store for recycling. Of the 137 who had not disposed of a CFL (or were unsure if they had), only 40% said they would throw them in the trash when given a hypothetical scenario. These findings are similar to how people disposed of (or would hypothetically dispose of) CFLs in the previous two years, indicating that knowledge around disposal has not changed very much.

Further, just 10% of respondents knew that PPL Electric provides CFL recycling bins at retail locations and a small fraction of that group had seen the bins in the past six months.

We asked respondents who were aware of CFLs what, if any, concerns they had, and about 40% expressed concern about toxicity or special handling requirements.

Benchmarking Against Other Programs

This section discusses the results of Cadmus' benchmarking effort against similar programs offered by other utilities and summarizes specific program metrics such as delivery channels, program awareness, and factors affecting freeridership.

Program Delivery Channels

In addition to the upstream buy-down, Efficiency Maine sent 78,696 CFLs to participants in its Appliance Recycling Program and distributed 168,960 CFLs through a food bank.

Ameren Missouri uses a social marketing distribution channel to deliver free CFLs to low-income customers. Ameren Missouri's PY13 evaluation reports that there are several types of nonprofit organizations in this channel, but they are primarily food banks in areas comprising at least 80% Ameren Missouri customers. The evaluation assumed that the bulbs distributed through this channel had a NTG ratio of 100%.

Program Awareness

Low awareness of upstream lighting programs appears to be common. The Wisconsin Focus on Energy customer survey found that almost three-quarters (74%) of respondents did not know that it bought down bulb prices. The Efficiency Maine Residential Lighting process evaluation found that 61% of respondents who purchased CFLs did not know about discounts or markdowns. Ameren Missouri found that only 25% of respondents knew they had purchased an Ameren Missouri-discounted CFL (in other words, 75% who purchased bulbs did not know).

Marketing and Outreach Strategies

Similar to PPL Electric, the FirstEnergy companies and Ameren Missouri found that in generating customer awareness of product rebates, retailers were the most effective marketing ally; communication from contractors to customers was low.[8]

The evaluations reviewed noted the missed opportunity of not using HPWH contractors or installers to inform customers about the rebate. For example, two-thirds (66%) of Ameren Missouri participant survey respondents who purchased equipment through contractors said their contractor did not inform them of the rebate program.

The Efficiency Maine report stated that future marketing plans will place increasing emphasis on heat pump technologies, including HPWHs. The report recommends that this will require developing outreach channels beyond retailers because these technologies tend to be installed by professional contractors.

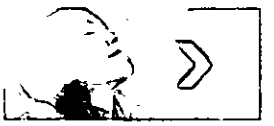
Factors Affecting Freeridership

Low incentives relative to retail price, regardless of the incremental cost of efficient equipment, have been shown to increase freeridership. Both the Focus on Energy and Efficiency Maine evaluations suggested that lower incentives relative to retail price may be the driver of the lower NTG ratios for specialty and LED bulbs. Rapidly changing markets, such as for televisions, can also make it difficult for incentive programs to keep ahead of natural market adoption.

PPL Electric has already made several changes to address these issues, such as eliminating the midstream incentives for televisions and increasing the incentive and required efficiency tier for refrigerators. Because the upstream lighting program in PY6 will consist entirely of LEDs, an emerging and relatively expensive technology, it will be important for PPL Electric to monitor the effect of incentive levels on participation and sales lift attributable to the program.

The NTG ratio for Ameren's RebateSavers is notably high. The 2013 impact evaluation estimates freeridership at the measure level and found that freeridership was less than 15% for HPWHs. Spillover (participant and nonparticipant) totaled less than 4% and was not broken down by measure. This

[8] FirstEnergy companies in Pennsylvania are Metropolitan Edison (Met-Ed), Pennsylvania Electric (Penelec), Pennsylvania Power (Penn Power), and West Penn Power.



resulted in a NTG ratio of 89% for HPWHs, which accounted for about 68% of the savings for all rebated measures; rebated measures comprise about 11% of total program savings. (Energy-efficiency kits, comprising about 78% of program savings, had a combined freeridership score of 15%.)

Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-2** of the report titled *"PY5 Annual Report."*

Process Maps

The process maps for the Residential Retail Program are **Figure 15**, **Figure 16**, and **Figure 17**.

Figure 15. Customer Awareness Process

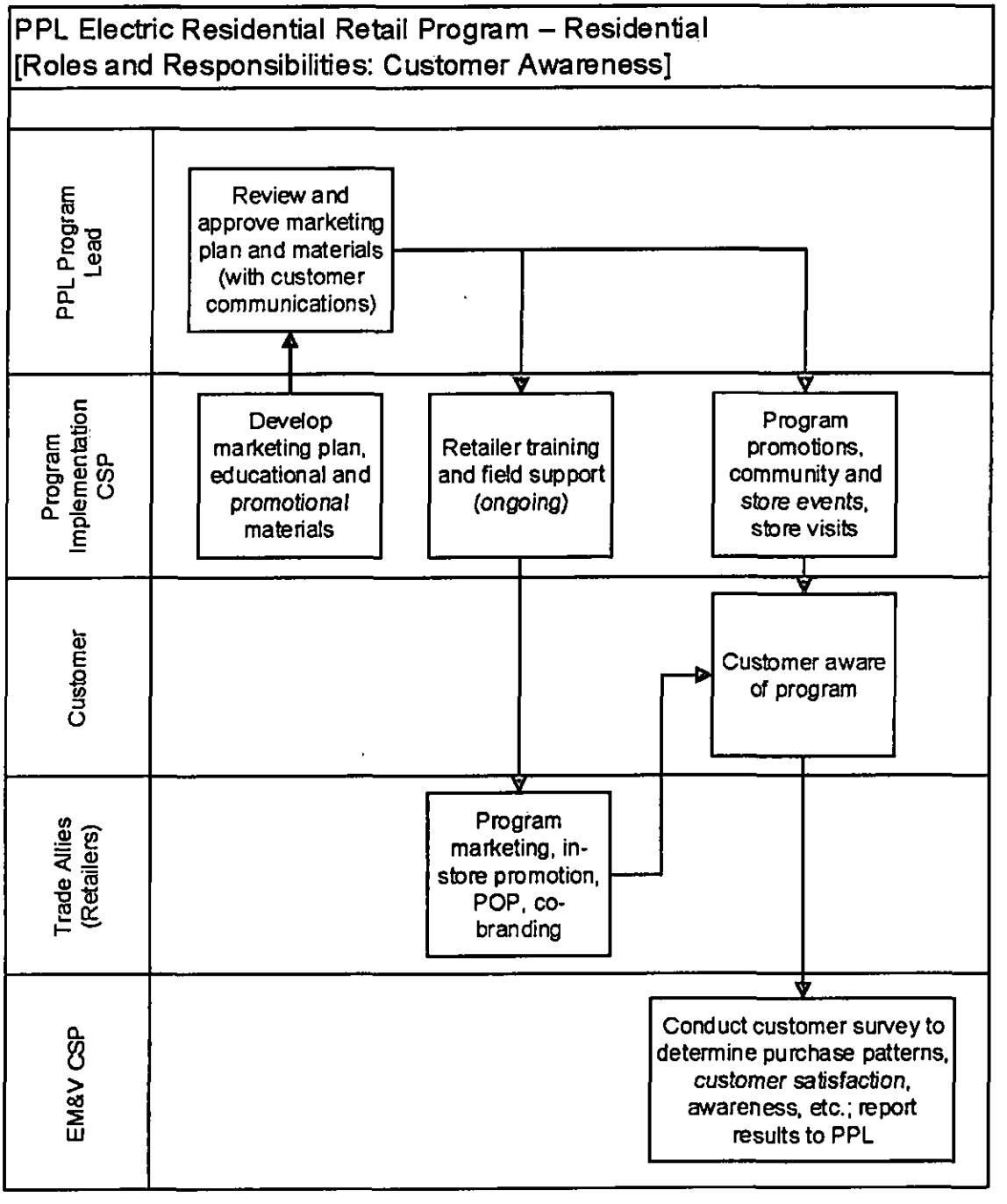


Figure 16. Participation and Data Processing – Upstream Lighting

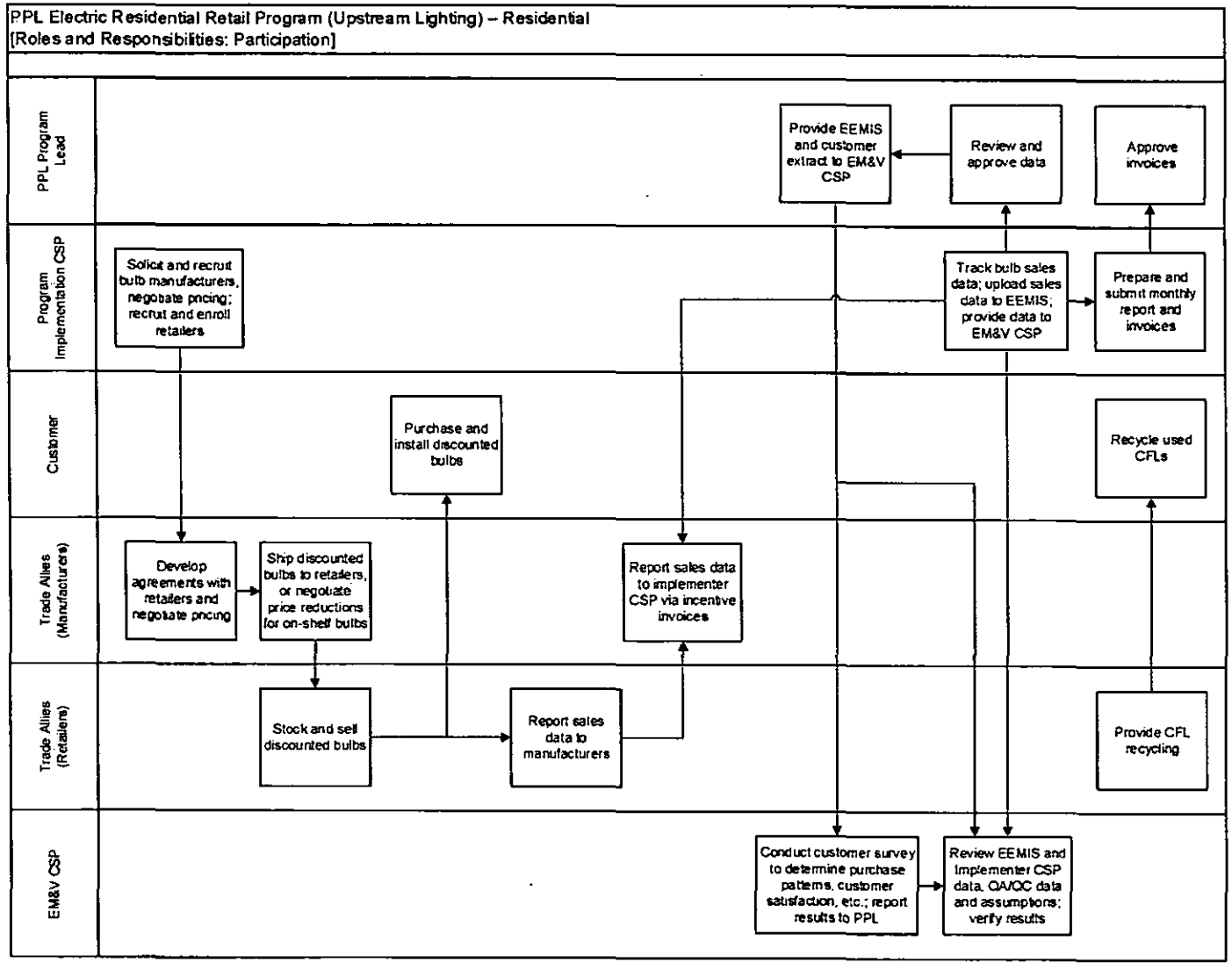
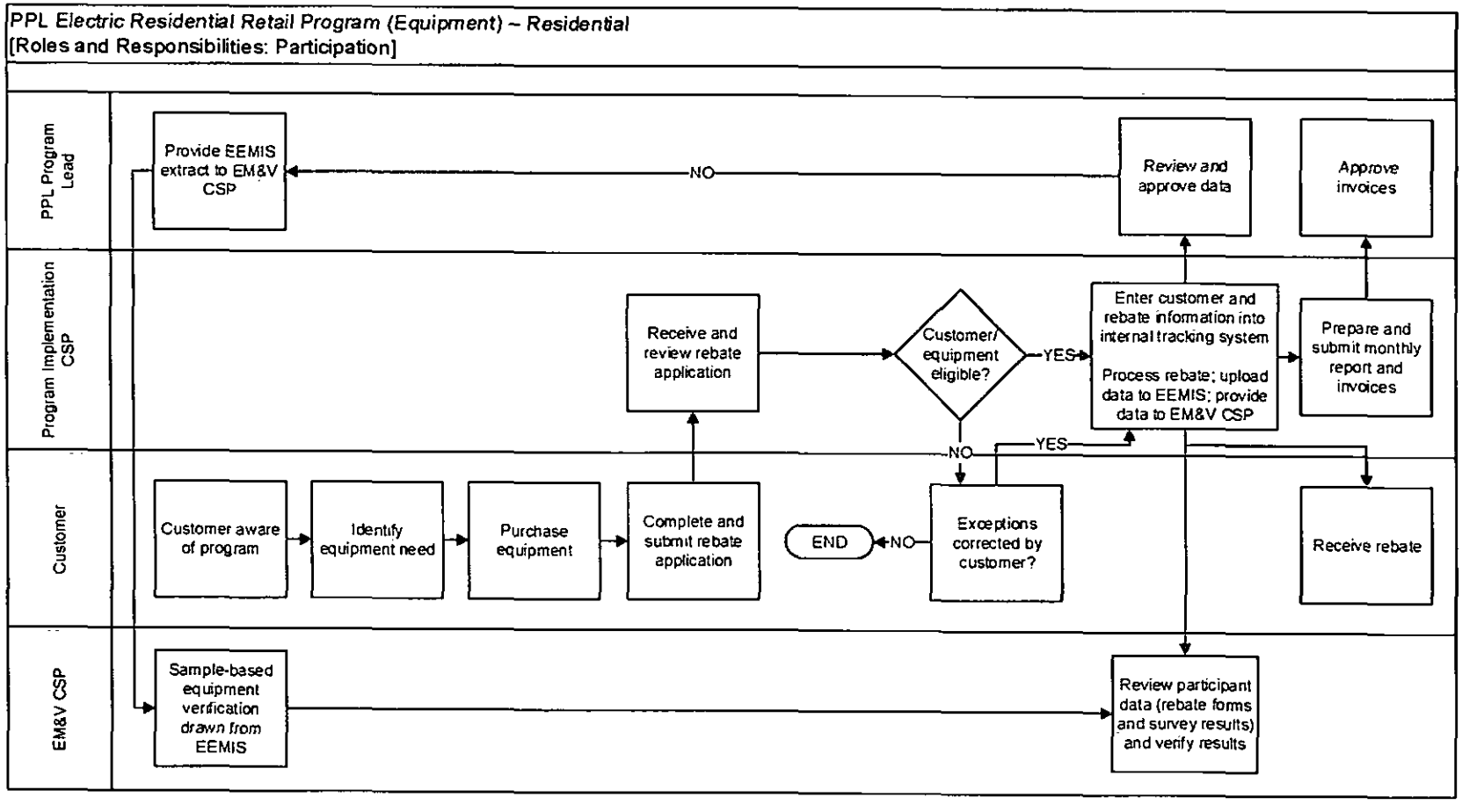


Figure 17. Participation and Data Processing – Equipment



Prescriptive Equipment

The Prescriptive Equipment Program is delivered through two channels—the standard program and the direct discount channel. In PY5, Cadmus conducted these process evaluation activities:

- Participant surveys (n=150)
  - Lighting participants (n=75)
  - Direct discount participants (n=75)
  - Non-lighting participants (n=0)
- Program staff and implementer interviews (n=2)
- Program literature review and benchmarking
- Database and QA/QC review of records
- Process map review

Achievements Against Plan

In PY5, the program achieved 96% of its planned MWh/year savings and 84% of its planned MW savings (**Table 3**).[9]

Overall, the Prescriptive Equipment Program met its PY5 planned MWh/year savings and achieved fewer MW reduction savings. At the end of PY5 (May 31, 2014), the Prescriptive Equipment Program had achieved:

- 40% of its 203,919 MWh/year three-year planned savings
- 35% of its 35.7 MW three-year planned demand reduction

Table 3. Prescriptive Equipment Program Savings

	PY5 Verified Savings	PY5 Planned Savings	Percentage of PY5 Planned Savings	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/year	81,170	84,729	96%	203,919	40%
MW	12.58	14.89	84%	35.7	35%

[9] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania Public Utilities Commission on April 7, 2014, Small C&I Table M6, p. 106; Large C&I Table O6, p. 121; and GNI Table Q6, p. 138.

There are several possible reasons why the program achieved fewer of its planned PY5 MW savings. These include:

- Low uptake of appliances, HVAC, and refrigeration equipment measures
- *No uptake of agricultural measures, as these were not marketed to customers until mid-year*
- Differences between reported and installed specifications for lighting measures

These are discussed in further detail in *"PY5 Final Annual Report."*

Program Delivery

Through the Prescriptive Equipment Program, PPL Electric provides rebates and incentives for nonresidential customers who install equipment from a list of specific energy-efficiency measures and services. The Prescriptive Equipment Program has three delivery channels:

- **Standard Path (Prescriptive) Measures.** Customers purchase energy-efficient equipment and submit their rebate application to PPL Electric. For lighting retrofits, customers or the commercial and industrial (C&I) implementer also submit the 2013 Pennsylvania Technical Reference Manual (TRM) Appendix C. For new construction lighting, customers or the C&I implementer also submit TRM Appendix E. For motors, customers or the C&I implementer also submit TRM Appendix D.
- **Direct Discount Measures.** This is a separate delivery channel designed to make it easier and more economical for small businesses and institutions to have a contractor evaluate and install energy-efficient lighting and commercial refrigeration upgrades. The contractor completes and submits the required paperwork and gets the incentive.
- **Agriculture Standard Path Measures.** These audits and measures are specific to farms in PPL Electric's service territory. This includes farms with a residential rate class and nonresidential rate class.

Table 4 lists the number of projects completed in PY5 by program delivery channel. In PY5, no measures were rebated through the Agriculture Standard Path program delivery channel and only a handful of non-lighting measures (e.g., motors and variable frequency drives [VFDs]) were rebated.

Table 4. Number of Completed PY5 Projects by Delivery Channel

	Standard Path	Direct Discount	Agriculture Standard Path
Number of Completed Projects	996	1,352	0

In PY5, the Cadmus team revised process flow maps diagramming roles and responsibilities and program activities for the standard program and direct discount delivery channels. Through the standard program, customers install efficient equipment and apply for a rebate after the equipment has been installed. Through direct discount, contractors recommend efficient equipment upgrades to customers and receive the rebate, and the savings are passed to the customer so that the customer pays a lower

upfront cost. **Figure 23** through **Figure 25** (at the end of this chapter) diagram the application process for the Prescriptive Equipment Program. **Figure 26** through **Figure 28** show the application process for the direct discount delivery channel.

Program Changes and Outcomes

PPL Electric made a number of changes to the Prescriptive Equipment Program from Phase I to Phase II, including:

- Creating separate prescriptive equipment programs for nonresidential customers and residential customers. In Phase I, the Efficient Equipment Program offered rebates to residential and nonresidential customers for prescriptive equipment measures.
- Conducting very limited marketing of program rebates in order to avoid oversubscription.
- Streamlining rebate offerings and eliminating rebates for equipment with low participation rates in Phase I.
- Adding energy audits and incentives for agricultural customers. (There was no uptake of these measures during PY5, but PPL Electric expects to receive rebate applications for agricultural measures in PY6 and PY7.)
- Adding a program requirement that customers must submit applications within 180 days of project completion to minimize freeridership and better track program participation.
- Adding preapproval requirement to ensure eligibility prior to beginning project work.
- Expanding the direct discount option to include all nonresidential customers. (For example, PPL Electric targeted schools during PY5.)

One of PPL Electric's main goals for Phase II is to improve tracking of participation, spending, and savings. With improved tracking, PPL Electric can manage program participation rates and avoid program oversubscription. PPL Electric plans a "slow and steady" pace for applications during Phase II to closely track program participation.

To support this pace, PPL Electric conducted limited marketing in PY5. This strategy may have led to low participation rates for non-lighting measures; however, the program is meeting its planned savings through lighting projects. Also, the program staff and implementer interviews indicated that trade allies have remained engaged, a new network of agricultural trade allies has been established, and non-lighting and agricultural measure participation is expected to increase in PY6.

In PY6, the Prescriptive Equipment Program will require preapproval of all applications in order to further improve tracking and forecasting of program participation, spending, and savings.

Program Tracking and Realization Rates

This section summarizes factors affecting the Prescriptive Equipment Program's realization rates during PY5 and PPL Electric's systems and processes to track data and monitor the program. This section focuses on lighting measures because they account for the majority of savings for the program.

The EEMIS program tracking records contained all the data needed to conduct the impact evaluation. Cadmus did not uncover any significant errors or omissions. There were no *ex ante* adjustments.

Factors affecting realization rates fall into one of two categories:

- Miss-application of Technical Reference Manual (TRM) requirements
- Differences between measure and project specifications and actual conditions

TRM requirements for data sources vary with project change in connected load and anticipated energy savings. For example, projects with a change in connected load less than 20 kW use whole-building lighting hours, while all others use site-specific hours by usage group; in some projects both whole-building and site-specific hours were observed.

Corrections made to measure specifications include fixture counts, fixture types, presence or absence of *space cooling, building type and associated lighting hours of use.*

Overall the effect of the corrections was small as captured by the realization rates of 93% for MWh and 94% for MW.

Satisfaction

Satisfaction with PPL Electric

Survey respondents reported high overall satisfaction with PPL Electric as a provider of electric service. Eighty-five percent of direct discount participants and 77% of standard path (customer prescriptive rebates) participants rated their satisfaction as 8 or higher (on a 10-point scale, with 10 *outstanding* and 1 *unacceptable*). This is a slight decrease in satisfaction levels reported in PY4 for direct discount respondents (89%) but an increase for the standard program participants (73%).

The respondent opinions of PPL Electric improved *somewhat* or *significantly* as a result of the program. The opinions of customers participating in the standard program delivery channel improved slightly *more than those participating in the direct discount channel* (**Table 5**). *Only one direct discount* respondent said his opinion of PPL Electric *decreased somewhat* because of participation in the program.

Table 5. Changes in Opinion of PPL Electric as a Result of the Program

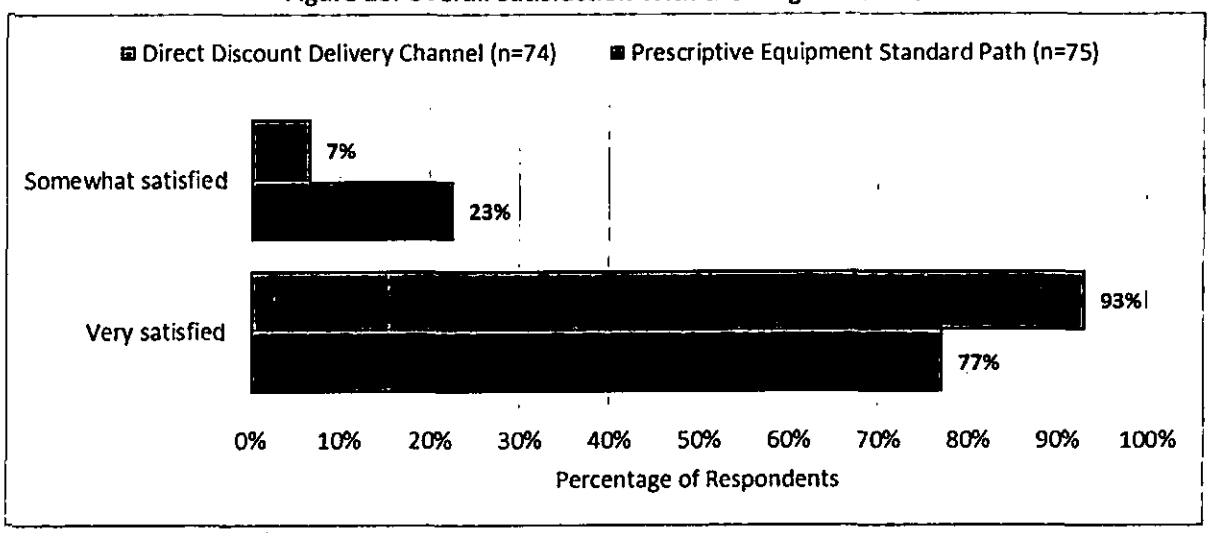
Survey Group	Improved Significantly	Improved Somewhat	Has not Changed	Decreased
Standard Channel (n=70)	14%	41%	44%	0%
Direct Discount Channel (n=75)	16%	29%	53%	1%

Source: Questions K2 and L2. "Since participating in the program has your opinion of PPL Electric...?"

Program Satisfaction

Overall satisfaction with the Prescriptive Equipment Program among PY5 respondents is high. All respondents were either *very satisfied* or *somewhat satisfied* with the overall program (**Figure 18**). The percentage of direct discount delivery channel respondents satisfied with the program was higher than standard path (customer prescriptive rebates). Ninety-three percent of respondents in the direct discount channel ranked their satisfaction as *very satisfied* compared with 77% for the standard path (customer prescriptive rebates).

Figure 18. Overall Satisfaction With the Program in PY5



Source: Questions E1f and K1f. "How satisfied are you with your program experience overall? Would you say...?"

Compared to PY4, respondents reporting they were *very satisfied* with the program overall fell slightly, from 94% to 93% for the direct discount channel and from 85% to 77% for the standard program path. Additionally, the proportion of respondents reporting they were *not satisfied* in the program also dropped compared to PY4, from 1% to zero for the direct discount channel and from 3% to zero for the standard program path.

In PY5, Cadmus changed how it asked respondents to rate their satisfaction with the program. We moved from the 10-point rating scale used in PY4 to a four-point word scale, in which participants were asked to rate their satisfaction as *very satisfied, somewhat satisfied, not too satisfied,* or *not satisfied at all.* To compare results between PY4 and PY5, we treated ratings of 8, 9, or 10 in PY4 as equivalent to the *very satisfied* category in PY5.

Standard Program Delivery Channel Components

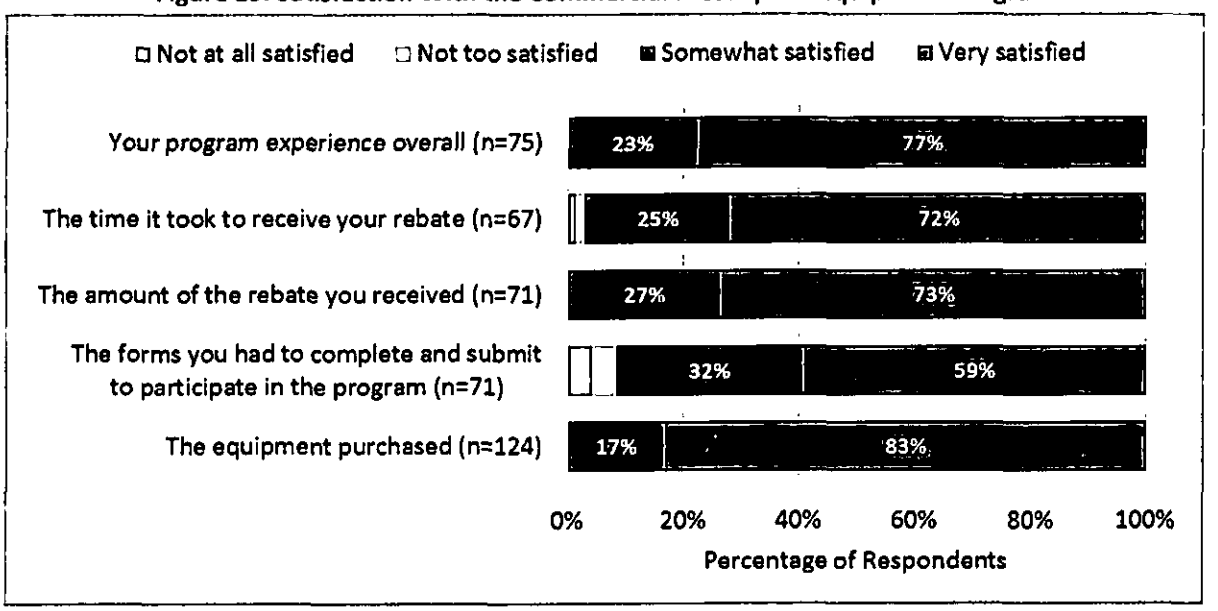
Lighting customers participating in the standard program delivery channel were generally *very satisfied* with individual components of the Prescriptive Equipment Program. No surveys were completed with participants who received non-lighting rebates. **Figure 19** shows the differences in participant experiences across various aspects of the program. Participants were most satisfied with the equipment they purchased—83% reported they were *very satisfied* with this aspect of the program—and less

satisfied with the application materials they had to complete to participate (only 59% of respondents reported they were *very satisfied)*. This aspect of the program had the largest number of respondents (4%) who said they were dissatisfied.

This finding is not altogether surprising because application requirements are a common source of dissatisfaction in prescriptive rebate programs. Further, in Pennsylvania, large lighting projects are required to include a completed TRM Appendix C lighting calculator, which requires a thorough understanding of the lighting technologies replaced and installed through the program. Thus, customers with large projects may have more difficulties and challenges with the process.

This supposition is supported by a review of reported project savings. The average reported kWh savings of projects where customers indicated they were *somewhat satisfied* or *very satisfied* with the application materials they completed to participate was 22,260 kWh, while the average reported kWh savings of projects where customers indicated they were *not too satisfied* or *not at all satisfied* with the application materials they completed to participate was 43,628 kWh.

Figure 19. Satisfaction With the Commercial Prescriptive Equipment Program



Source: Question E1. "How satisfied are you with...?"

Although most respondents reported they were *very satisfied* or *somewhat satisfied* with their program experience, eight respondents (approximately 11%) said they were dissatisfied with some aspect of the program. When asked why they were dissatisfied (reporting either *not too satisfied* or *not at all* satisfied), the two most common reasons cited were:

- Difficult and time consuming application paperwork; and
- Uncertainty around the status of submitted application materials.

Respondents did not mention the amount of the rebate as a source for dissatisfaction; this was a common source of dissatisfaction reported in the PY4 survey.

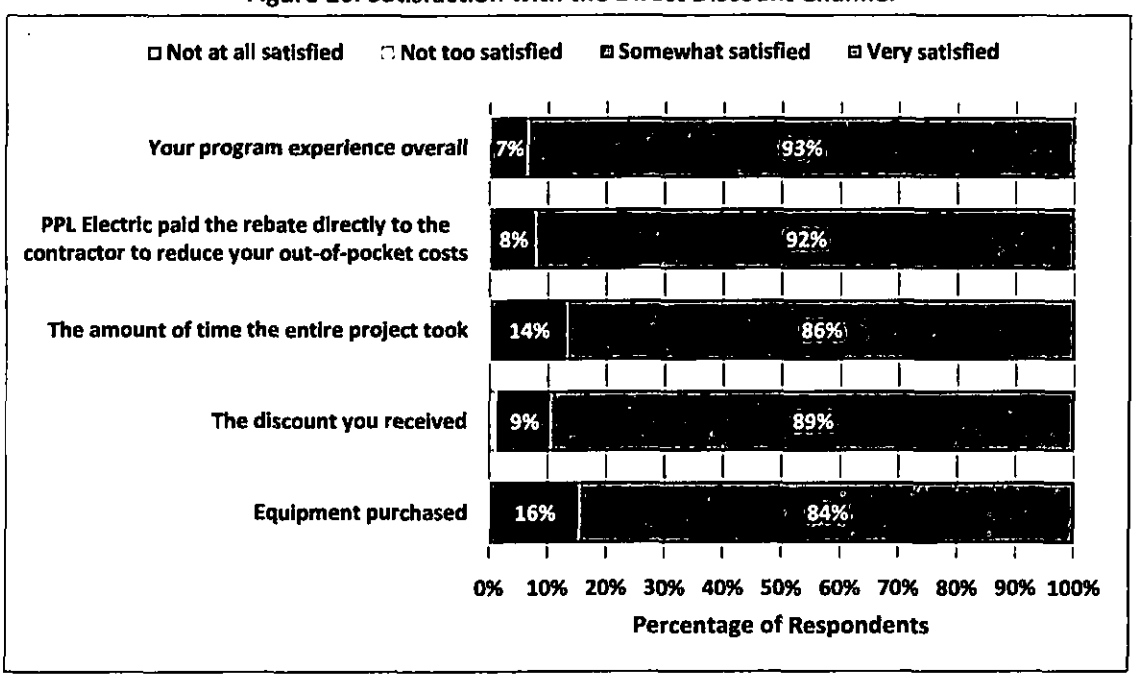
Direct Discount Delivery Channel Components

Every customer who participated in the direct discount delivery channel was satisfied (*very satisfied* or *somewhat satisfied*) with the option to have PPL Electric pay the rebate directly to the contractor and, *therefore, reduce the customer's upfront costs. A clear majority of respondents (92%) reported being very satisfied* with this aspect of the program, and it was the highest rated individual program component. In addition, participants reported high levels of satisfaction with these components:

- The overall length of time the project took
- The discount received
- The equipment they purchased and installed

Figure 20 presents the differences in participant experiences across components.

Figure 20. Satisfaction with the Direct Discount Channel



Source: Question K1. "How satisfied are you with...?" Equipment purchase n=121, all other bins n=75.

In PY4, customers expressed dissatisfaction in the performance of equipment, observable energy savings, and the professionalism of the installation contractor. These issues did not resurface in PY5. There were a very small number of respondents who did not have a positive experience with their contractor this year (see discussion below in Satisfaction With the Energy Assessment and Satisfaction With Contractor).

Direct Discount Energy Assessment

Participants in the direct discount delivery channel received a free energy assessment of their facility as part of participation. Cadmus asked participants a variety of questions pertaining to the energy assessment to understand their experience and to explore the value and effectiveness of the assessment. In general, participants reported high levels of satisfaction with the assessment.

Satisfaction With the Energy Assessment and Satisfaction With Contractor

Over 98% of respondents reported being *very satisfied* or *somewhat satisfied* with all aspects of the assessment, including:

- Quality of the assessment
- Recommendations from the assessment
- Clarity of information received about services and qualifying equipment offered through the direct discount channel

Respondents also rated their satisfaction with their installation contractor. Ninety-nine percent of respondents reported they were *very satisfied* or *somewhat satisfied* with their overall experience working with the contractor, and only one respondent reported any level of dissatisfaction. When asked about the contractor's quality of work, only one respondent reported dissatisfaction. Another respondent reported some dissatisfaction with easily finding a direct discount contractor.

Importance of Energy Assessment

The vast majority of direct discount participants indicated that the free energy assessment was important in their decision to complete a lighting retrofit; 96% of respondents reported it was *very important* or *somewhat important*. Only three people reported the assessment was *not too important* in their decision. This finding is in line with the PY4 participant survey findings in which 98% of respondents reported it was *very important* or *somewhat important* in their decision.

Further, responses indicate auditors are effectively communicating critical information on the opportunities to save energy as well as the payback period—both of which are important considerations in customer decision-making. For example, 93% of direct discount participants reported the auditor told them how much energy pursuing the recommended retrofits might save, and 83% reported this information was *very important* in their decision to implement the recommendations. Seventy-five percent of respondents reported information on payback periods was *very important* in their decision.

Implementation of Recommended Measures

Cadmus asked direct discount participants if they implemented all of the auditor's recommendations. Most respondents (88%) implemented all of the recommendations, and 11% implemented some but not everything. One respondent did not recall receiving a free energy audit. In the PY4 survey, only 82% of respondents reported implementing all recommendations.

Benchmarking Against Other Programs

Cadmus compared PPL Electric's measure offerings and rebate amounts to offerings from other Pennsylvania electric distribution companies (EDCs). We also reviewed the preapproval process impacts at other programs.

Prescriptive Measures – Lighting

Cadmus compared the prescriptive lighting incentive structure and rebate amounts from information available on the Pennsylvania EDC websites for business customers (referred to as C&I and government, nonprofit, and institutional [GNI] customers). We used the rebate catalogs and calculators that are available to business customers on the EDC websites. This section discusses the results of our comparison.

PPL Electric's lighting incentives reflect changes in the lighting market resulting from the recent federal *regulations described here:*

- **The Energy Information and Security Act of 2007 (EISA).** EISA established efficiency standards for general service lamps (the common medium screw base bulb) sold in the United States that went into effect nationally in 2012. Although EISA does not ban incandescent light bulbs, its legislation has contributed to an industry shift toward more efficient lighting technologies such as energy-efficient incandescent, halogen, compact fluorescent, and LED lamps, with halogen lamps being the least efficient and the closest replacement for incandescent lamps.
- **U.S. Department of Energy (DOE) Rulemaking on T12s.** DOE Rule 10 CFR Part 430, effective July 14, 2012, specified efficiency standards for linear fluorescent lamps. Most T12 four-foot and two-foot U-shaped lamps fail to comply with the DOE rule.[10] The primary impact of this rule has been the retrofit of T12 lamps to T8 lamps. (Therefore, it can be argued that utility programs that offer incentives for the retrofit of T12 lamps with regular T8 lamps are no longer necessary.)

However, not all other Pennsylvania EDCs incentives reflect market changes related to these regulations. For example, PPL Electric is the only EDC that does not offer incentives for CFLs to its C&I and GNI customers. Here are other differences Cadmus found when comparing PPL Electric's offerings against other EDC offerings:

- Consistent with the market shift resulting from EISA, PPL Electric does not offer incentives for switching from incandescent lamps to energy-efficient incandescent, halogen, or CFLs. The FirstEnergy companies are the only companies that still offer incentives for switching from incandescent lamps to energy-efficient incandescent and halogen. The FirstEnergy companies, PECO and Duquesne Light, offer incentives for incandescent retrofits with CFL lamps and fixtures.

[10] Only a few very high lumen rare earth phosphor lamps comply. Lamps with a color rendering index greater than 87 are exempt from the rule.

- PPL Electric goes beyond DOE's new standard by offering incentives for retrofitting T12 lamps with high performance (HP) T8 lamps.[11] PPL Electric and PECO are unique in requiring further performance qualifications from the T8 retrofits. In addition to accepting HP T8 lamps, PECO accepts reduced wattage (RW) T8 lamps for T12 retrofit incentives.[12] Other EDCs are still rebating standard T12-to-T8 retrofits.
- When replacing T8 lamps with T8 lamps, most EDCs require a reduction in wattage, but PPL Electric requires only that the retrofit lamps meet the specifications for HP T8 lamps, which does not necessarily result in a reduction in wattage (for example, both standard T8 and HP T8 lamps can have a nominal wattage of 32 watts). By contrast, PECO does not offer incentives to retrofit T8 lamps with T8 or HP T8 lamps—the retrofit lamp must be a RW T8 lamp. Cadmus investigated this issue for PPL Electric's program by reviewing its PY5 EEMIS data and found that in T8-to-T8 retrofit projects (involving the same number of lamps before and after retrofit) only a small number of T8 lamps (38) had a higher wattage per fixture than the lamps they replaced. This indicates that PPL Electric's choice of HP T8 lamps, as opposed to RW T8 lamps, for the incentive does not result in increased wattage for the vast majority of projects.
- PPL Electric is the only EDC that does not offer incentives for CFLs in exterior applications; instead it promotes LEDs. Other EDCs offer incentives for CFLs, hardwired CFLs, metal halide lamps (ceramic or pulse start), and linear fluorescents with electronic ballast for exterior applications. Although LEDs are better suited for cold weather exterior applications, there is anecdotal information that LEDs and CFLs still compete closely for exterior applications in price, lighting quality, and availability.[13]
- Under Duquesne Light's programs, customers can combine delamping incentives with the linear fluorescent incentives but PPL Electric's programs do not allow this. The FirstEnergy companies and PECO do not offer any delamping incentives.
- PPL Electric requires either an ENERGY STAR or Design Light Consortium listing for LED lighting fixtures and an ENERGY STAR listing for screw base LED bulbs. This requirement is consistent with Duquesne Light and PECO offerings. The FirstEnergy companies do not require any qualifications for LED fixtures or lamps.

Rebate Amounts

- The LED incentives offered by PPL Electric on a per-lamp basis are less than those offered by Duquesne Light (we cannot compare the incentive amounts with other EDCs since they are

[11] HP T8 lamps must meet the Consortium for Energy Efficiency's (CEE's) specifications. Available online at: http://library.cee1.org/content/cee-high-performance-t8-specification

[12] RW T8 lamps must meet the CEE's specifications. Available online at: http://library.cee1.org/content/reduced-wattage-t8-specification

[13] This information is based on conversations with Cadmus colleagues and their discussions with manufacturers.

based on reduced wattage or kWh). For example, for LED PAR lamps, Duquesne Light offers up to $14 per lamp, whereas PPL Electric caps the incentive amount at $5.

- *PPL Electric has more generous incentives for exit signs than the other EDCs.*
- The maximum incentive amount for control sensors offered by PPL Electric (up to $45 per sensor) is higher than the other EDCs, which offer a maximum of $35 to $38 per sensor.

Lighting Incentive Structure

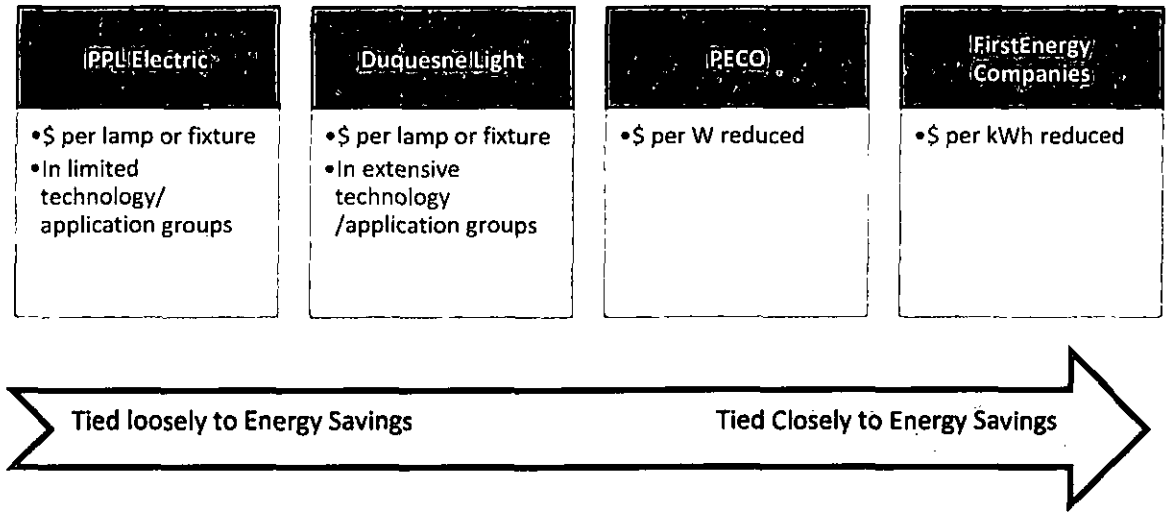
The variety of incentive structures used by the EDCs reflects their attempts to strike a balance between closely matching the incentive to the energy savings resulting from the retrofit and devising an incentive structure that utility customers can easily understand. This is particularly true for lighting measures—the diversity of energy-efficient technologies, products, and wattages available for a single lighting application makes it challenging for utilities to design an incentive structure that balances these two needs.

The FirstEnergy companies have set an incentive structure at $0.05 per kWh (with the exception of exit signs and controls), which is closely tied to the energy savings expected from the retrofit. PECO's incentive structure is based primarily on the number of watts reduced. Duquesne Light and PPL Electric's incentive structures are tied to the number of fixtures or lamps replaced and, as such, are indirectly tied to the energy savings expected from the retrofit. **Figure 21** presents a schematic range of EDC rebate structures by how closely they are tied to the energy savings expected from each lighting retrofit.

Duquesne Light's incentives are laid out in extensive technology/application groupings. By contrast, PPL Electric offers incentives that are based on a simple one-page table laying out the amount of incentive per lamp or per fixture for various technologies. For example, there are 38 different linear fluorescent rebate categories based on lamp type, wattage, the number of lamps, the length of the fixture, and ballast type in Duquesne Light's rebate catalog. By contrast, PPL Electric's linear fluorescent rebate amounts are offered in five categories and are much easier to navigate.

All EDC commercial lighting customers must fill out a TRM Appendix C calculation as part of the lighting incentive application, which computes the expected annual energy savings. By the end of the application process, both the customers and the EDCs will have documentation of the expected energy savings. However, PPL's incentive structure and its simplicity allows for an easy upfront estimate of the rebate expected and a comparison of the rebate amount expected for different efficient technologies that may be suitable for a single retrofit project.

Figure 21. The EDCs Lighting Retrofit Rebate Structure in the Order of How Closely They Are Tied to the Energy Savings Expected from the Retrofit



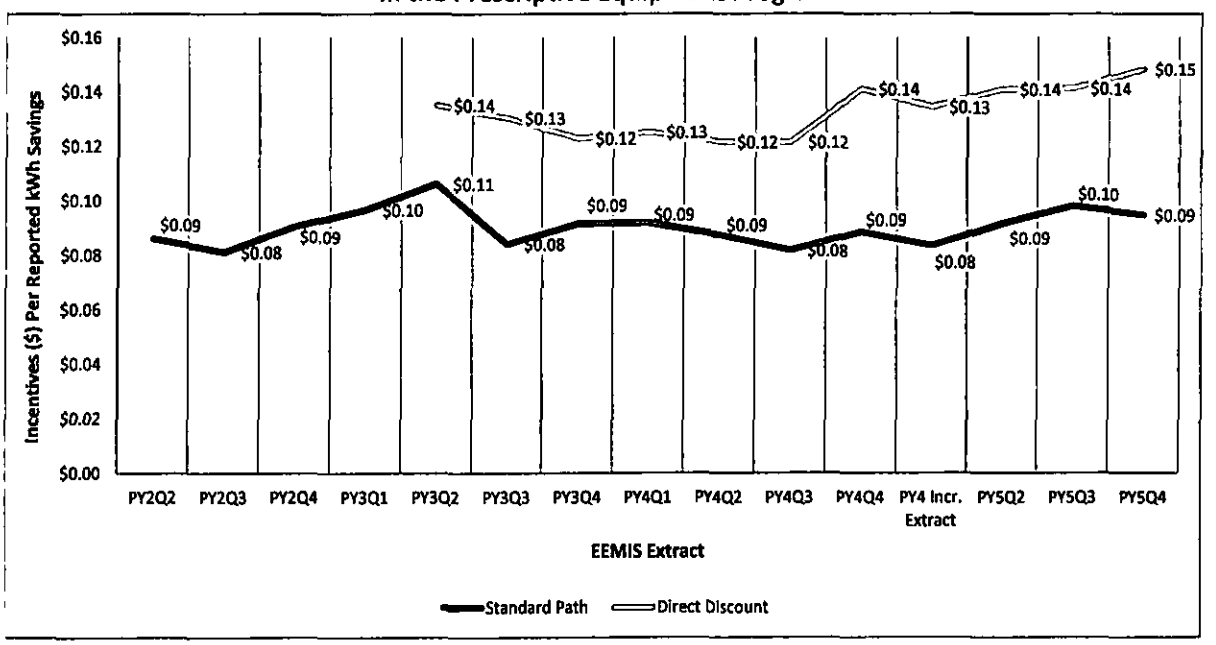
A spot-check review of incentive structures in other prescriptive lighting retrofit programs shows that incentive structures similar to PPL Electric and Duquesne's ($ per lamp or fixture) are much more common than the per-kWh incentive structure. Per-kWh incentive structures, on the other hand, are common in new construction or custom programs. **Table 6** shows a comparison of custom program lighting incentive amounts for PPL Electric, other EDCs, and a handful of other utilities.

Table 6. Custom Program Lighting Incentive Amounts among EDCs and a Selection of Other Utilities

Utility	Program Name	Custom Lighting Incentive Amount (per kWh)
PPL Electric	New Construction Interior and Exterior *Lighting*	$0.10 based on reduction from the ASHRAE 90.1 building energy code
EDCs		
Duquesne Light	Custom or Calculated Incentives	No information
PECO	*Custom Incentives (lighting)*	$0.08
FirstEnergy	Custom Incentives (lighting)	$0.05
Other		
NYSERDA	Electric Efficiency Performance-Based Incentives for Existing Facilities Program (lighting)	$0.12 (upstate NY) $0.16 (downstate NY)
Commonwealth Edison - Illinois	Custom Projects (may include lighting)	$0.07
PacifiCorp - Washington	Incentives for lighting (new construction/major renovation)	$0.08

Cadmus reviewed the amount of incentives PPL Electric's Prescriptive Equipment Lighting Program paid per reported kWh in PY2 through PY4. **Figure 22** shows the results by quarter (PY1 and PY2 data are excluded due to lack of reliable total energy savings data per project in the EEMIS system).[14] The yellow line shows the incentive amount per kWh savings averaged across individual projects in each quarter. [15] The blue line shows the total incentive amounts per total kWh savings in each quarter. The values shown by the blue line are consistently lower than the values shown by the yellow line because a few *small, lower savings projects are driving the high project-level incentive amount.*

Figure 22. Incentive per kWh paid by PPL Electric to Lighting Projects in the Prescriptive Equipment Program



[1] The PY4 Q4 incremental extract is abbreviated as 'PY4 Incr. Extract' in figure above.

The data show that PPL Electric's per-lamp or per-fixture incentive structures are equivalent to a per-kWh incentive of $0.10 to $0.15 per kWh. This amount is two to three times as much as the FirstEnergy companies are offering ($0.05 per kWh) on a per-project basis.

The custom incentive amounts included in **Table 6** on the previous page allow for further comparison of PPL Electric's prescriptive equivalent per-kWh incentive amounts with its custom lighting incentive offering for new construction projects and what other utilities offer for custom lighting retrofit projects. PPL Electric's prescriptive incentive amounts overall are equivalent to $0.10/kwh, and in-line with what

[14] The program started in PY2, but the PY2 data in the EEMIS database do not contain accurate total kWh savings because the Pennsylvania TRM Appendix C was not consistently or correctly filled in with the rebate applications during that period.

[15] An individual project corresponds to a unique CSPJOBNO. One premise can have several projects.

other utilities offer to custom lighting projects, but on a per-project basis incentives are equivalent to $0.15/kWh, which are about one and half times higher than what others offer to custom lighting projects.

Prescriptive Measures – Non-Lighting

Similar to the comparison of lighting measures, Cadmus reviewed the incentive structure and amounts offered by PPL Electric for non-lighting measures to those offered by other Pennsylvania EDCs.

HVAC

PPL Electric's HVAC incentives are limited to heat pumps (air-source, geothermal ground-source, and ductless mini-splits). As of PY6, the ground-source heat pump incentive is offered to GNI customers installing systems less than 65,000 Btu, though PPL Electric has stricter eligibility requirements in PY6 than in Phase I to ensure only ground-source systems that the Pennsylvania TRM algorithms apply to receive these rebates. Incentives for more complex ground-source heat pump systems are available under the custom program.

In general, PPL Electric's incentives for air-source heat pumps start at one energy efficiency rating threshold higher than those offered by the FirstEnergy companies and one energy efficiency rating threshold lower than those offered by PECO. In addition to air-source heat pump measures, PECO offers incentives for air conditioners, water-source heat pumps, and packaged terminal system replacements. The FirstEnergy companies offer incentives for all of these measures, plus unitary/split HVAC systems and chillers. Duquesne Light does not offer any HVAC incentives.

Variable Frequency Drives (VFDs)

Duquesne Light offers incentives for VFDs on chilled or hot water pumps, on HVAC fans, and on air compressor motors. PECO and FirstEnergy companies also provide incentives for VFDs. PPL Electric is unique in that it does not offer any incentives for VFDs in its prescriptive program; customers can apply for VFD rebates under the custom program.

Appliances and Equipment

In the appliance and equipment category, PECO is the only EDC that does not offer any appliance or equipment incentives to business customers. PPL Electric offers incentives for commercial reach-in refrigerators, ice makers, and steam cookers that meet ENERGY STAR requirements—a fairly limited selection compared to the FirstEnergy companies and Duquesne Light—and the incentive amounts for these measures are less than those offered by other EDCs. In addition to these measures, First Energy and Duquesne Light also offer rebates for freezers, hot food holding cabinets, combination ovens, fryers, griddles, pre-rinse spray valves, commercial water heaters, commercial clothes washers, and office equipment.[16]

[16] PPL Electric offered incentives for many of these measures in Phase I. The savings from these measures constituted a small portion of the overall portfolio savings.

Based on PY5 data reviewed by Cadmus, participation in appliance and equipment measure incentives was low (only three customers received incentives for ice makers). Another reason for the low participation may be lack of awareness about the program in the C&I customer segment; PPL Electric conducted limited marketing for the non-lighting incentives during PY5.

Refrigeration Retrofits

In the refrigeration retrofit category, PPL Electric, PECO, and Duquesne Light offer incentives for electronically commutated motor retrofits for shaded pole and permanent split capacitor motors for evaporator fan motors in walk-in and reach-in refrigerators/freezers. PPL Electric also offers incentives for replacing shaded pole motors with permanent split capacitor motors in evaporator fans for reach-in refrigerators and freezers, which are not offered by PECO or Duquesne Light. PPL Electric's incentives per unit for evaporator fan motor retrofits increase based on the size of the motor, which is also different than PECO and Duquesne Light.

Duquesne Light's refrigeration incentives are much more extensive than both PPL Electric and PECO. In addition to the evaporator fan motor retrofits, Duquesne Light also covers night covers, strip curtains, door gasket replacement, anti-sweat heaters, and vending machine controllers.[17] The FirstEnergy companies have the most limited refrigeration retrofit incentives, covering only strip curtains and vending equipment controllers.

Application Preapproval

In PY6, PPL Electric began requiring all projects under the Prescriptive Equipment Program to obtain preapproval before starting project implementation so it can more accurately track program impacts and avoid program oversubscription. Cadmus reviewed several other utility programs that contain a preapproval component to identify challenges and possible solutions that may benefit PPL Electric program staff and implementers.[18]

Cadmus found that preapproval is more typical of custom incentive programs and not very common among prescriptive incentive programs. Wisconsin Focus on Energy's Business Incentive Program requires preapproval for all prescriptive projects over $25,000. Some of these custom program experiences may be relevant to PPL Electric's prescriptive program.

Utilities Reviewed

Cadmus reviewed these utilities' programs:

- Focus on Energy – preapproval process for custom and prescriptive projects
- Georgia Power – preapproval process for custom projects

---

[17] PPL Electric offered incentives for many of these measures in Phase I. The savings from these measures constituted a small portion of the overall portfolio savings.

[18] The Cadmus team reviewed findings from process evaluation reports and interviews with program staff from prior evaluations (all conducted by Cadmus).

- PacifiCorp/Rocky Mountain Power – preapproval process for custom projects
- Southern California Edison – preapproval process for custom projects
- NYSERDA – preapproval process for custom projects
- Xcel Energy (Colorado and Minnesota) – preapproval process for custom projects

Challenges with Application Preapproval Processes

Program managers identified these challenges with the preapproval process:

- The application process was slow and burdensome for the customer or the trade ally.
- Some customers or trade allies reported that requests for information were redundant, taking place during both the preapproval stage and the application stage.
- Some customers or trade allies indicated that they would like improved communication about project status.
- Follow-up for incomplete applications was not smooth, often requiring multiple interactions with the utility staff or implementers and sometimes with different contact people.
- The internal review process was lengthy and resource intensive; some utility staff expressed a need to balance the depth of the review with the benefit of reducing risk through the review.

Preapproval Times and Processes

Cadmus found large differences in the number of reviews required for preapproval of project applications. Although project applications would typically go through a minimum of one to two levels of reviews with program staff and/or implementers, certain projects at some utilities would trigger up to five reviews. Wisconsin Focus on Energy conducts a maximum of 10 reviews for preapproval of project applications.

Program managers who reported relatively efficient processing times (typically fewer than 20 days) received most project applications through an online application system and also had a large pool of technical reviewers available. Only one program manager indicated that management-level reviews were conducted for high-risk applications. All of the programs had quality assurance systems in place in which external engineering firms or state auditors reviewed randomly selected or complex projects.

Solutions to Improve Customer Experiences and Streamline the Preapproval Process

In the evaluations Cadmus reviewed, program managers said they focused primarily on the application form and the submittal step to improve participant experience and satisfaction and secondarily on reducing the overall processing time and communicating the project status to the applicant. Utilities used a variety of strategies to make the process smoother:

- **Redesigned the Application Forms.** Several program managers had recently redesigned and implemented the application forms and submission processes. They reduced the amount of information required from participants while still requesting sufficient data to assess a project for approval and support evaluation needs.

- **Provided Online Application Systems.** Several program managers who used Excel spreadsheets and PDF-based applications wanted to make it easier for applicants to properly complete the application forms for both prescriptive and custom incentives. They reported that most applications now go through online systems and that they have received very positive feedback from users. They require less time to process applications.
- **Implemented Internal Process Improvements.** To reduce overall processing times and customer wait times, program managers reported that they assign reviewers based on technology and project complexity, engaging external reviewers for projects exceeding risk thresholds. This method reduces the number of reviews needed before a project is approved.

Conclusions and Recommendations

The table containing the status of each recommendation is included in **Appendix A, Figure A-3** of the report titled *"PY5 Annual Report."*

Process Map for the Standard Prescriptive Equipment Program

Figure 23. Standard Prescriptive Equipment Program Customer Awareness

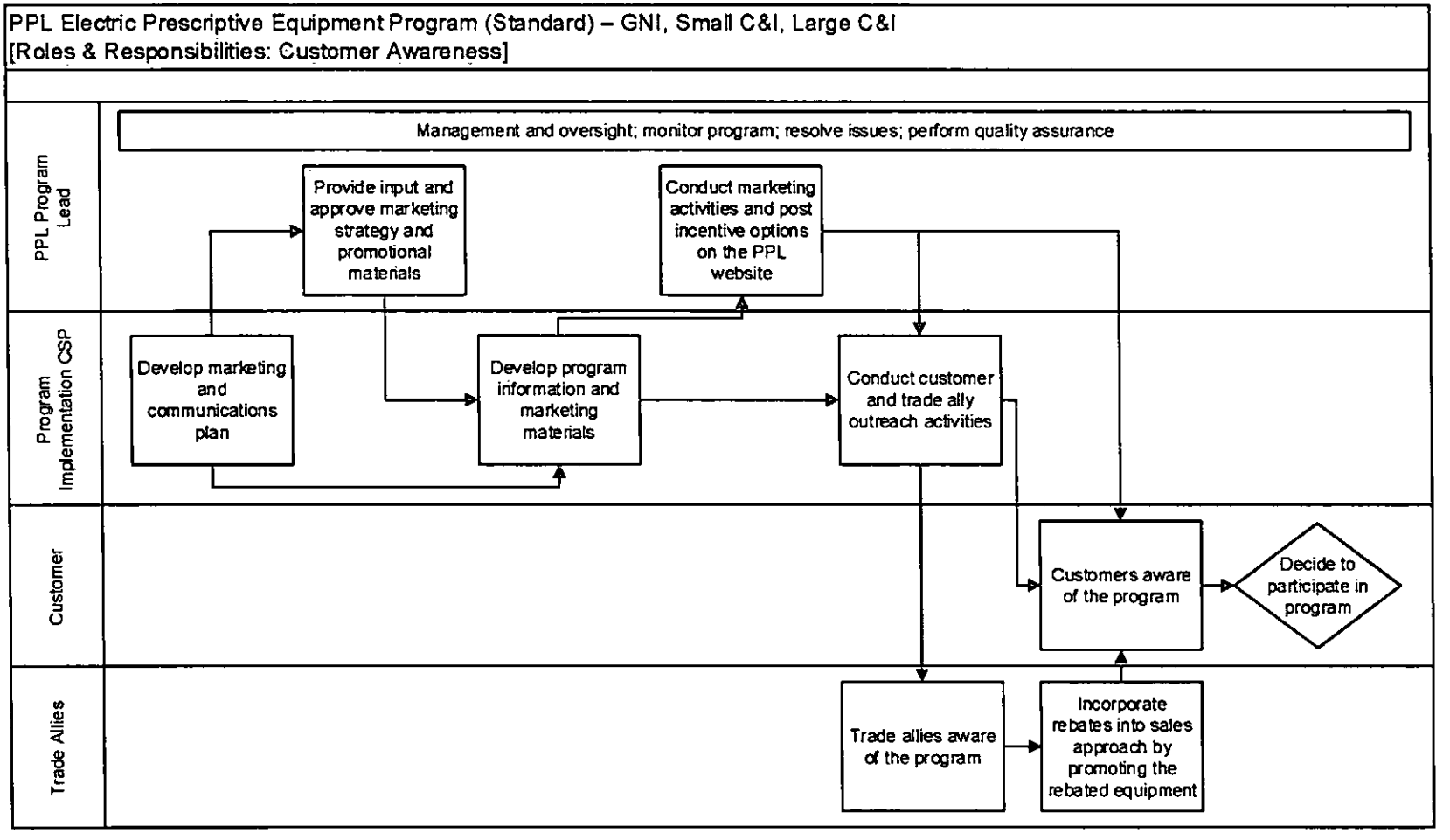
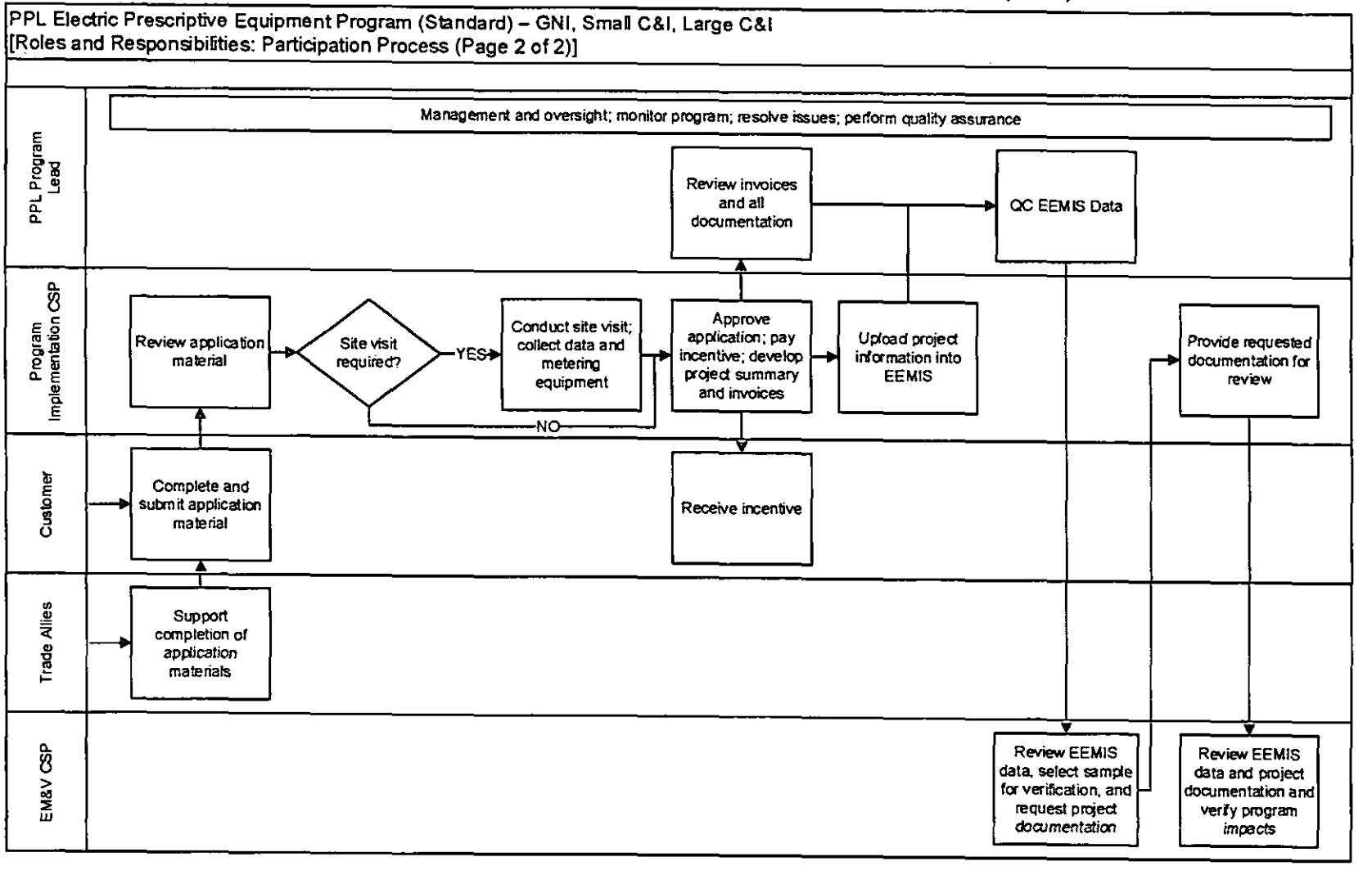


Figure 24. Standard Prescriptive Equipment Program Participation Process (1 of 2)

Figure 25. Standard Prescriptive Equipment Program Participation Process (2 of 2)



Process Map for the Direct Discount Offering

Figure 26. Direct Discount Prescriptive Equipment Program Customer Awareness

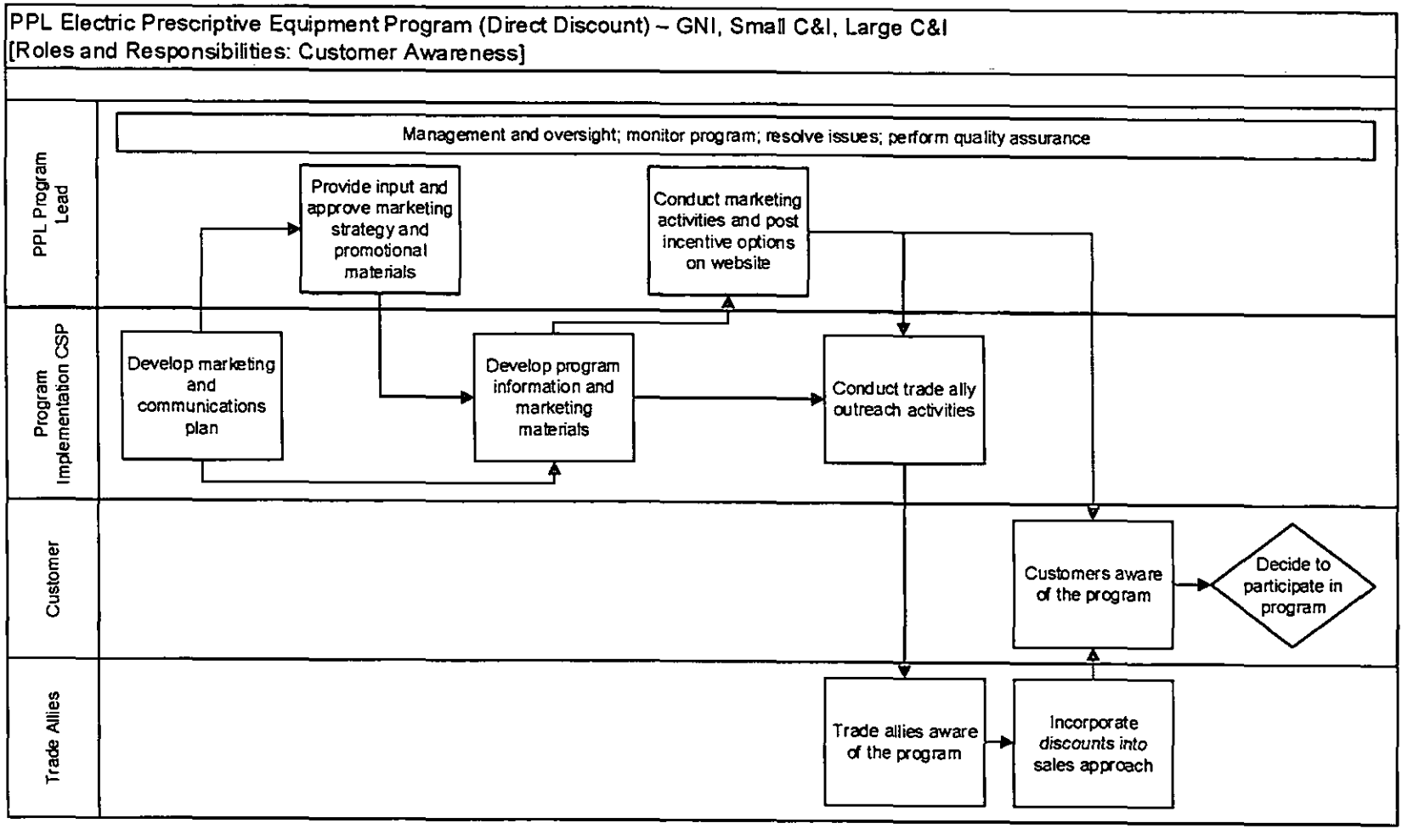


Figure 27. Direct Discount Prescriptive Equipment Program Participation Process (1 of 2)

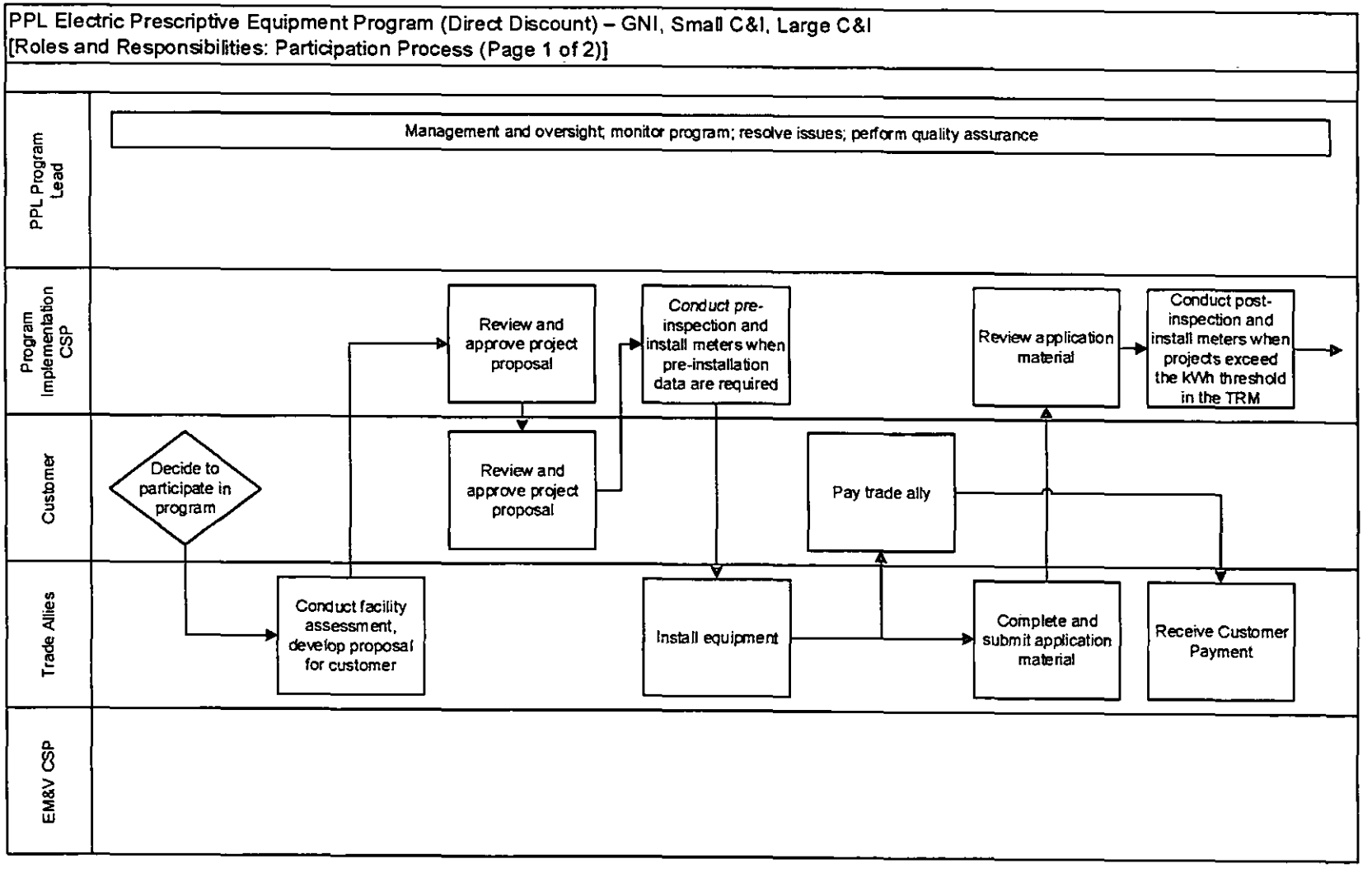
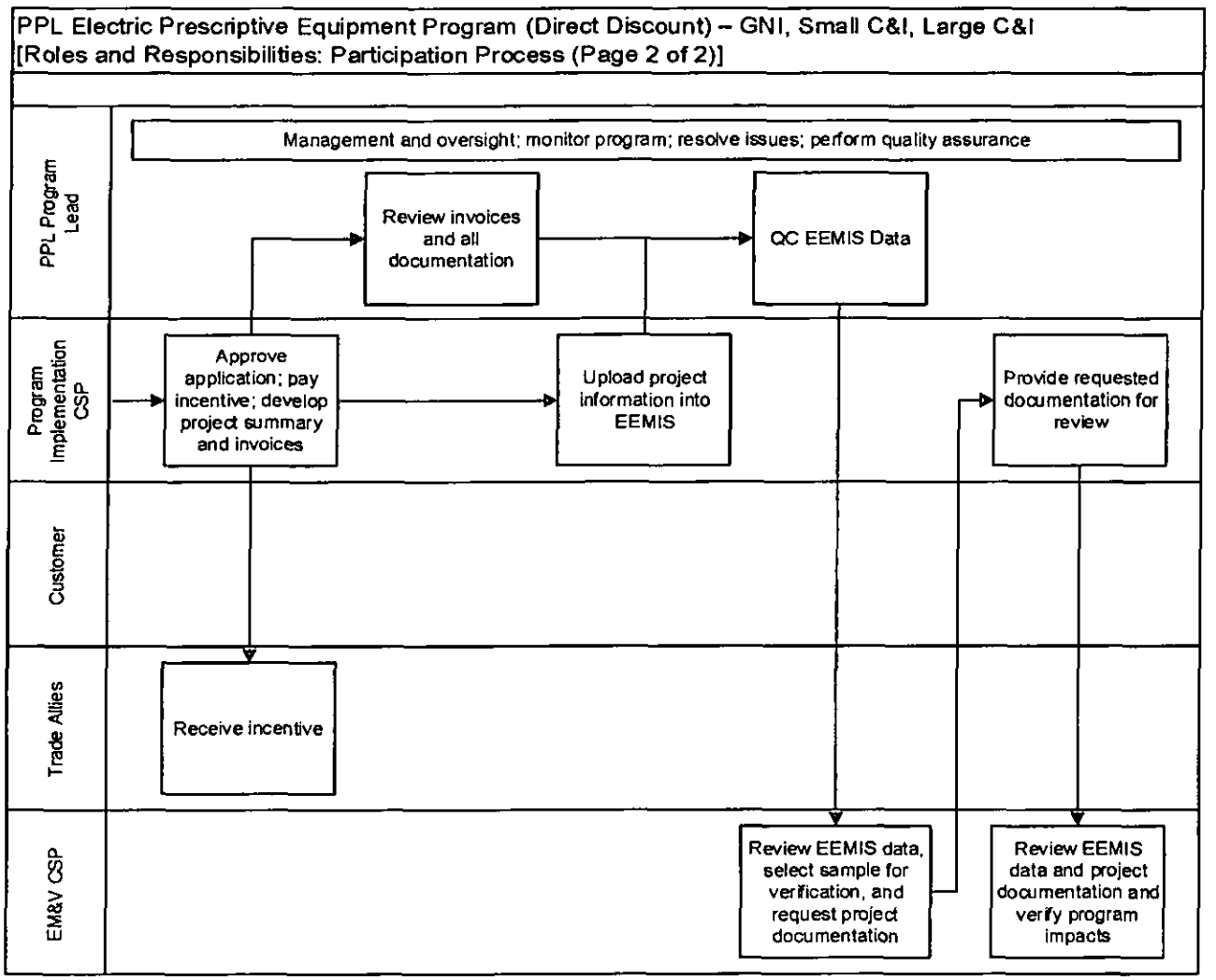


Figure 28 . Direct Discount Prescriptive Equipment Program Participation Process (2 of 2)



Appliance Recycling Program

For PPL Electric's Appliance Recycling Program (ARP), Cadmus conducted these PY5 process evaluation activities:

- Participant surveys (n=140)
- Nonparticipant surveys (n=11)
- Program staff and implementer interviews (n=2)
- Program literature review and benchmarking
- Database and QA/QC review of records
- Process map review

Achievements Against Plan

In PY5, the program achieved 101% of its planned MWh/year savings,[19] 143% of its planned MW savings, and 102% of its annual participation target (**Table 7**).

Overall, the ARP exceeded its PY5 planned MWh/year savings, MW reduction, and participation targets. At the end of PY5 (May 31, 2014), ARP had achieved:

- 35% of its 26,243 MWh/year three-year planned savings
- 52% of its 3.59 MW three-year planned demand reduction
- 36% of its three-year participation target of 37,000 units

Table 7. Appliance Recycling Program Savings

	PY5 Verified Savings	PY5 Planned Savings	Percentage of PY5 Planned Savings	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/year	9,255	9,121	101%	26,243	35%
MW	1.86	1.3	143%	3.59	52%

Both the reported and verified demand savings for PY5 surpassed the planned savings, the reported savings by 37%, and the verified savings by 43% with the difference being primarily due to the line loss adjustment. However, the room air conditioner participation targets in PY6 and PY7 are half of the target in PY5. And since room air conditioners account for a disproportionate amount of demand savings (8% of total units recycled but 42% of verified demand savings), demand savings will likely decline in PY6 and PY7.

[19] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania Public Utilities Commission (PUC) on April 7, 2014, Table D7, p. 42

Program Delivery

Program staff reported that the ARP ran smoothly in PY5. Staff focused on working with the implementer, JACO, and monitoring program participation, with monthly updates, provided by JACO, on progress toward energy savings.

The Cadmus team reviewed a process flow map diagramming roles and responsibilities and program activities (see figures at the end of this chapter). **Figure 29** diagrams customer awareness, and **Figure 30** *shows the participation process.*

Program Changes and Outcomes

There were no substantial changes to delivery, eligibility, or design of the Appliance Recycling Program in PY5.

In light of PPL Electric's focus to closely monitor participation and savings, it developed a flexible marketing plan for PY5 that staff could adjust based on the program's progress. For example, program staff could scale back advertising if participation was on track to surpass goals but redeploy it if participation dropped too sharply. Staff reported that this flexibility was built in to maintain energy savings and, if necessary, help the ARP achieve additional savings if other programs were short of energy savings.

Program Tracking

This section summarizes factors affecting the ARP's realization rates during PY5, and PPL Electric's systems and processes to track data and monitor the program.

Cadmus found no discrepancies in the program tracking data, either in EEMIS or in the data provided by JACO. *EEMIS and JACO appear to have differing cutoff dates for when the quarters close so the tracking* data JACO provides consistently has records that are not in the same quarterly EEMIS extract. However, the units that do not match from JACO's records to EEMIS are consistently found in the subsequent quarterly extract.

The program achieved a 95% realization rate for energy savings and approximately 97% for demand savings. The appliance replacement rate was a significant factor leading to a realization rate of less than 100%.The program experienced a higher replacement rate in PY5 (84%) than in PY4 (63%). This increase was significant since the PY4 replacement rate was used to develop the PY5 *ex ante* estimates used for reported savings.

PPL Electric's systems for monitoring savings and participation on a monthly basis, combined with the decision to selectively deploy or scale back advertising when necessary, has resulted in savings and participation only slightly surpassing the planned energy savings for PY5. Additionally, at 35% of the three-year Phase II energy savings after PY5, the ARP is on track to meet the Phase II energy savings. Additionally, the demand savings are currently at 52% of the three-year planned savings. At this rate, the program could meet the demand savings by the end of PY6.

Satisfaction

The survey findings revealed that satisfaction with the ARP overall was high in PY5. Ninety-nine percent of respondents rated their overall satisfaction with the program as *very satisfied* or *somewhat satisfied*. Ninety-eight percent of respondents said they were either *very satisfied* or *somewhat satisfied* with JACO.

Two respondents (approximately 2%) indicated they were *dissatisfied* with the ARP for these reasons:

- *"They rush[ed] her to take the old [appliance] out."*
- *"They said they were going to call a cell phone and called the house phone."*

Ninety-seven percent of respondents reported receiving their incentive checks within six weeks. Only 2% reported waiting seven to eight weeks, and 1% waited longer than eight weeks. In PY4, dissatisfied customers reported issues such as trouble scheduling a pick-up, missing work for the pick-up, having to reschedule, or the incentive being too low. Respondents in PY5 did not mention these issues.

Marketing and Outreach

Cadmus asked participants in the customer survey how they heard about the ARP. The largest proportion (39%) of respondents heard about the program through PPL Electric bill inserts or newsletters. Respondents also reported learning about the program from word of mouth (16%), media outlets (15%), appliance retailers (12%), and PPL Electric's website (12%).

Customers Seeking Information

Cadmus asked survey respondents where they look for information about energy efficiency, and only 14% of respondents said they look to PPL Electric as a source for energy efficiency information. In contrast, the majority of respondents said they were more likely to look for information about energy efficiency from the news or media first (37%), followed by websites (26%) and manufacturer or product details (19%).

Benchmarking Against Other Programs

Cadmus reviewed program design and cost-effectiveness for many comparable appliance recycling programs.

Innovative Program Designs

Some of the innovative program design approaches implemented for other appliance recycling programs across North America have these characteristics:

- ***Targeted Marketing Campaigns.*** Commonwealth Edison (ComEd) implemented a direct mail campaign that involved sending personalized letters and coupons to customers it determined would likely have an appliance to recycle. ComEd identified "likely customers" using PRIZM software, which profiled past appliance recycling program participants in ComEd's database.

Through profiling, ComEd found past participants had higher education and income levels and were considered "empty nesters" in specific communities.

Another Mid-Atlantic utility used PRIZM software and customer demographics to target households that had active accounts for 15 years or more, reasoning that these households would have appliances that were older, on average, than households that were historically more likely to participate. During the year of the targeted marketing campaign, the average age of both refrigerators and freezers recycled through the program increased by five years and *resulted in a 19% increase in gross savings.*

- ***Inclusion of Multifamily Appliance Pick-Ups.*** Rocky Mountain Power and Pacific Power extended eligibility for their appliance recycling programs to apartment complex owners and managers who provided tenants with appliances. Renters were also eligible to participate as long as they owned the recycled appliance. Although bulk pick-ups can increase participation, they can also require additional outreach and logistical efforts from program and implementation staff. PG&E has also administered bulk pick-ups from multifamily and business customers.
- ***Inclusion of Free Energy Savings Kits.*** In an effort to increase savings from their appliance recycling program, Rocky Mountain Power and Pacific Power offered participants in Idaho, Utah, Washington, and Wyoming a free energy savings kit at the time of the appliance pick-up (and in addition to the financial incentive for recycling the appliance). The kits contained two 13-watt CFLs, a refrigerator thermometer card, energy-saving educational materials, and information on other residential efficiency programs. However, the incremental savings boost from this option will likely decrease as EISA continues to impact deemed savings values for CFLs.

PPL Electric's program currently allows multifamily property managers or owners to participate in the program, though it is not advertised.

Targeted marketing may not be as useful for PPL Electric's program as the savings are deemed in the TRM so there is no opportunity to increase savings within a given program year. However, if PPL Electric was not achieving savings early in the program phase, it could use targeted marketing to increase savings values for future years.

Additionally, as the ARP is meeting its planned savings, including energy savings kits currently offers little benefit. However, kits may be beneficial in future years if savings decline or the program is not cost-effective.

Program Cost-Effectiveness Results

As noted above, Pacific Power and Rocky Mountain Power (in Idaho and Utah) successfully reduced their program incentives from $40 to $30 in mid-2007 to improve the program's cost-effectiveness. Additionally, Pacific Power cut back on advertising for the 2007 and 2008 program years, which decreased program spending and increased the overall program cost-effectiveness.

PPL Electric's total resource cost (TRC) results are considerably higher than any of the other programs, including PECO and Duquesne Light in PY4, other Pennsylvania EDCs that share the same regulatory environment. Many of the programs do not stipulate if they are using gross or net savings to measure cost-effectiveness, and fully understanding the reasons for the differences in TRC results would require a careful review of all of the inputs, which are largely unavailable.

One factor contributing to the relatively high TRC ratios for PPL Electric's program is the demand savings for air conditioners, for which PPL Electric provides more incentives (allowing four units per year) than other Pennsylvania utilities. The per-unit demand savings is approximately three times higher for air conditioners than for refrigerators and freezers (0.64 kW compared to 0.205 kW for refrigerators that are not replaced), at least in Phase I. The greater demand savings increases avoided capacity costs, which would improve the cost-effectiveness of the program.

The Pennsylvania EDCs that accepted air conditioners (all but PECO and Duquesne Light in PY4) had higher benefit-cost ratios for their TRC tests. And PECO declined from a 6.9 benefit-cost ratio in PY3 to 3.41 in PY4 after it stopped accepting air conditioners as part of its program.

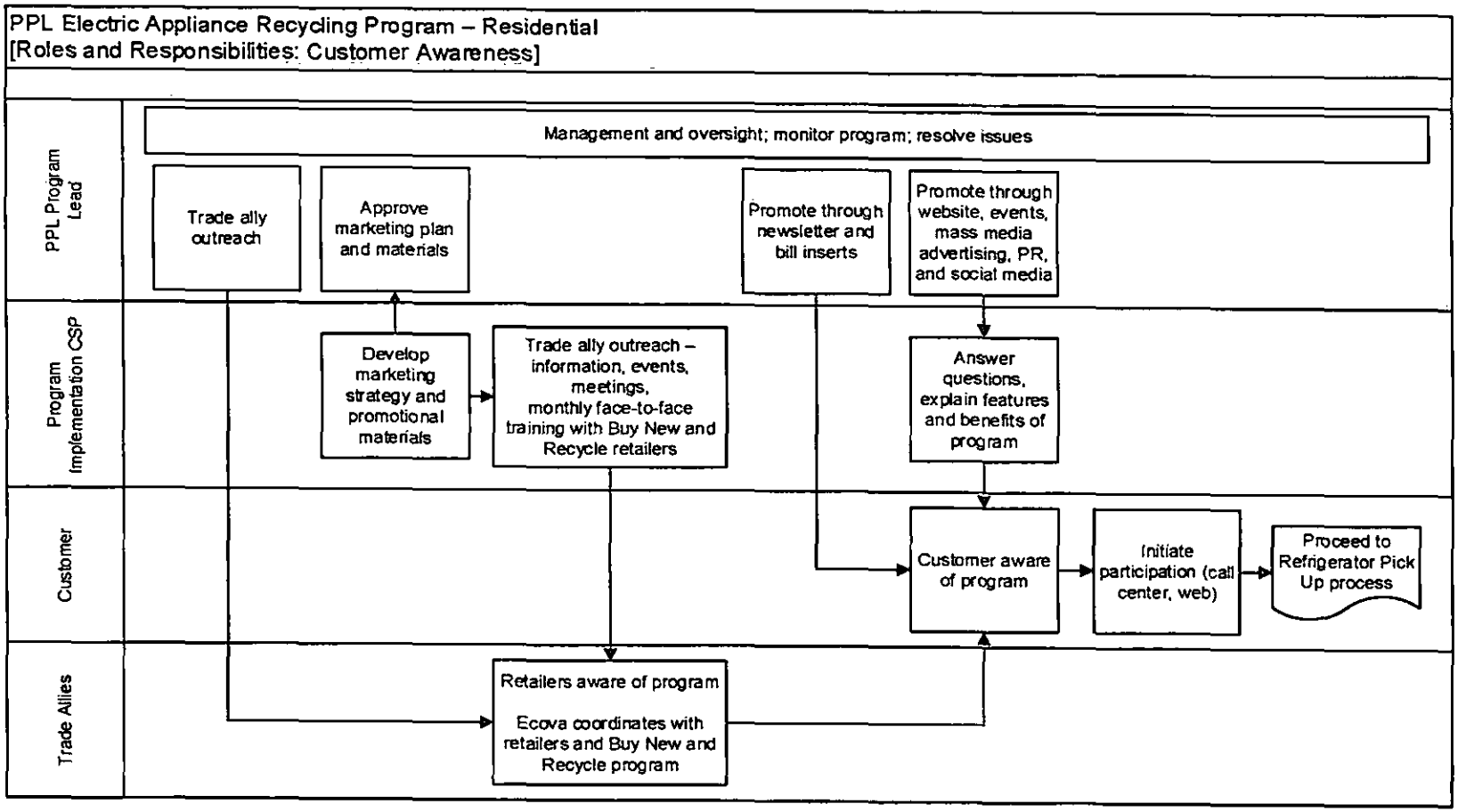
Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-4** of the report titled *"PY5 Annual Report."*

Process Map

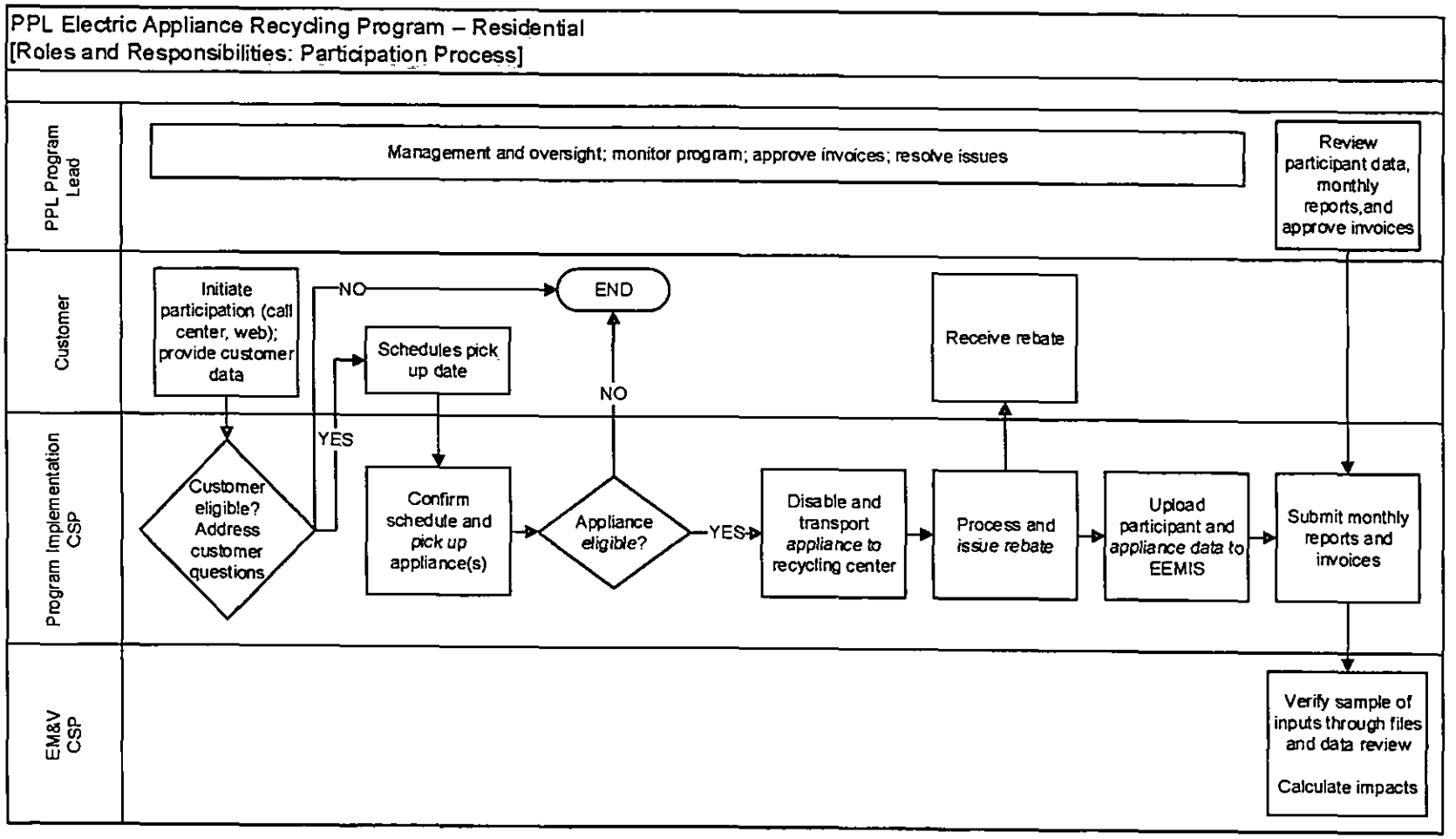
Figure 29 and **Figure 30** contain the process maps for this program.

Figure 29. Appliance Recycling Process Map—Customer Awareness[1]



[1] Ecova distributes ARP materials for the "Buy New and Recycle" portion of the program.

Figure 30. Appliance Recycling Process Map—Participation Process



References

ADM Associates, Inc. *Final Annual Report to the Pennsylvania Public Utility Commission For the Period June 2012 through May 2013 Program Year 4*. Written on behalf of the California Public Utilities Commission. 2008.

The Cadmus Group, Inc. *Rocky Mountain Power 2009-2010 Utah Cool Cash Program Evaluation.* 2011. Available online: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/UT_Cool_Cash_2009_2010_FINAL_Evaluation_Report.pdf.

The Cadmus Group, Inc. *Rocky Mountain Power Wyoming Evaluation 2009–2010 Report.* 2011. Available online: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/DSM_WY_SYLR_2011.pdf.

The Cadmus Group, Inc. *Rocky Mountain Power Wyoming See ya later, refrigerator: Program Evaluation Report 2011-2012.* 2013. Available online: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2013/2011-2012_SYLR_Wyoming_SeeYaLaterRefrigerationProgramEvaluation.pdf.

The Cadmus Group, Inc. *Idaho Refrigerator and Freezer Recycling Program 2006-2008.* Prepared for Rocky Mountain Power. 2010. Available online: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/ID_SYLR_Report.pdf.

The Cadmus Group, Inc. *Rocky Mountain Power Idaho See ya later, refrigerator: Program Evaluation Report 2011-2012.* 2013. Available online: http://rtf.nwcouncil.org/subcommittees/fridgerecycle/ID_SYLR_Report_2011-2012.pdf.

The Cadmus Group, Inc. *Utah Refrigerator and Freezer Recycling Program 2006-2008.* Prepared for Rocky Mountain Power. 2010. Available online: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/DSM_UT_SYLR.pdf.

The Cadmus Group, Inc. *Rocky Mountain Power Utah See ya later, refrigerator: Program Evaluation Report 2011-2012.* 2013. Available online: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2013/UT_2011-2012_SYLR_Report_FINAL.pdf.

The Cadmus Group, Inc. *Washington Refrigerator and Freezer Recycling Program 2006-2008.* Prepared for Pacific Power. 2010. Available online: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/DSM_WA_SYLR.pdf.

The Cadmus Group, Inc. *Pacific Power Washington See ya later, refrigerator: Program Evaluation Report 2011-2012.* 2013. Available online: http://rtf.nwcouncil.org/subcommittees/fridgerecycle/WA_2011-2012_SYLRReportFINAL23OCT13.pdf.

Commonwealth Edison. "Save money by recycling your old fridge or freezer." Accessed August 23, 2014. https://www.comed.com/home-savings/rebates-incentives/pages/refrigerator-recycling.aspx.

Navigant Consulting. *Energy Efficiency / Demand Response Plan: Plan Year 2 (6/1/2009 – 5/31/2010). Evaluation Report: Residential Appliance Recycling Presented to Commonwealth Edison Company.* 2010. Available online: https://www.ceeforum.org/sites/default/files/library/8613/CEE_Eval_ComEdApplianceRecyclingPY2EvaluationReport2010_12_21_Final_21Dec2010.pdf.

Navigant Consulting, Inc. *Final Annual Report for the Pennsylvania Public Utility Commission for the Period June 2012 through May 2013 Program Year 4.* Prepared for PECO Energy Company. November 15, 2013. Available online: https://www.peco.com/CustomerService/RatesandPricing/RateInformation/Documents/PDF/New%20Filings/PECO%20Act%20129%20PY4%20Annual%20Report%20Fin%2011%2015%202013.pdf.

Navigant Consulting, Inc. *Final Annual Report for the Pennsylvania Public Utility Commission for the Period June 2011 through May 2012 Program Year 3.* Prepared for PECO. November 15, 2012. Available online: https://www.peco.com/CustomerService/RatesandPricing/RateInformation/Documents/PDF/New%20Filings/ACT%20129%20EECP.pdf.

Navigant Consulting, Inc. *Final Annual Report for the Pennsylvania Public Utility Commission for the Period June 2012 through May 2013 Program Year 4.* Prepared for Duquesne Light. Revised January 6, 2014. Available online: https://www.duquesnelight.com/DLDocs/WattChoices/DLC_Phase_I_Final_Report_11-15-13_revised.pdf.

Pennsylvania Public Utility Commission. "Technical Reference Manual June 2013 with Erratta Corrections 2014.04.07." 2014.

Rocky Mountain Power. "Refrigerator Recycling." Accessed August 23, 2014. https://www.rockymountainpower.net/res/sem/idaho/roa.htmlhttp://www.rockymountainpower.net/res/sem/epi/idaho/roa.html.

Summit Blue Consulting. *Commonwealth Edison Company Energy Efficiency/Demand Response Plan Year 1 (6/1/2008-5/31/2009).* 2009. Available online: http://library.cee1.org/sites/default/files/library/8614/CEE_ComEdApplianceRecyclingY1EvaluationReport2009_12_02FINAL_.2Dec2009.pdf.

Student and Parent Energy-Efficiency Education Program

The Student and Parent Energy-Efficiency Education Program is a new program in Act 129 Phase II of the EE&C Plan. For several years, PPL Electric has offered this program (generally referred to as the Think!Energy Program) to schools and students outside of Act 129.

PPL Electric provides school-based energy-efficiency education through in-classroom workshops for students in various grade levels, training for teachers, and community workshops for parents in low-income neighborhoods. Participants in all components receive educational materials and a take-home energy-efficiency kit of low-cost measures they can install. These measures are tailored to each program component; the kit contains items such as CFLs, low-flow showerheads, faucet aerators, smart power strips, and electroluminescent nightlights.

PPL Electric selected the National Energy Foundation (NEF) as the program implementer. NEF marketed the program and recruited potential schools, teachers, and parent teacher organizations; created curriculum correlated to academic standards in Pennsylvania; secured support of the program components by the Pennsylvania Department of Education; conducted the various energy-efficiency presentations; and assembled and shipped the take-home energy-efficiency kits. PPL Electric collaborated with NEF on the program's strategic direction while maintaining overarching Act 129 administrative, program support, and evaluation and data management systems.

NEF presented the Think!Energy Program to students who had been organized into one of three groups—Bright Kids for students in primary grades, Take Action for students in intermediate grades, and Innovation for students in secondary grades.

Process Evaluation Activities

In Program Year 5 (PY5), Cadmus conducted the following process evaluation activities:

- Participant surveys
  - Teacher workshop survey (n=10)
  - Parent workshop survey (n=45)
  - Teacher participant survey (n=312)
  - Parent participant survey (n=194)
- Analysis of NEF-administered student-parent kit surveys (n=15,610)
- Analysis of NEF-administered parent postcard surveys (n=1,346)
- Program staff and implementer interviews (n=2)
- Literature review and benchmarking
- Database and QA/QC review of records
- Developed the program process map

Achievements Against Plan

The Student and Parent Energy-Efficiency program achieved 105% of its planned 4,900 MWh/yr PY5 savings,[20] 58% of its planned 0.60 MW PY5 savings,[21] and 101% of its PY5 participation target of 20,800 energy-efficiency kits.[22]

Overall, the Student and Parent Energy-Efficiency program achieved its planned MWh/year savings and participation goals (**Table 8**). It achieved fewer PY5 MW reduction savings than planned. At the end of PY5 (May 31, 2014), the program had achieved:

- 42% of its 12,199 MWh/year three-year planned savings
- 23% of its 1.50 MW three-year planned demand reduction
- *33% of its three-year participation target of 63,100 energy-efficiency kits* [23]

Table 8. Student and Parent Energy-Efficiency Program Savings

	PY5 Verified Savings	PY5 Planned Savings	Percentage of PY5 Planned Savings	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/yr	5,147	4,900	105%	12,199	42%
MW	.35	.60	58%	1.50	23%

The following provide possible reasons why the program reached its planned MWh energy savings, but achieved fewer than its MW planned savings for PY5:

- The program's wide-ranging student group involvement may have contributed to achieving the planned MWh energy savings.
- Among the kit measures, the CFL and showerhead measures made the greatest overall contribution to savings. However, the lower than expected installation rates may have contributed to lower than expected demand reduction savings.
- Parent participants cited two reasons—an improper structural fit and lack of need—for not installing certain measures in the first place.
- Parent participants reported removing or terminating the use of certain measures due to dissatisfaction with the measure's performance and the measure not working.

---

[20] All planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2334388) filed with the Pennsylvania PUC on April 7, 2014, Table H5p. 71

[21] Ibid.

[22] Derived from internal e-mail communications with implementer, PPL Electric, and Cadmus (May 2, 2013) and included in Cadmus' approved EM&V plan.

[23] Ibid.

Further details are described in the remainder of this report.

Survey Methodology

Cadmus surveyed teachers and parents who participated in the Think!Energy Program. Additionally, NEF administered two parent surveys about the energy-efficiency kits distributed to students in participating classrooms. Altogether, Cadmus and NEF deployed six surveys, as shown in **Table 9**, to assess program delivery components from the teacher and parent perspective.

Table 9. Summary of Think!Energy Program and Workshop Surveys

Survey	Administering Party	Target Audience
Teacher Workshop Survey	Cadmus	Teachers who attended the Think!Energy Teacher Workshops, held between June 2013 and December 7, 2013
Parent Workshop Survey	Cadmus	Parent participants of a Think!Energy Community in Action workshop held between June 2013 and December 2013
Teacher Participant Survey	Cadmus	Teachers whose classrooms participated in the Think!Energy Program, held between September 2013 and October 2013
Parent Participant Survey	Cadmus	Parents of students who participated in the Think!Energy Program
Parent Kit Survey (Home Energy Worksheet)	NEF	Parents of students who participated in the Think!Energy Program
Parent Postcard Survey	NEF	Parents of students who participated in the Think!Energy Program

The six surveys addressed these topics:

- Marketing and outreach
- Workshop and program satisfaction
- Program aspects that are working well and areas of improvement
- Satisfaction with PPL Electric
- Energy-efficiency kits
- Awareness of energy efficiency and its impact
- Willingness to pay
- Classroom characteristics
- Demographic profile

Cadmus and a survey subcontractor, Opinion Dynamics, administered the teacher workshop and teacher participant surveys over the Internet. Parent participant and parent workshop surveys were administered over the Internet and by phone. Teachers and parents with e-mail addresses received an invitation to the web-based survey, but not all parents had e-mail addresses. To encourage

participation, we sent two e-mail reminders to teachers and parents. After two weeks, we called parents who had provided a phone number and had not completed the web-based survey.

Survey Sample

For the teacher and parent participant surveys, the achieved number of completed surveys often exceeded the target quota. **Table 10** shows the survey field dates, population, targets for completed surveys, and the achieved number of completed surveys.

Table 10. Completed Teacher and Parent Participant Surveys

Survey Group	Field Dates	Population	Target	Achieved	Percent of Target Achieved
Teacher Workshop	3/13/2014 through 4/1/2014	153	Census*	10	N/A
Parent Workshop	3/18/2014 through 4/11/2014	999	Census*	45	N/A
Teacher Participants	3/18/2014 through 4/3/2014	713	70	312	446%
Bright Kids		210	22	109	495%
Take Action		398	40	168	420%
Innovation		105	8	35	438%
Parent Participants	3/17/2014 through 4/11/2014	15,610	210	194	92%
Bright Kids		3,952	70	74	106%
Take Action		8,809	70	80	114%
Innovation		2,815	70	40	57%

*The number of completes is based on the number of available records.

Table 11 lists the sample frame we used for its surveys. The sample frame included participants of the programs who opted in for a follow-up survey.

Table 11. Survey Sample Attrition

Description	Teacher		Parent	
	Workshop	Participant	Workshop	Participant
Total population	**47**	**713**	**999**	**17,439**
Survey Sample Frame	**47**	**713**	**318**	**1,970**
Adjusted Survey Sample Frame (records sent to survey subcontractor)	**46**	**713**	**262**	**1,826**
Removed because no e-mail address and no phone number	0	0	41	116
Removed because no e-mail and incomplete phone number	0	0	7	28
Removed because incomplete or unreadable e-mail and no phone number	0	0	8	0
Removed because duplicate e-mail address	1	0	0	0

Description	Teacher		Parent	
	Workshop	Participant	Workshop	Participant
Records Attempted	**46**	**713**	**262**	**1,826**
Undeliverable e-mail	6	60	0	0
Undeliverable e-mail and no phone number	0	0	35	287
Did not qualify to take survey	0	1	3	6
Nonworking number	*0*	*0*	*4*	*22*
Business/wrong number	0	0	3	6
Refusal	0	0	4	26
Language barrier	0	0	0	4
Did not complete survey	0	0	0	8
No answer/answering machine/phone busy	0	0	16	135
Nonspecific or specific callback scheduled	0	0	9	33
Partially completed survey	3	79	6	35
Remaining non-final records[1]	27	261	137	1,070
Completed survey	**10**	**312**	**45**	**194**

[1]These records were included in the sample frame but participants did not respond.

Survey Findings

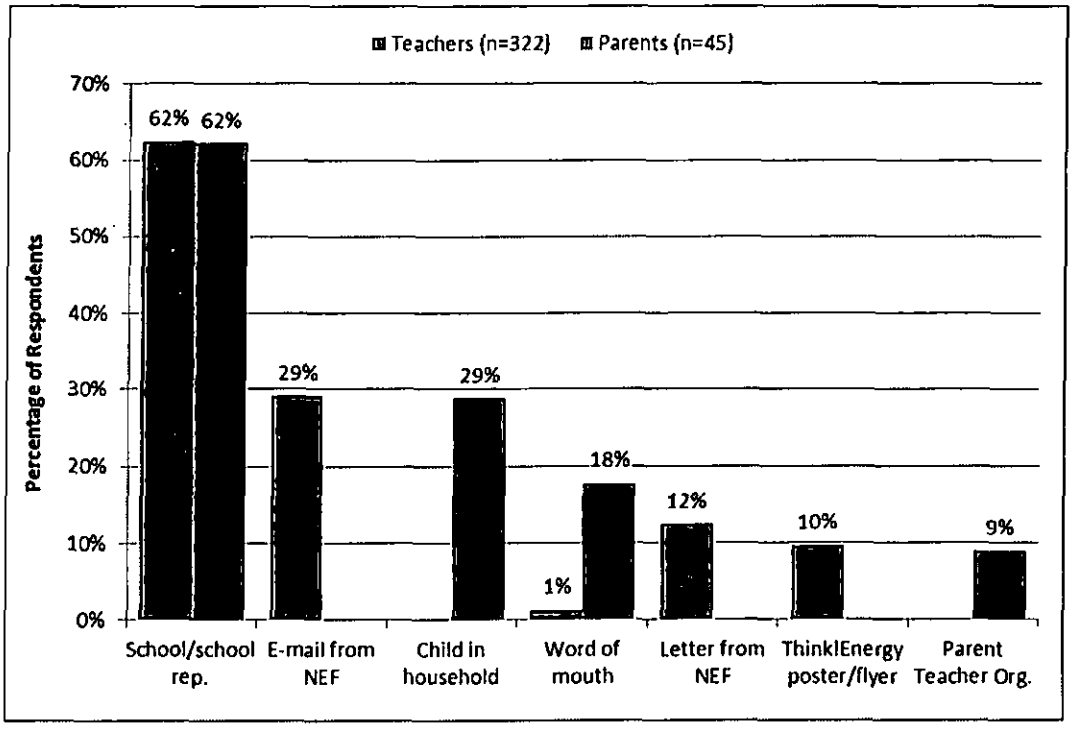
This section provides key findings from the six Think!Energy Program surveys.

Marketing and Outreach

Survey respondents heard about the program and the workshops primarily through the school context. As shown in **Figure 31**, 62% of teacher respondents and 62% of parent respondents reported that they heard about the program and workshops from the school or a school representative.

Respondents differed about the second most-cited source; 29% of teacher respondents cited the e-mail from NEF, and 29% of parent respondents cited their child. Word of mouth marketing was a much higher source for parent respondents (18%) than for teachers (1%). Very few parent respondents (9%) cited the parent teacher organization.

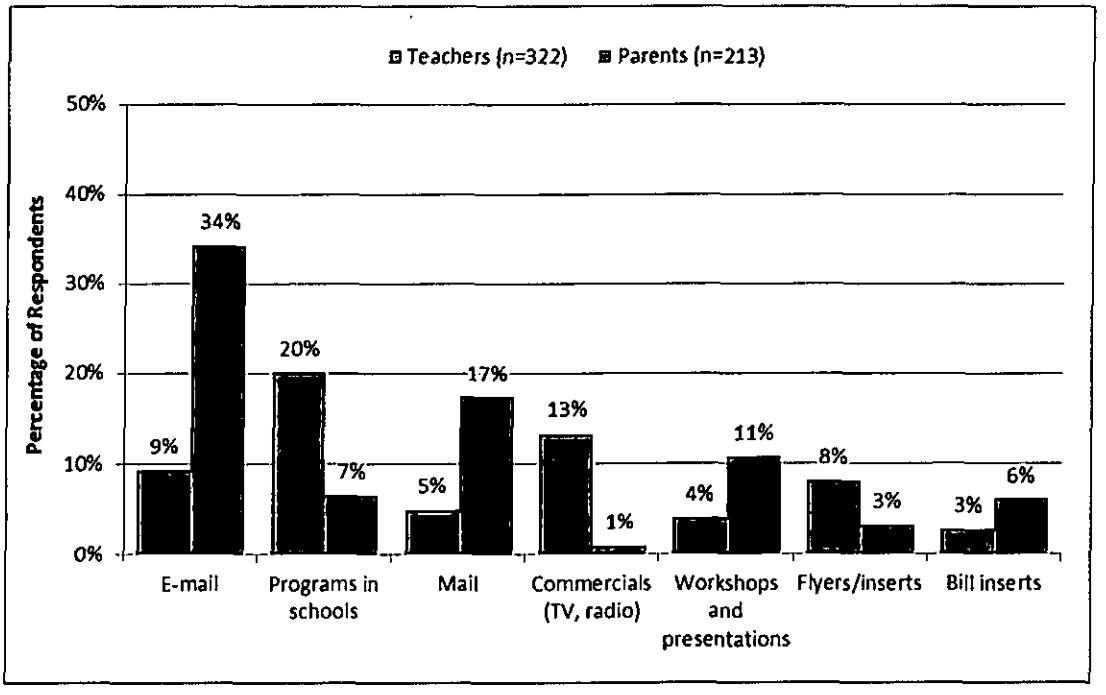
Figure 31. How Teachers and Parents Heard about Think!Energy Program and Workshops



Note: Parents did not receive an e-mail from NEF; therefore, this category applies only to teachers. The category "child in household" applies only to parents.
Source: Teacher Workshop Survey; Parent Workshop Survey; Teacher Participant Survey. Question, "How did you hear about PPL Electric's Think!Energy workshop/program?" These were multiple response questions. Percentages may add up to more than 100%.

Teachers and parents widely differed on the best ways for PPL Electric to inform the public about energy-efficiency programs (**Figure 32**). Teacher respondents indicated programs in schools (20%) and commercials (13%) as their top two ways. Parent respondents indicated e-mail (34%) and mail (17%) as their top two ways to inform them about energy-efficiency programs. The general pattern of responses in **Figure 32** suggests that the best way for PPL Electric to inform teachers is through the school context, and for parents it is through varying channels.

Figure 32. Best Ways to Inform about Energy-Efficiency Programs



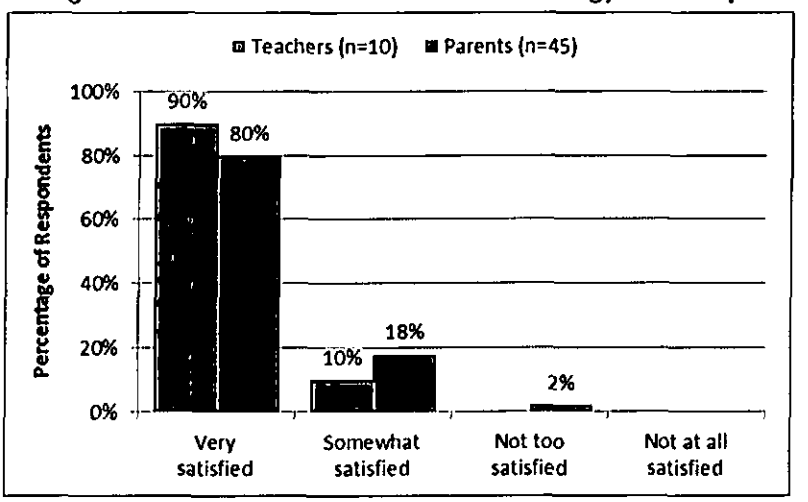
Source: Teacher Workshop Survey; Parent Workshop Survey; Teacher Participant Survey; Parent Participant Survey. Question, "What is the best way for PPL Electric to inform you about energy efficiency programs?" These were multiple response questions. Percentages may add up to more than 100%.

Workshop Satisfaction

Cadmus asked survey respondents to rate their satisfaction for the overall workshop, using a scale ranging from *very satisfied, somewhat satisfied, not too satisfied,* and *not at all satisfied.* Both the teacher and the parent workshops achieved high satisfaction ratings.

As shown in **Figure 33**, 90% of teacher respondents and 80% of parent respondents reported being *very satisfied* with the overall workshop. Two percent of parent respondents reported being *not too satisfied;* no respondents reported being *not at all satisfied.*

Figure 33. Overall Satisfaction with Think!Energy Workshops



Source: Teacher Workshop Survey; Parent Workshop Survey. Question, "How satisfied were you overall with the workshop?"

Teachers

Teacher respondents who reported being *very satisfied* with the workshop indicated they liked the "goodies," the classroom ideas, and the collaborative exchange. Respondents said:

- *"I love that we walked away with a binder full of ideas ready to use in the classroom and a bag full of goodies to take and share with our class."*
- *"The accommodations were nice, the presenters were friendly and knowledgeable, and the pace was great. All the 'goodies' are much, much appreciated."*
- *"We had a lot of opportunities to work cooperatively with others, share ideas and brainstorm new ideas for lesson plans and lessons."*

The one teacher respondent who reported being *somewhat satisfied* explained that the workshop focused more on sustainability instead of energy than he or she would have liked.

Parents

In general, parent respondents who reported they were *very satisfied* with the workshop liked how the workshop incorporated the family and provided useful information. Some examples of respondents' comments are:

- *"Involved the audience and was family friendly."*
- *"Informative and helpful."*
- *"Learned about ways to save energy and money."*

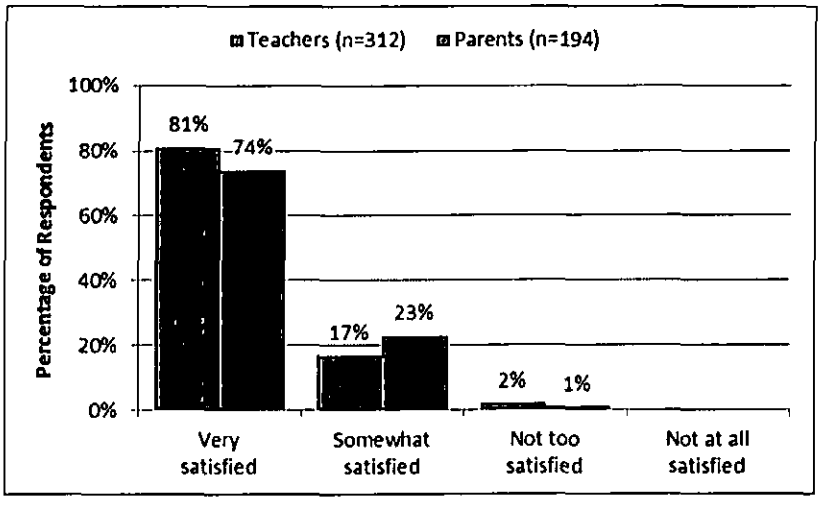
The few parent respondents who were *somewhat satisfied* or *not too satisfied* with the workshop specifically indicated they thought the workshop setting and understandability of the information was problematic. Respondents said:

- *"It was hard to hear the lady speaking b/c we were in the gymnasium and there were a lot of kids/parents talking. But then the movie they played afterwards was very loud. We left early."*
- *"Some things I didn't understand."*

Program Satisfaction

The program achieved high satisfaction ratings among teacher and parent participants. As shown in **Figure 34**, 81% of teacher respondents and 74% of parent respondents reported they were *very satisfied* with the overall program. A very small proportion of teacher (2%) and parent (1%) respondents reported they were *not too satisfied*; however, no respondents reported they were *not at all satisfied*.

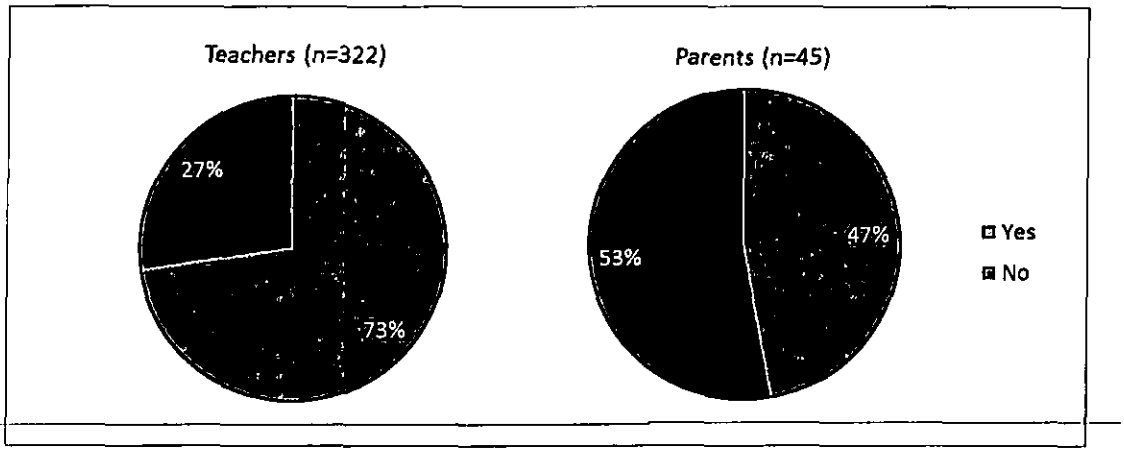
Figure 34. Overall Satisfaction with Think!Energy Program



Source: Teacher Participant Survey; Parent Participant Survey. Question, "How satisfied were you overall with the program?"

Cadmus asked respondents if they recommended the program and workshops to others, such as friends, relatives, and colleagues. Teachers' and parents' responses differed, as shown in **Figure 35**, with 73% of teacher respondents recommending the program to others compared to 47% of parent respondents. These results suggest that the program and workshops are on track for teachers but that improvements are needed to encourage more parents to recommend the program.

Figure 35. Recommended Think!Energy Program and Workshops to Others

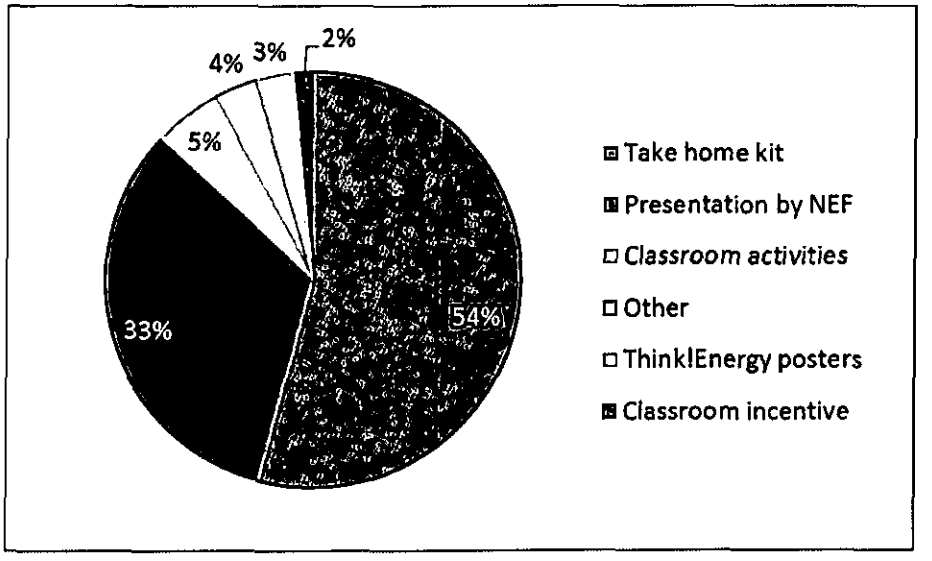


Source: Teacher Workshop Survey; Parent Workshop Survey; Teacher Participant Survey. Question, "Since participating in the Think!Energy workshop/program, have you recommended the workshop program to any friends, relatives, or colleagues?"

Teachers

Teacher respondents appreciated the materials and resources made available for program participants, as shown in **Figure 36**. The materials and resources they liked most were the energy-efficiency kits and NEF's educational presentation. Notably, only 2% of respondents indicated the classroom incentive—the educational mini-grant rewarded to participating teachers for classroom use. The results suggest that teacher participants value materials and resources that can be directly applied in the classroom.

Figure 36. Teachers' Most Liked Aspect of Think!Energy Program



Source: Teacher Participant Survey. Question H7, "What do you like most about the Think!Energy program?" (n=312).

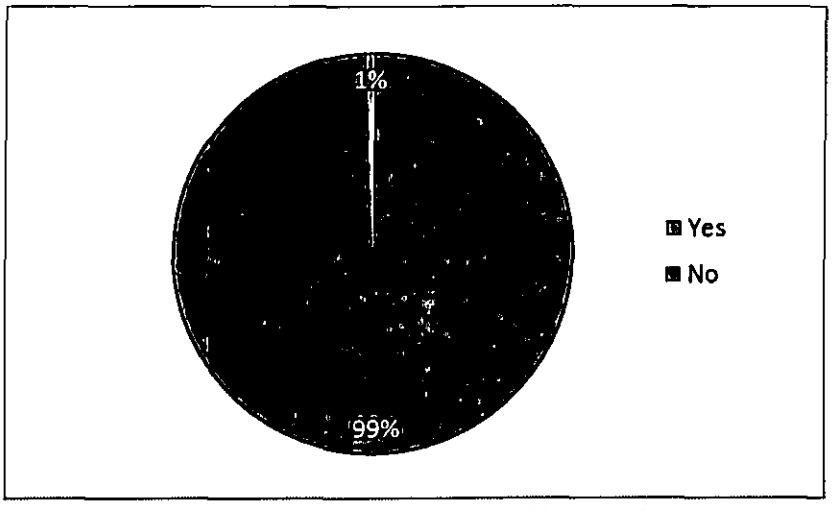
The few teacher respondents who reported being *somewhat satisfied* or *not too satisfied* focused their comments on the program information hotline for teachers and the energy savings kit. Two respondents said:

- *"All of the above, except for hotline which I didn't use, were excellent."*
- *"The kits are disappointing. The light bulbs contain mercury and need to be disposed of at a different location and are known for causing fires. The showerhead doesn't allow enough pressure to be able to shower."*

Parents

Cadmus surveyed parents of students who received an energy-efficiency kit to take home. Although only 47% of parent respondents said they recommended Think!Energy to others (see **Figure 35**), nearly all (99%) reported that they would like to see the program continue (**Figure 37**).

Figure 37. Continuation of Think!Energy Program in Schools



Source: Parent Postcard Survey. Question 3, "Would you like to see this program continued in local schools?" (n=1,345).

Overall, parent respondents who reported being *very satisfied* with the program liked the measures provided in the kit. For example, respondents said:

- *"We liked receiving the useful, efficient items in the kit. It definitely made us more aware of energy use/conservation as the program intended."*
- *"I think the package itself is very well conceived and the products are good choices and the age selection of the kids is good."*

Moreover, parent respondents were impressed with the idea of teaching energy conservation to children. Respondents said:

- *"I think that it is great to introduce the children to energy conservation at a young age so that it becomes a part of them."*
- *"Well I thought my child learned a lot. He is constantly turning the heat down."*

On the other hand, parent respondents who were less than *very satisfied* with the program largely complained about measures in the energy-efficiency kit. For instance, some respondents were expecting to see light-emitting diodes (LEDs) instead of CFLs, because they had concerns about the heat emitted from CFLs. Other respondents were disappointed to see that their kit did not contain the shower timer. Several respondents indicated they had previously installed the same measures included in the kit.

All of these comments suggest that the kits can be improved to feature measures that better match the needs and characteristics of the household.

Aspects Working Well and Areas of Improvement

Table 12 lists the most frequently reported program and workshop aspects that teachers and parents indicated as working well and areas that can be improved.

Table 12. Teacher and Parent Feedback on Think!Energy Program Components

Program Component	Aspect Working Well	Area of Improvement
Teacher Workshop	• Materials and resources • Length of workshop • Presentations and the speakers	• More LED bulbs • Cover the subject of energy, not just energy conservation[1]
Parent Workshop	• Family friendliness • Energy-saving information and tips • Length of workshop	• Less noisy workshop environment • Provide activities • More measures in the kit • Make information easier to understand • More information on light bulbs and weatherization
Teacher Classroom Participation	• Materials and resources, especially the energy-efficiency kit • Presentation by NEF • Student engagement • Meeting teachers' curriculum needs	• Think!Energy teacher hotline • Think!Energy website • Provide hands-on activity guides

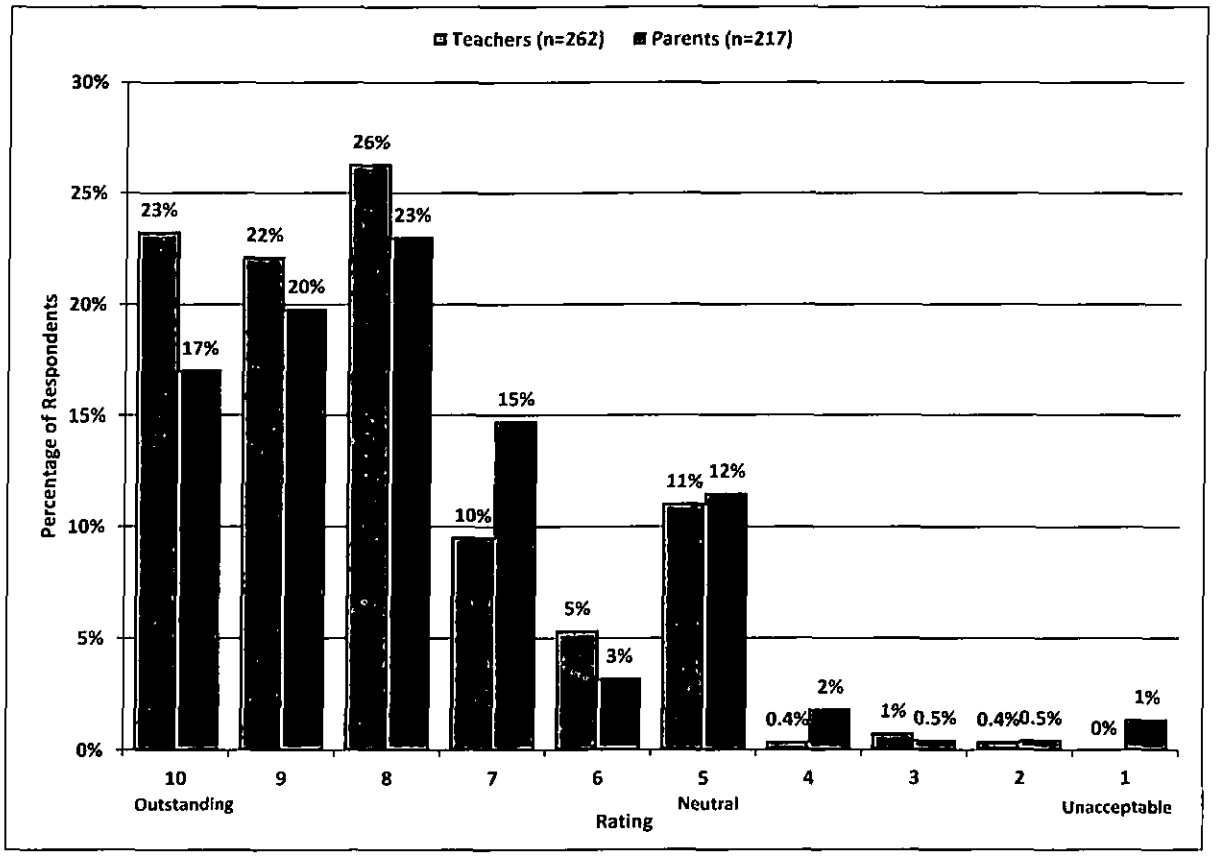
Program Component	Aspect Working Well	Area of Improvement
Parent Classroom Participation	• Energy-efficiency kit • Parent engagement • Student engagement • Easy installation of measures	• Include LEDs in the kit • Customize the energy-efficiency kit

[1] Only one respondent provided this type of comment. Due to the small number of respondents who completed the Teacher Workshop Survey (n=10), this comment was included.
Source: Teacher Workshop Survey; Parent Workshop Survey; Teacher Participant Survey; Parent Participant Survey; Parent Postcard Survey.

Satisfaction with PPL Electric

Using a 10-point scale where 1 means unacceptable, 5 means average, and 10 means outstanding, teacher and parent respondents rated PPL Electric as a provider of electric service. Overall satisfaction with PPL Electric was high for both teachers and parents, with more teacher respondents giving a higher satisfaction rating than parent respondents. As shown in **Figure 38**, 71% of teacher respondents and 60% of parents rated their overall satisfaction as an 8 or higher.

Figure 38. Overall Satisfaction with PPL Electric

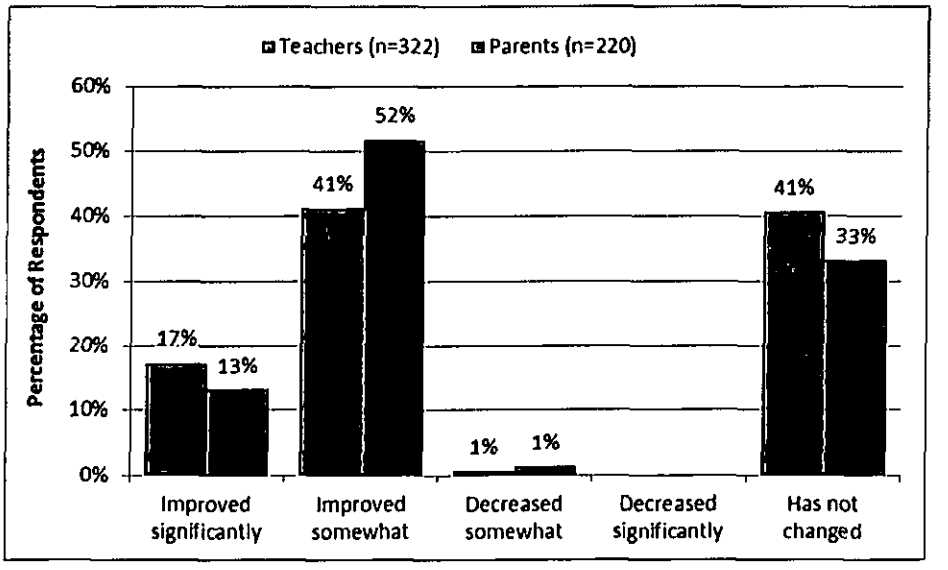


Source: Teacher Workshop Survey; Parent Workshop Survey; Teacher Participant Survey; Parent Participant Survey. Question, "Using a 10-point scale where 1 means unacceptable, 5 means average and 10 means outstanding, using any number from 1 to 10, how do you rate PPL Electric overall as a provider of electric service to your organization/home?"

When asked if participating in the program and workshops had changed their opinion about PPL Electric, most teacher and parent respondents said their opinion of PPL Electric had improved. The majority of parent respondents (52%) said that their opinion had *improved somewhat*, as shown in **Figure 39**. Far more parent and teacher respondents indicated that their opinion had either *improved somewhat* or had *not changed* than that it had *improved significantly*.

Nonetheless, the program and workshops have not had a negative influence on respondents' opinions of PPL Electric, as only 1% of respondents among teachers and parents indicated that their opinion had decreased.

Figure 39. Opinion of PPL Electric after Participating in Program and Workshops



Source: Teacher Workshop Survey; Parent Workshop Survey; Teacher Participant Survey; Parent Participant Survey. Question, "After participating in the ThinkIEnergy workshop/program, has your opinion of PPL Electric..."

Energy Savings Kits

The selection of measures in the energy-efficiency kits varied depending on its intended group—the teacher workshop kit, the parent workshop kit, and the parent classroom kit. This section organizes the key findings of the uses of these kits by group.

Teacher Workshop Kit

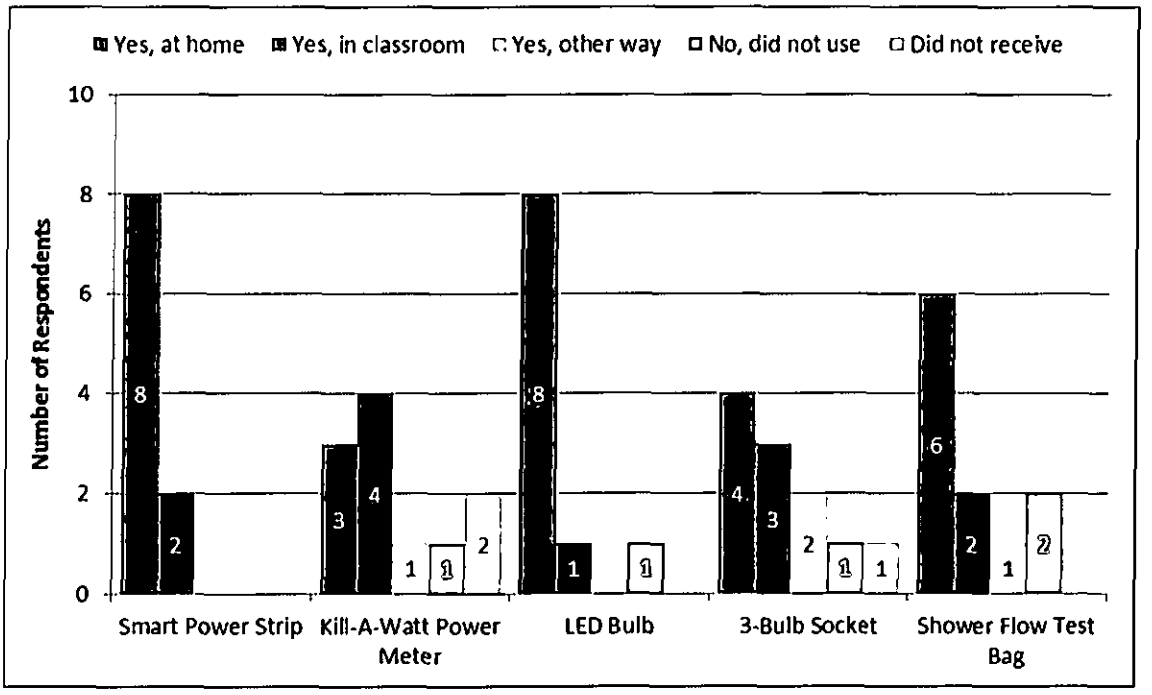
Teachers received the following measures in the kit provided at the workshop:

- A smart power strip
- A P3 Kill-a-Watt® power meter
- An LED bulb
- A 3-bulb socket
- A shower flow test bag

Use of Measures

The majority of teacher respondents said they used the items (measures) provided in the kit. Of the five measures, respondents most frequently used the smart power strip and the LED bulb (**Figure 40**); all 10 respondents reported using the smart power strip, and nine respondents reported using the LED bulb. More respondents reported using the measures in the home rather than in the classroom. The only exception was the Kill-a-Watt® power meter, which respondents indicated they used more in the classroom than in the home. The few respondents who reported not using a particular measure explained they had not yet come across an opportunity to use the measure.

Figure 40. Use of Measures from Teacher Workshop Kit



Source: Teacher Workshop Survey. Question E1, "Have you used the [measure] since attending the workshop?" (n=10). Multiple responses were allowed.

Measures Still in Use

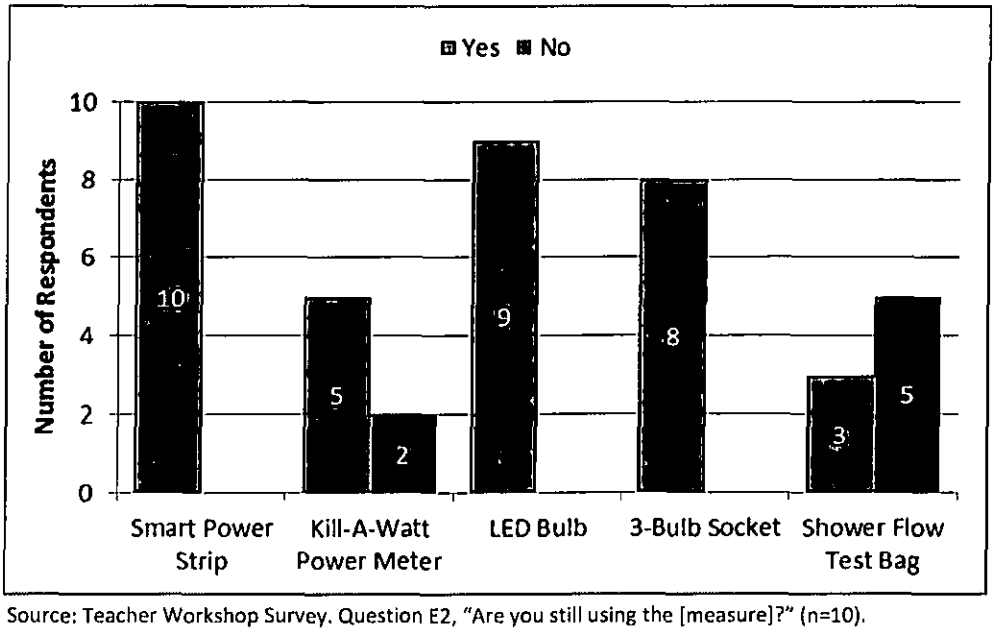
Similarly, when we asked respondents about the measures that were still in use, all of the respondents reported the smart power strip, and nine of 10 said they used the LED bulb (**Figure 41**). Three of 10 respondents reported still using the shower flow test bag.

Results from **Figure 40** and **Figure 41** suggest that measures that are constantly "plugged in" (smart power strip, LED bulb, and 3-bulb socket) are the measures both used and used the most. "Inspection" measures such as the Kill-a-Watt® power meter and the shower flow test bag generated occasional use.

Comments from the respondents also support this trend:

- *"Only use [Kill-a-Watt power meter] for a brief time to check the wattage used."*
- *"I only needed to use [the shower flow test bag] once to know how much water my old showerhead used."*

Figure 41. Teacher Workshop Kit Measures Still in Use



Source: Teacher Workshop Survey. Question E2, "Are you still using the [measure]?" (n=10).

Parent Workshop Kit

Parents received the following measures in the kit provided at the workshop:

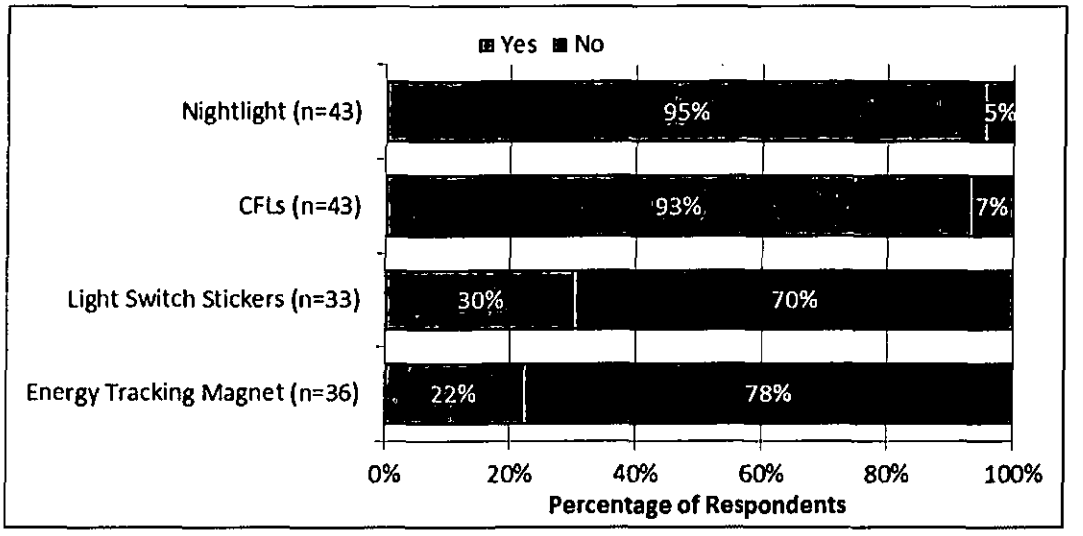
- Two CFLs
- One nightlight
- Light switch stickers
- An energy-tracking magnet

Use of Measures

As shown in **Figure 42**, 95% of parent workshop respondents reported using the nightlight and 93% of respondents reported using the CFLs. A large majority of respondents did not use either the energy-tracking magnet (78%) or the light switch stickers (70%).

Similar to the teacher respondents, parent respondents used the two "plugged-in" measures the most (nightlight and CFLs). Respondents used the "reminder" measures (energy-tracking magnet and light switch stickers) the least.

Figure 42. Use of Measures from Parent Workshop Kit



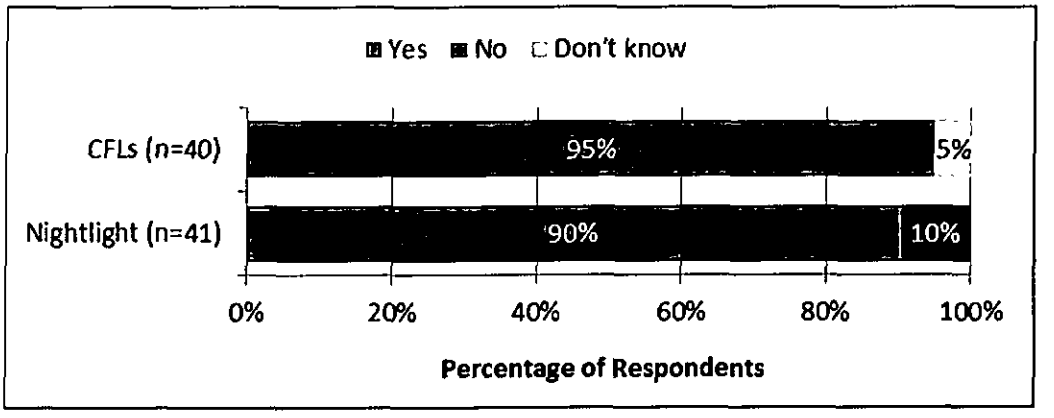
Source: Parent Workshop Survey. Question, "Did you use/install the [measure]?"

The few respondents who did not use the nightlight said there was no need for it. The respondents who did not use the CFLs said they already had CFLs installed. The survey did not inquire further about the reasons respondents did not use the energy-tracking magnet and light switch stickers.

Measures Still in Use

Cadmus asked respondents who reported they used the nightlight and CFL measures if they were still in use. As shown in **Figure 43**, nearly all respondents reported they continue to use the CFLs (95%) and nightlight (90%). Respondents who stopped using the nightlight gave reasons such as *"difficulty sleeping with the nightlight"* and the *"nightlight was not bright enough."*

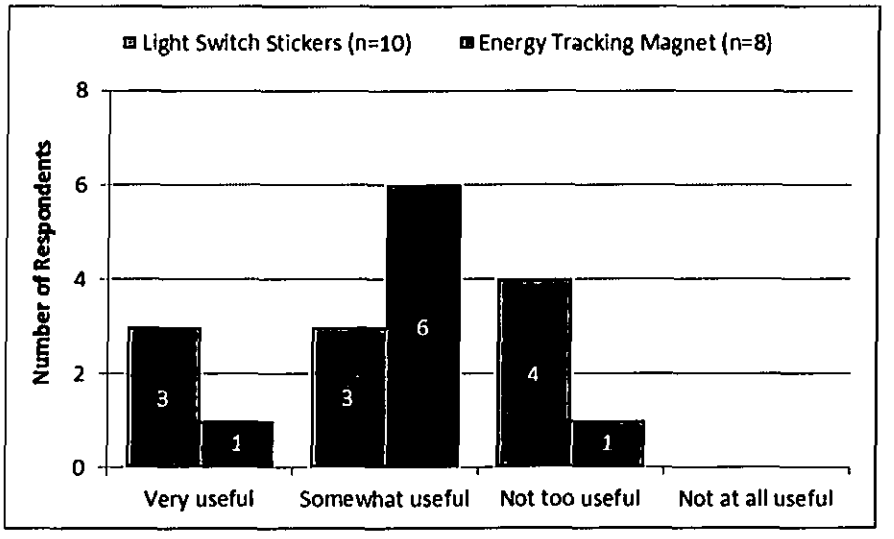
Figure 43. Parent Workshop Kit Measures Still in Use



Note: The question about the measure being still in use was not asked for the light switch stickers and the energy-tracking magnet. Source: Parent Workshop Survey. Question F3, "Have you removed the CFL bulbs?" Question H2, "Are you still using the [measure]?"

Cadmus asked respondents who used the light switch stickers and the energy-tracking magnet to rate their usefulness, using a scale ranging from *very useful, somewhat useful, not too useful,* to *not at all useful.* As shown in **Figure 44**, most respondents (14 of 18 respondents) did not find the energy-tracking magnet and the light switch stickers to be very useful *(not too useful).*

Figure 44. Usefulness of Reminder Measures from Parent Workshop Kit



Source: Parent Workshop Survey. Question, "How useful was the [measure]? Would you say..."

Parent Classroom Kit

Teachers in classrooms participating in the Think!Energy Program handed out kits for students to take home to their parents. Parents received a specific kit based on the student group to which their child belonged—Bright Kids, Take Action, or Innovation. **Table 13** lists the grade level and items in each of the three student groups.

Table 13. Student Groups and the Items Provided in the Parent Kit

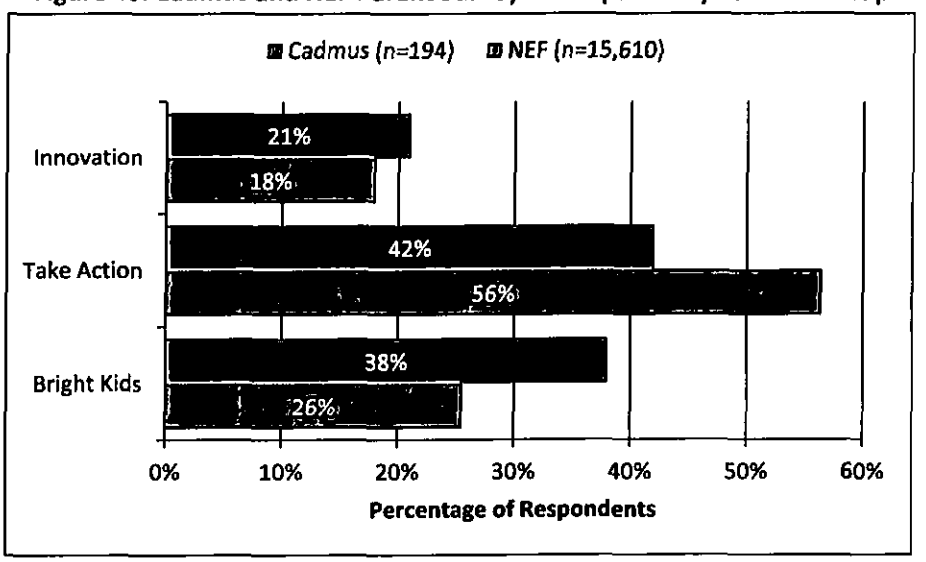
Student Group	Grade Level	Items in the Kits								
		CFLs	Light Switch Stickers	Nightlight	Showerhead	Shower Timer	Kitchen Aerator	Furnace Whistle	Smart Power Strip	Bathroom Aerator
Bright Kids	Primary	X	X	X						
Take Action	Intermediate	X	X	X	X	X	X	X		
Innovation	Secondary	X	X		X	X			X	X

Survey and Program Participation

Cadmus conducted the parent participant survey over the phone and Internet; NEF conducted the parent kit survey in the participating classrooms as part of the Think!Energy Program classroom incentive component. NEF's survey yielded a higher participation (n=15,610) than Cadmus' survey (n=194).

Despite the sizeable difference in survey participation, **Figure 45** shows that Cadmus' survey results are proportionally comparable to NEF. Overall, Take Action parents represented the majority of program participants, followed by Bright Kids and Innovation.

Figure 45. Cadmus and NEF Parent Survey Participation by Student Group



Source: Parent Participant Survey; Parent Kit Survey.

Use of Measures

Over two-thirds of the parent respondents across all student groups used the measures provided in the kit (**Table 14**). On average, Bright Kids respondents (83%) reported using the measures more than Innovation (73%) and Take Action (68%) respondents; note, however, that the Bright Kids respondents received the fewest number of measures. Interestingly, as more measures are added to the kit, the use of measures appears to decrease.

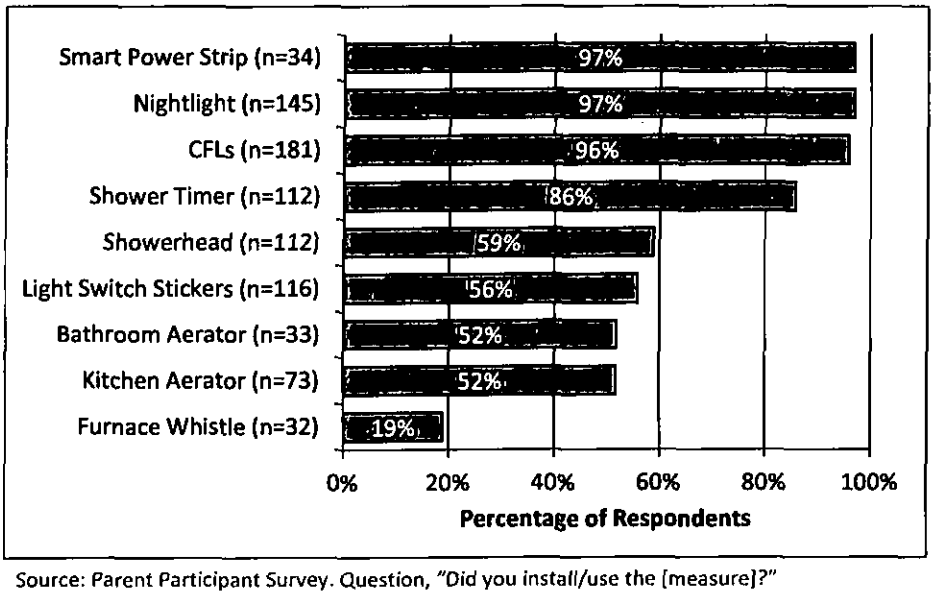
Table 14. Use of Measures and Overall Kit by Student Group

Measure	Bright Kids	Take Action	Innovation
Nightlight (n=145)	96%	97%	--
Smart Power Strip (n=34)	--	--	97%
CFLs (n=181)	99%	97%	97%
Shower Timer (n=112)	--	88%	80%
Showerhead (n=112)	--	61%	54%
Light Switch Stickers (n=116)	54%	60%	55%
Kitchen Aerator (n=73)	--	52%	--
Bathroom Aerator (n=33)	--	--	52%
Furnace Whistle (n=32)	--	19%	--
Average	**83%**	**68%**	**73%**

Source: Parent Participant Survey. Question, "Did you install/use the [measure]?"

At the individual measure level, respondents most frequently reported using the nightlight (97%), smart power strip (97%), CFLs (96%), and shower timer (86%). Similar to the workshop kit respondents, parent participant respondents used the "plugged-in" measures more than the "reminder" measures. Respondents reported using the furnace whistle (19%) the least. **Figure 46** shows the overall percentage of use for the individual measures.

Figure 46. Used Measures from Parent Classroom Kit



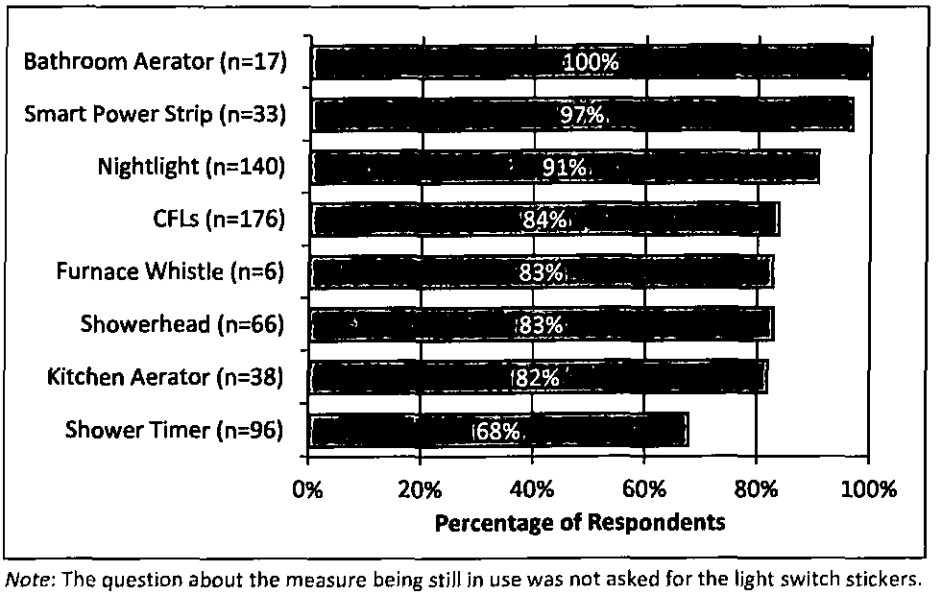
Source: Parent Participant Survey. Question, "Did you install/use the [measure]?"

Respondents who reported not using a particular measure provided their reason for not installing or using the measure. In general, respondents said there was no need for the measure, they already had the measure, or they have not gotten around to installing the measure. Reasons did not differ much across the three student groups.

Kit Items Still in Use

Among the measures that were used, most parent respondents reported they were still using the measures (**Figure 47**). Respondents reported the bathroom aerator (100%), smart power strip (97%), and the nightlight (91%) as the top three measures still in use. Respondents reported still using the shower timer (68%) the least of all the measures.

Figure 47. Parent Classroom Kit Measures Still in Use

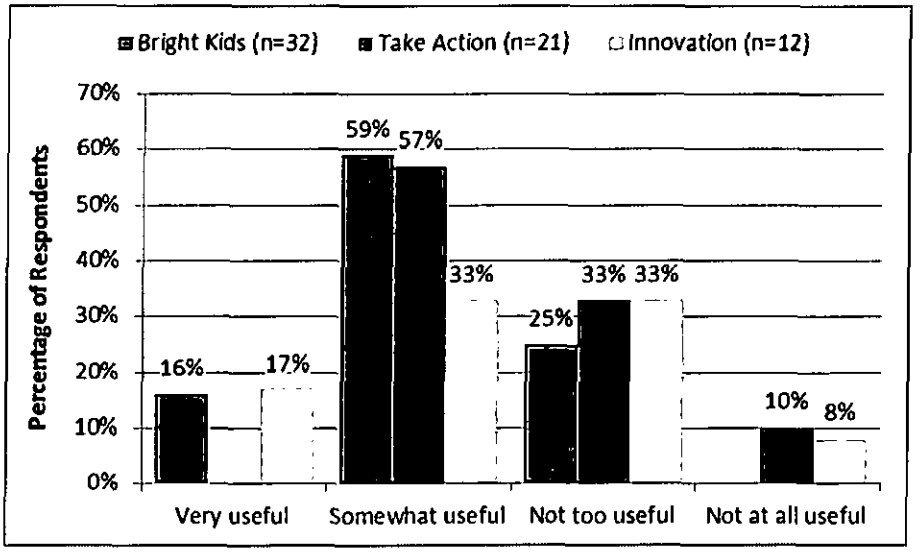


Note: The question about the measure being still in use was not asked for the light switch stickers.
Source: Parent Participant Survey. Question E3, "Have you removed any of the CFLs provided in the kit?" Question, "Are you still using the [measure]?"

Most respondents who removed or stopped using the particular measures said that they were unhappy with the performance or that the measure failed or broke. Respondents found the CFLs were especially fragile and the nightlight was not bright enough. For the shower timer, respondents explained that no one paid attention to the timer while showering. Reasons did not differ across the three student groups.

All three student group respondents who used the light switch stickers were asked to rate its usefulness. Like the findings from the parent workshop respondents (**Figure 44**), a majority of parent participant respondents reported the light switch stickers were *somewhat useful* or *not too useful* (**Figure 48**).

Figure 48. Usefulness of Light Switch Stickers from Parent Classroom Kit



Source: Parent Participant Survey. Question N2, "How useful were the light switch stickers to you? Would you say..."

Energy-Efficiency Awareness and Impact

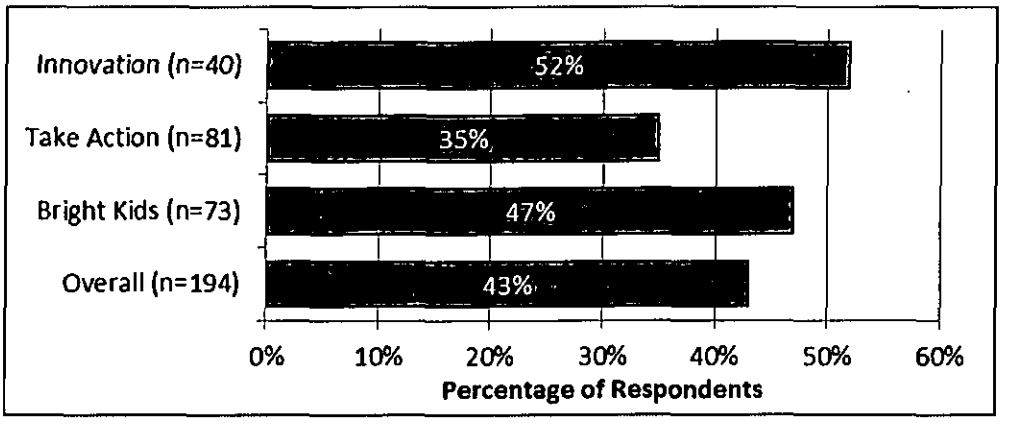
Parent respondents said they were more knowledgeable about how to save energy after having participated in the program. Nearly all of the parent respondents said they were *very* or *somewhat knowledgeable* about how to save energy in their home (97%).

Following the workshop, 90% (n=10) of teacher respondents and 69% (n=45) of parent respondents reported that their knowledge of energy and energy efficiency had increased.

Past Energy Education and Importance of Energy Education in Schools

According to **Figure 49**, 43% of students had received energy education in school prior to the Think!Energy Program. Among the three student groups, parent respondents in the Innovation group reported the highest number of students having previously received energy education. The majority (75%) of parent respondents across all three student groups reported that learning about energy and energy conservation in school is *very important*; 23% of respondents reported that it was *somewhat important*.

Figure 49. Students Who Received Past Energy Education in School

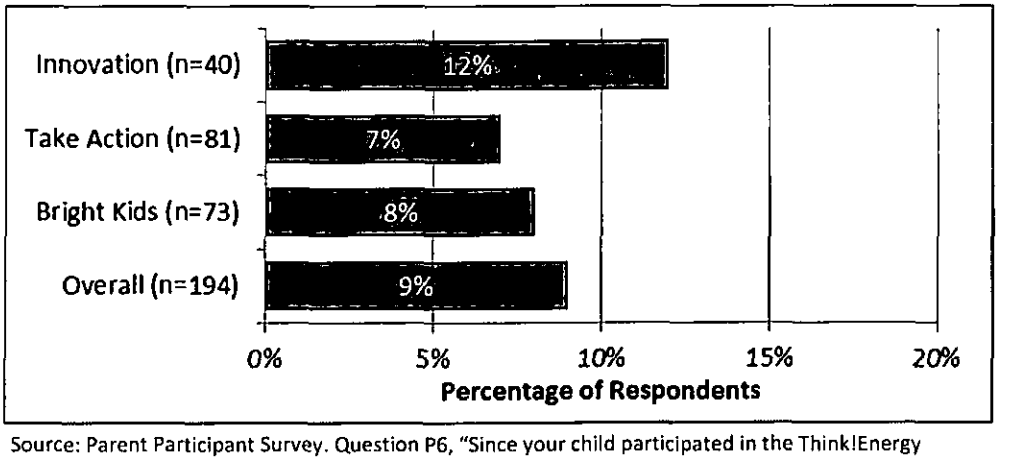


Source: Parent Participant Survey. Question P3, "Did your child receive any instruction on energy and energy conservation in school before participating in the Think!Energy program during the fall of 2013?"

Program Impact on Participation in Other Energy-Efficiency Programs

As shown in **Figure 50**, very few parent respondents (9%) reported participating in other PPL Electric energy-efficiency programs following their participation in the Think!Energy Program. None of the parent or teacher workshop respondents reported participating in the classroom program because of participation in the workshop.

Figure 50. Parent Participation in Other PPL Electric Programs



Source: Parent Participant Survey. Question P6, "Since your child participated in the Think!Energy Program, have you or others in your household participated in other PPL Electric energy efficiency programs?"

Of the parent respondents who indicated participation in other PPL Electric's energy-efficiency programs, respondents most frequently mentioned participating in energy kit-related school programs in other grades.

Table 15 lists the programs respondents participated in because of the Think!Energy Program.

Table 15. Other PPL Electric Programs Parents Participated In

Programs	Number of Respondents
Participated in other grades	4
Walk-through audit	2
Workshops	2
PPL Electric sent a kit in the mail	1
Participated in kit program as a teacher	1
Go Green program	1
Installed building installation	1
Turned off air conditioner to conserve energy	1
ENERGY STAR appliance	1
Winter Relief Assistance Program (WRAP)	1
Online survey	1

Source: Parent Participant Survey. Question P7, "Please describe the other PPL Electric energy efficiency programs you participated in." (n=16)

Program Impact

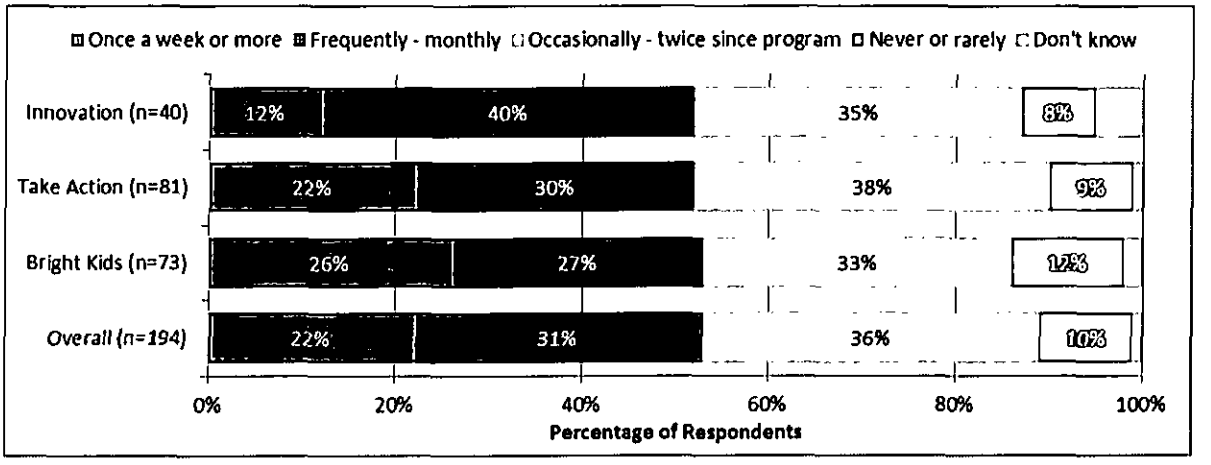
Overall, parents and teachers have changed the way they use energy in their homes and classrooms because of the program.

Parents

Seventy-three percent of parent workshop participants and 66% of parent program participants said they have changed the way they use energy in their home. The most common energy-use change for parent workshop participants is turning off the lights (24%) followed by changing the lights to more energy-efficient bulbs (21%). Innovation participants reported these changes more frequently (75%) than the other two groups (58% for Bright Kids and 70% for Take Action).

Over half (53%) of the student group respondents said their children talk about saving energy with family members *often* or *frequently* compared to 73% of the parents who participated in the workshop. The frequency that students talk with family members about saving energy differs by student group. Parent participants reported that students in the Innovation group are less likely to speak *often* or *frequently* about saving energy than are students in the other two student groups. **Figure 51** provides details by student group.

Figure 51. Frequency of Students Talking about Saving Energy with Family Members



Source: Parent Participant Survey. Question P1, "Since your child participated in this program, how often has your child talked with family members about saving energy around the house; for example, shutting off lights when they are not being used, turning down the heat, closing doors and windows?"

Forty-seven percent of parent workshop participants have purchased energy-efficient products for their homes. The most common improvement was installing more energy-efficient appliances (29%) followed by installing CFLs (19%) and LEDs (14%). Seventy-seven percent of parent workshop participants said their participation in the workshop was *very* or *somewhat important* in their decision to purchase these products.

Teachers

After participating in the program, over half (54%) of the classroom teacher respondents said they are *very likely* to incorporate energy efficiency into future curriculum. Teacher respondents who said they were *not likely* to incorporate energy efficiency into future curriculum provided several reasons:

- Energy efficiency does not fit the curriculum of the class.
- Time will be taken away from other more important subjects.
- Materials do not correspond with state and/or national standards.
- Students are not interested in energy education.

After attending the workshop eight out of 10 teacher respondents said they integrated energy efficiency into their lesson plans and all 10 plan to do so in the future.

Only two out of the 10 teacher workshop participants subsequently participated in the classroom program. The reasons teachers did not participate in the classroom program included not being selected, not having enough time, not getting support from the administration to participate, and missing the deadline to participate.

Eight out of 10 teachers who attended the workshop changed the way they use energy in their classroom.

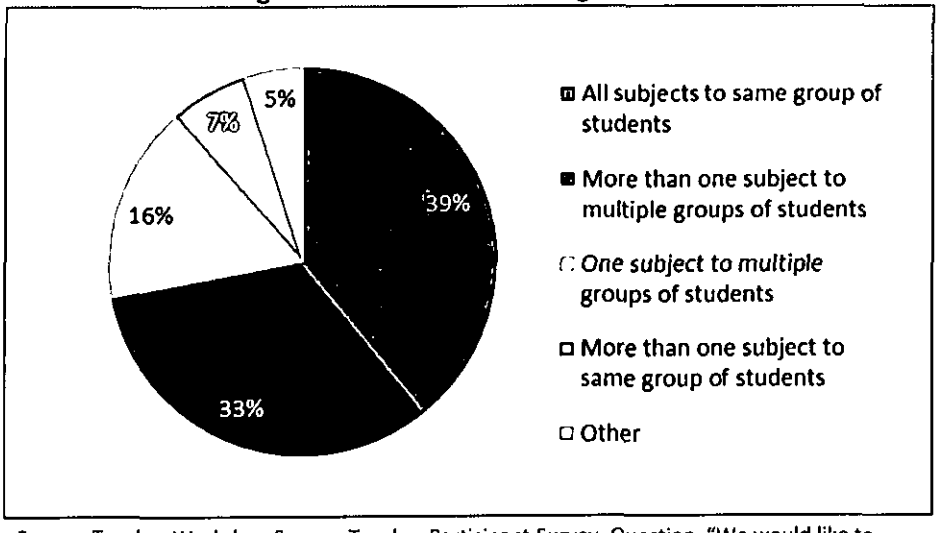
Teachers who attended the workshop said they are more aware of their energy consumption, have a greater understanding of energy, and are able to integrate this into their curriculum.

Classroom Characteristics

Participating teachers answered questions about the structure of their school, the subjects they teach, and if their classroom had participated in the Think!Energy Program in previous school years.

Most teachers said they taught all subjects to the same group of students or taught more than one subject to the same group of students. **Figure 52** presents the answers to this question about the school structure.

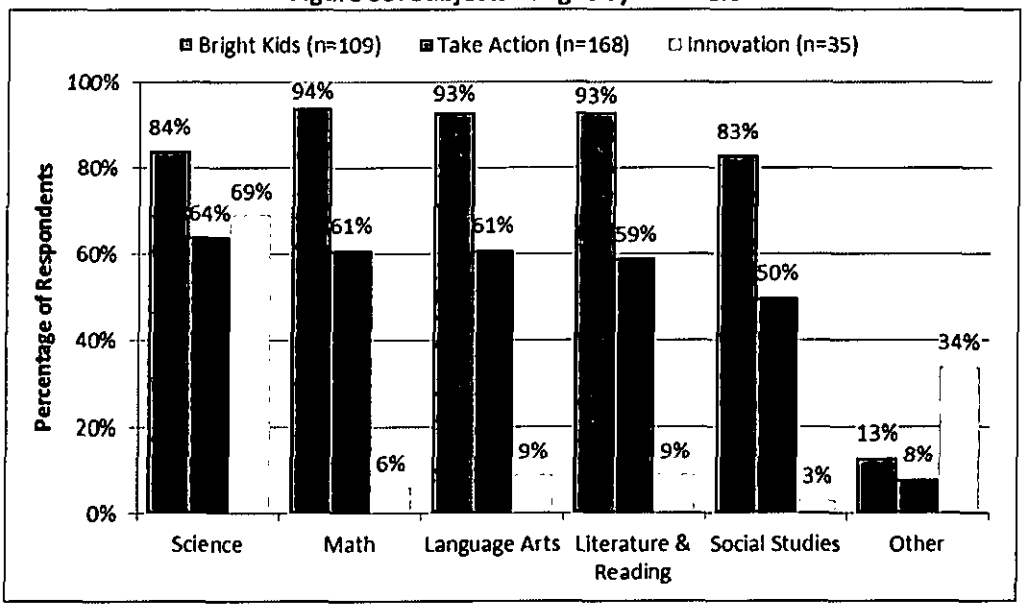
Figure 52. Classroom Teaching Structure



Source: Teacher Workshop Survey; Teacher Participant Survey. Question, "We would like to understand how different schools structure their classes. Please select the statement that best describes the organization of the grade where you taught the Think!Energy curriculum." (n=322).

The most commonly taught subjects among teachers across the three student groups were science, math, and language arts. **Figure 53** shows the subjects respondents taught in their schools.

Figure 53. Subjects Taught by Teachers



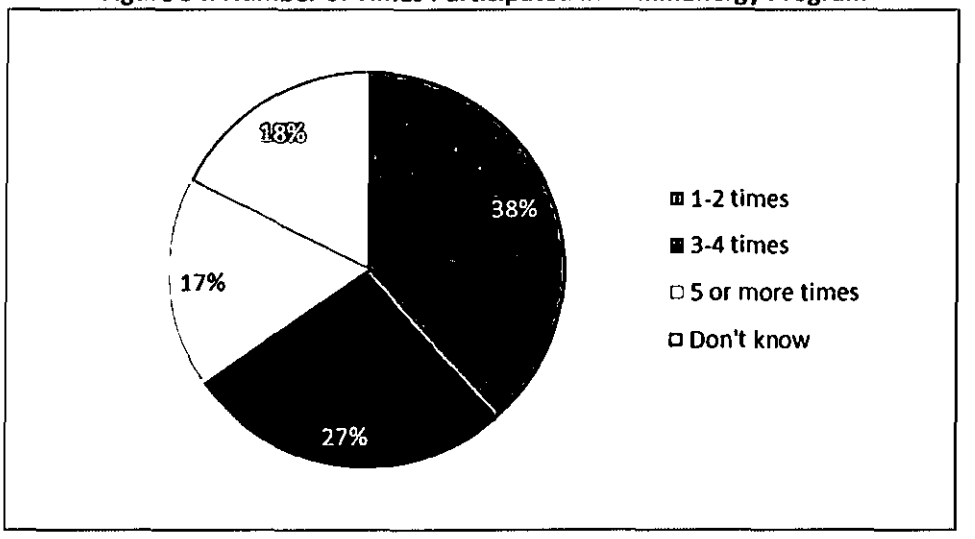
Note: Language Arts include writing and grammar.

Source: Teacher Workshop Survey and Teacher Participant Survey. Question, "What subjects do you teach?" These were multiple response questions. Percentages may add up to more than 100%.

A majority of the classrooms that participated in the program in 2013 had participated in a previous school year (72%). This was highest among classrooms that participated in the Bright Kids program; 83% of the teacher respondents said their classrooms had participated in a previous year. In a previous year, program participation was 74% in the Take Action classrooms and 26% in the Innovation classrooms.

Of the classrooms that had participated in a previous year, 65% of classroom teacher participants said that they had participated four or fewer times. **Figure 54** presents the number of times teachers said their classrooms had participated.

Figure 54. Number of Times Participated in Think!Energy Program



Source: Teacher Workshop Survey; Teacher Participant Survey. Question, "Including your participation in 2013, how many times has your classroom participated in the Think!Energy Program?" (n=222).

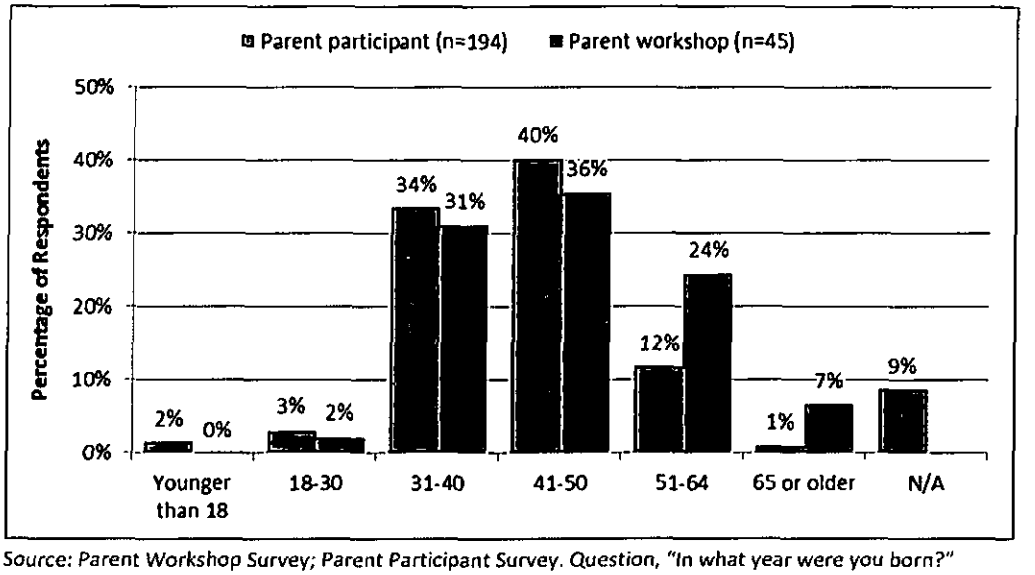
Demographic Profile

Respondents who participated in the student group survey answered questions about their age and education level; they also answered questions about type of residence, number of residents, and income level of household.

Respondent Characteristics

Twenty-seven percent of parent respondents were male, and 73% were female. The majority of respondents were between the ages of 31 and 50 (72%). **Figure 55** shows the ages of parent participants and the parent workshop participants.

Figure 55. Age of Parents



Source: Parent Workshop Survey; Parent Participant Survey. Question, "In what year were you born?"

Parent respondents indicated their education level. Twenty percent have a high school diploma or less, 55% have some college or a college degree, 23% have a graduate or professional degree, and 2% refused to answer the question.

Household Characteristics

Seventy-nine percent of parent respondents live in single-family homes, 17% live in attached homes, and 4% live in multifamily apartments with four or more units.

Over 50% of parent respondents have an income of $50,000 or more (52%), 26% have an income of under $50,000, and 22% did not provide a response.

Benchmarking

Cadmus researched three other student and parent energy-efficiency education kit programs with similar implementation strategies and design to benchmark against PPL Electric's program. The research included one publicly available evaluation—Dayton Power & Light's (DP&L) Be E3 Smart Energy Education Program[24]—and two evaluations of utility programs in the Midwest.[25]

---

[24] Cadmus. *2011 Evaluation, Measurement, and Verification Report.* May 2012. Prepared for Dayton Power & Light.
Cadmus. *2012 Evaluation, Measurement, and Verification Report.* May 2013. Prepared for Dayton Power & Light. Report available upon request.

[25] *Cadmus conducted a process evaluation in 2011 and a process and impact evaluation in 2010 and 2011 for* programs offered by utilities in the Midwest. Neither of these reports is available to the public.

Program Design

PPL Electric's Student Parent Energy-Efficiency Education Program closely resembles the program design of the three other utility programs Cadmus has studied. Students in all four utility programs participate through their classroom and receive instruction on natural resources, energy production, home energy uses, and methods for conserving energy. The students also take home energy-efficiency kits with a similar lineup of measures. Students then complete surveys with their parents and return them to their teachers. Teachers who collect completed surveys earn grant incentives.

The one key difference in program design was the focus on grade level. PPL Electric cast the widest net by involving students in primary, intermediate, and secondary school grade levels compared to the three other programs:

- 5th through 12th grade for DP&L
- 4th through 6th grade for Midwest Utility 1
- 5th grade for Midwest Utility 2

Program Impacts

Compared to the other three programs, PPL Electric's Think!Energy Program had the highest overall participation of participants who received energy savings kits and the highest verified gross energy savings. **Table 16** shows the participation, verified gross savings, and NTG ratio for PPL Electric and the three comparison programs.

Table 16. Student Parent Energy-Efficiency Kit Program Impacts Comparison

Utility	Program Year Evaluated	Number of Schools	Number of Teachers	Number of Participants	Verified Gross Energy Savings (kWh)	NTG Ratio
PPL Electric	2013	188	713	21,733	5,147,000	N/A
DP&L	2012	N/A	84	9,226	4,386,130	N/A
Midwest Utility 1	2011	572	587	15,847	N/A	0.9
Midwest Utility 2	2011	14	29	708 (electric) 468 (gas)	168,788	N/A

We found several commonalities related to program impacts between PPL Electric and the other programs:

- **Participants' energy-efficiency awareness increased.** A persistence survey conducted for Midwest Utility 1 found that 73% of the participants had increased their awareness of energy efficiency. Survey respondents cited this benefit 40% more often than they had in the previous year's survey, suggesting that the program's benefits became more apparent over time.

- **The majority of measures stay installed.** The persistence survey for Midwest Utility 1 found that three-quarters or more of the key measures installed during the first year survey were still installed at the time of the persistence survey one year later. The pieces of equipment that were least likely to still be installed were the water-saving measures (the low-flow faucet aerator and showerhead).
- **Nightlights are not a significant contributor to savings, but they have high satisfaction and persistence rates.** The Midwest Utility 2 evaluation found that nightlights contributed only 0.4% to program savings. Many participants reportedly installed these measures in open sockets. However, participants did report high levels of satisfaction with this item, and persistence was high.

Feedback from Teacher and Parent Participants in Other Programs

Feedback from teacher and parent participants of PPL Electric's program followed the same positive trends as the feedback from the other programs. Survey findings from PPL Electric's program shared the following key findings with the other utility programs:

- **Program satisfaction is high among teachers and parents.** Across all four utility programs, teacher and parent satisfaction with the program was above 85% and as high as 92%.
- **Utility satisfaction is high among parents.** Specifically for Midwest Utility 1, parent participants' satisfaction with the utility increased from 42% to 53% because of their child's involvement with the program.
- **Teachers value the program materials and resources.** Teacher participants from Midwest Utility 1 appreciated the classroom materials, videos, and hands-on activity guides. Interestingly, like PPL Electric's teacher participants, the teacher participants from Midwest Utility 1 also indicated that the hotline was not useful.
- **Parents who did not install a particular measure reported already having the measure installed or an improper fit with existing fixtures.** The majority of parent participants from DP&L's program and the Midwest utility programs did not install CFLs and aerators because the measure was already installed. For aerators, parent participants reported that they could not install the kitchen or bathroom aerators because it was an improper fit with existing fixtures.

Quality Assurance/Quality Control Review

This section describes the factors affecting the program's realization rates during PY5. Cadmus calculated in-service rates (ISR) for each measure included in the kit. We compared these results to PPL Electric's Phase II Schools Program planning document,[26] which estimates the ISRs from PY5 to PY7.

[26] Excel spreadsheet, Portfolio_Forecasting_Model_Phase2_Oct2013 DRAFT.xls, received from PPL Electric October 11, 2013.

Surveys from participants about the energy-efficiency kits distributed in the three student programs, as well as results from Cadmus' parent workshop survey, indicated that five kit measures had lower than anticipated installation rates. See **Table 17** for details.

Table 17. Planned ISR Compared to Survey Response ISR

Kit Measure	Planning Document Based ISRs[1]	Survey Response Rate ISRs [2]
CFLs	74%	65%
Electroluminescent Nightlight	83%	83%
Low-flow Showerhead	46%	32%
Kitchen Aerator	59%	35%
Bathroom Aerator	59%	36%
Furnace Whistle	47%	15%[3]
Smart Strip	(no ISR specified)	80%

[1] Expected installation rates from the Portfolio Forecasting Model for Phase II (Oct 2013)

[2] Survey response rates computed from combined ISRs for the four programs used to assess savings- Bright Kids, Take Action, Innovation, and Parent Workshop.

[3] Furnace Whistle ISR for savings calculations will be set at 47% per the 2013 TRM.

Cadmus conducted a records review, comparing data recorded in EEMIS, PPL Electric's reporting database, with program data provided by NEF. Our records review did not identify duplicate or inaccurate records in EEMIS.

Program Design and Implementation

Program Goals

Although PPL Electric manages and oversees the program, NEF ensures goals are met. PY5 is the first year PPL Electric offered the program within the Act 129 portfolio. The Act 129 program distributes energy conservation kits to five groups—Bright Kids (grades 2 through 3), Take Action (grades 4 through 7), Innovation (grades 9 through 12), parent workshops, and teacher workshops. Four of the five groups contributed to the energy savings (all but the teacher workshops).

The teacher workshops contributed to the second goal, i.e., extending energy education within the community. These workshops (lasting up to eight hours and held during the summer) are designed to help teachers and administrators find ways to incorporate energy-efficiency concepts into classroom curricula.

The program extends energy education to the community by offering a workshop at a Parent Teacher Organization meeting in a low-income community. Educating parents is important because they implement energy-saving activities and items in family settings at home. Educating students contributes to short-term and long-term goals as future ratepayers learn about energy-efficient practices.

Educational elements are designed to encourage participation. Participating teachers in the student programs are eligible to receive mini-grants for their classrooms. The mini-grants are provided on a sliding scale, depending on the rate at which students fill out the Home Energy Worksheets that are part of the energy conservation kits. Parent workshop sponsors, usually parent teach organizations or school administrators, receive similar mini-grants; the grant amount depends upon the number of families or households attending the workshops.

Program Implementation

Planning for the Student and Parent Energy Efficient Education Program takes place in the spring of each year. At that time, training materials, marketing strategy, and items to include in the energy conservation kit are reviewed and finalized. Once plans are in place, the implementer markets the program to potential participants.

The program reaches low-income communities through the parent workshop at schools where at least 30% of the students participate in the free lunch program. The parent workshop takes place in the evening and last about an hour. Each year, at least 30% of the schools sponsoring parent workshops are new to the program.

NEF recruits teachers and maintains wait lists if needed. Teachers or groups who remain on the wait list receive first priority in the following year.

Student in-classroom educational sessions take place primarily in the fall, during the regular school day. Each student presentation lasts about an hour. The educational content of the student presentations is adapted to the students' age and to Pennsylvania education requirements.

The teacher workshops do not offer monetary incentives, but participants receive in-service education credits, counted toward their teacher certification requirements. Teacher workshop participants receive a binder of educational activities and energy-saving items.

Challenges

The Student Parent Program has two challenging areas:

- Increasing attendance at teacher workshops
- Increasing the return rate of the home energy worksheets in secondary schools

Increasing Attendance at Teacher Workshops

Two factors contributed to enrollment challenges at teacher workshops. First, the Pennsylvania Department of Education relaxed requirements on the annual in-service credits teachers need to maintain certification. The workshops provide in-service credits, and it appears teachers were not as compelled to attend the workshop because they did not need as many credits as in previous years. Second, teachers cannot attend the workshop if they attended a workshop with the same curriculum in a prior year. This is a new Department of Education requirement.

PPL Electric and NEF are considering altering the workshop curriculum to meet Department of Education requirements.

Increasing Secondary School Home Energy Worksheet Return Rates

The Home Energy Worksheets help implementers understand participants' home energy use profile and the installation rates of items in the energy conservation kit. Greater worksheet return rates will result in additional data used to accurately measure energy savings.

Return rates were high for Bright Kids (87%) and Take Action (83%). The return rate for Innovation was much lower, at 58%. Innovation students took the worksheets home and filled them out. The other student groups filled out the worksheets in the classroom with teacher assistance, using notes made at home after installing items in the kit.

A change in procedure, requiring all student groups to fill out the forms in the classroom with teacher assistance, may help to increase Innovation worksheet return rates.

Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-5** of the report titled *"PY5 Annual Report."*

Student and Parent Energy Efficient Education Program Process Maps

The Cadmus team developed a process flow map diagramming roles and responsibilities and program activities, starting with the spring planning efforts through to the fall class presentations. The first chart (**Figure 56**) diagrams the overall program process. The next two charts **(Figure 57 and Figure 58)** how roles and responsibilities for program marketing and program registration details.

Figure 56. Program Process

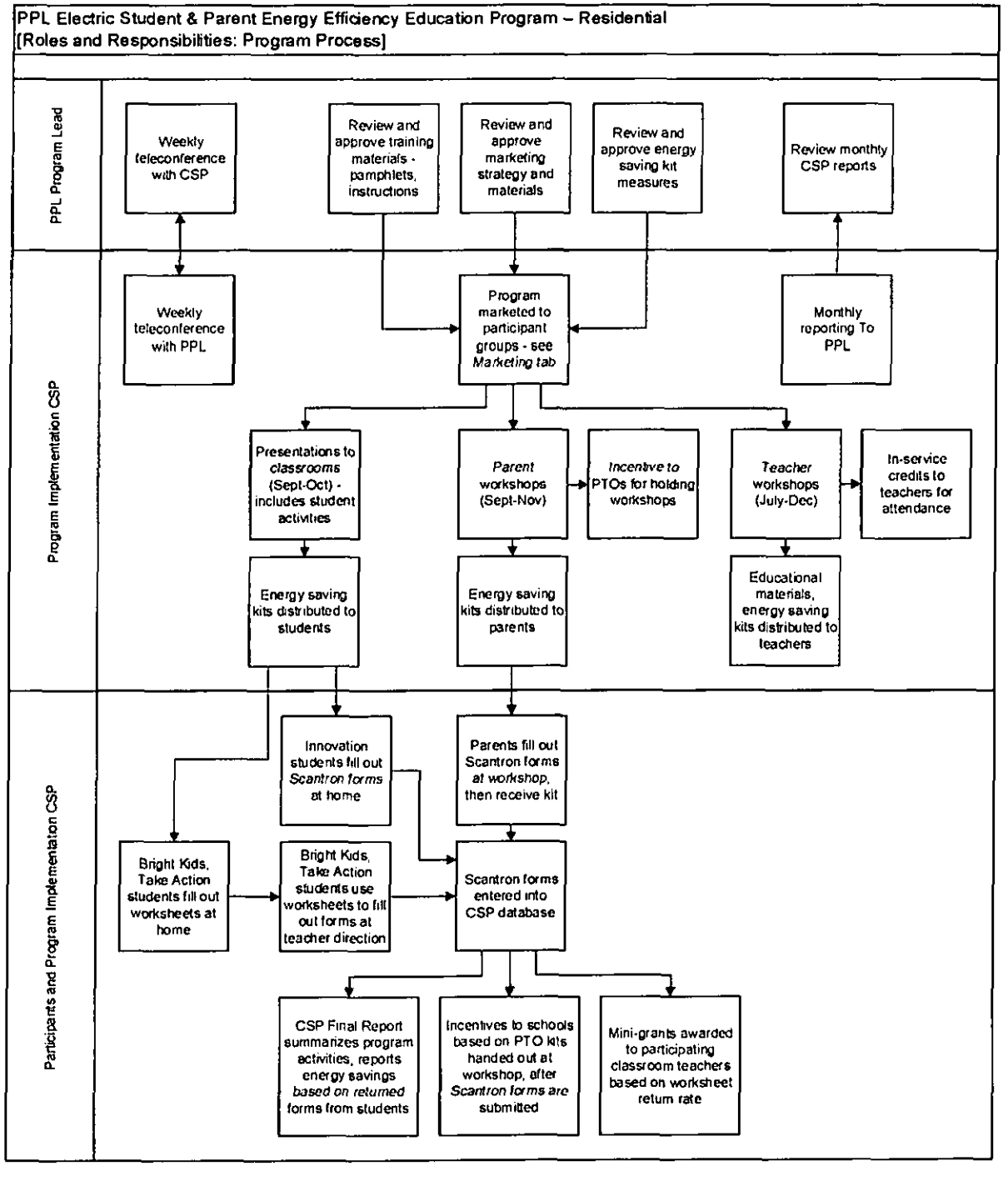


Figure 57. Program Marketing

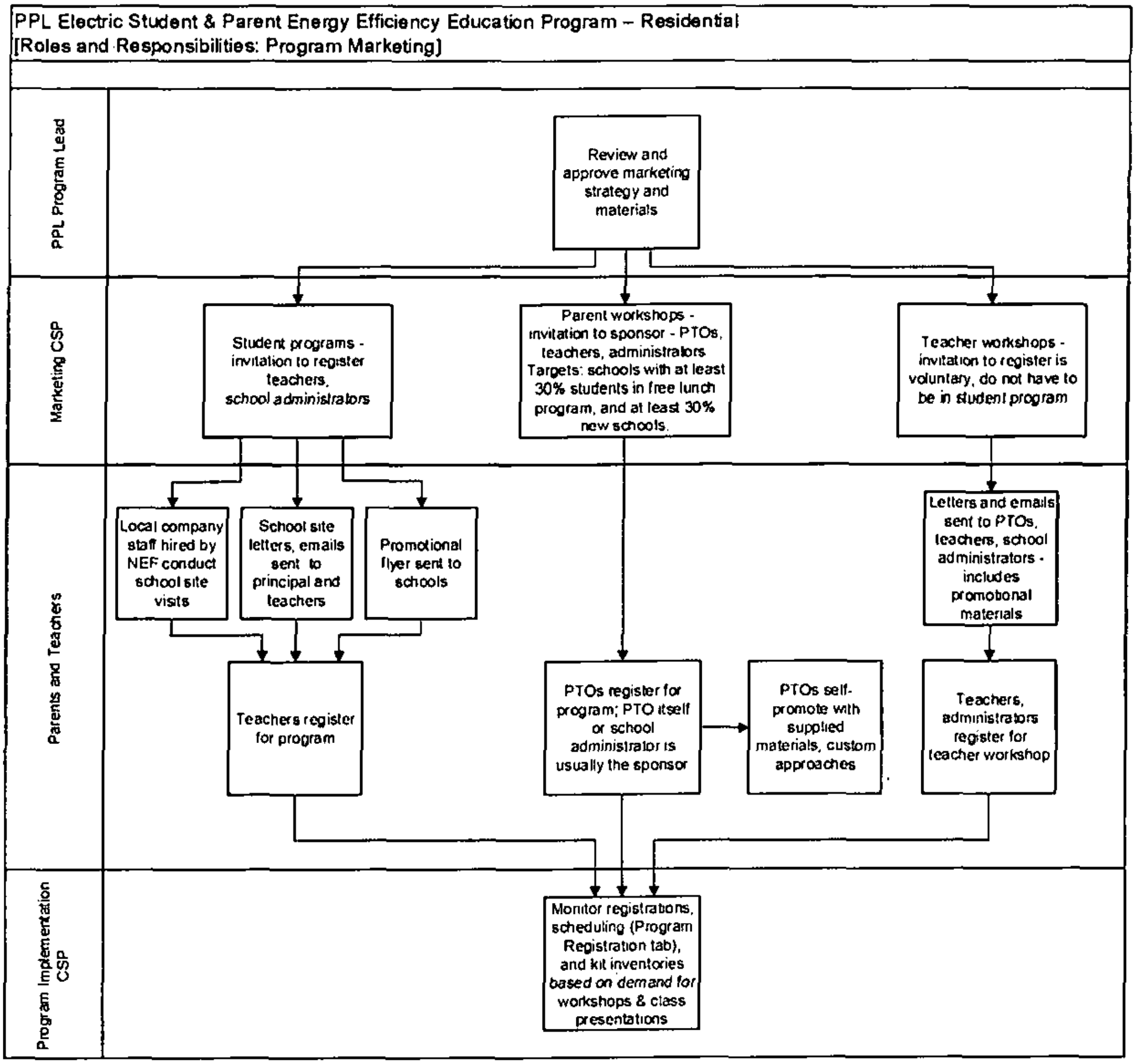
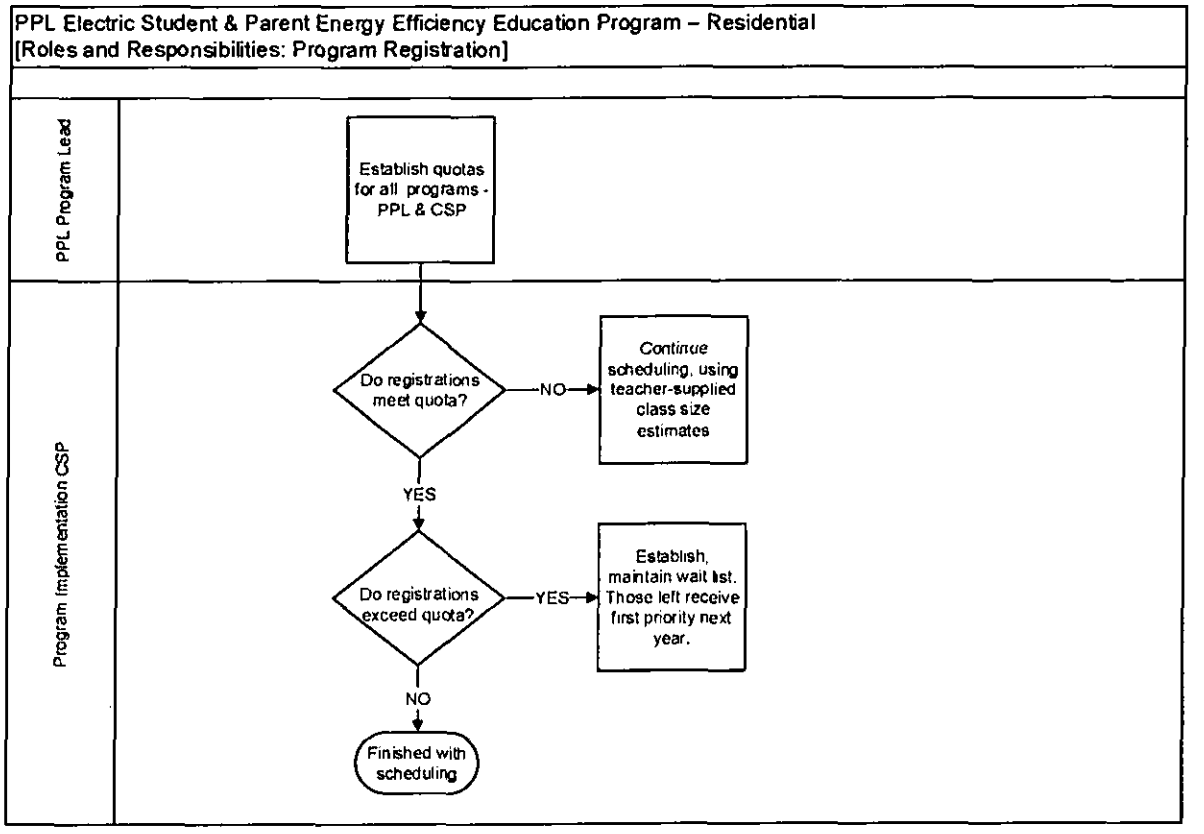
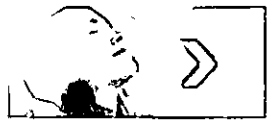


Figure 58. Program Registration





Custom Incentive Program

For the Custom Incentive Program, the PY5 process evaluation activities were these:

- Participant surveys (n=11)
- *Partial participant surveys (n=2)*[27]
- Program staff and implementer interviews (n=3)
- Program literature review and benchmarking
- Database and QA/QC review of records
- Process map review

Achievements Against Plan

In PY5, the program achieved 22% of its planned MWh/year savings and 14% of its planned MW savings.[28] Annual participation targets were not set for the program, but the program achieved 36% of its Phase II participation target (**Table 18**).

Although the program achieved fewer savings in PY5 than planned, it appears to be on track to meet Phase II planned savings based on the size and number of projects currently in the planning and development phase. At the end of PY5 (May 31, 2014), the Custom Incentive Program had achieved:

- 8% of its 65,660 MWh/year three-year planned savings
- 5% of its 9.26 MW three-year planned demand reduction
- 36% of its three-year participation target of 156 participants

Table 18. Custom Incentive Program Savings

Units	PY5 Verified Savings	PY5 Planned Savings	Percentage of PY5 Planned Savings	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/yr	5,394	24,951	22%	65,660	8%
MW	0.484	3.52	14%	9.26	5%

There are several possible reasons why the program achieved fewer PY5 MWh/year and MW savings than planned. Projects could not be carried over from Phase I and PPL Electric required that all projects receive preapproval prior to installation. This means that projects that were already substantially developed or partially constructed were ineligible. The program may be seeing mostly projects that were early in the development phase at the beginning of Phase II. Custom projects often take a long time to develop, so it is not surprising that it has taken several quarters for activity to increase. The

[27] Partial participants as defined here are customers whose projects were cancelled.

[28] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania PUC on April 7, 2014, Table 5a, pp. 29

program does not provide incentives for measures listed in the Pennsylvania TRM. This also may have led to lower savings.

Program Delivery

The Custom Incentive Program promotes comprehensive energy-efficiency improvements by providing incentives for custom projects. This program targets small C&I, large C&I, and GNI sectors. Overall the program is functioning well according to program staff, implementer staff, and survey respondents. Among program and implementation staff there is some concern about not meeting performance expectations and about communicating with customers regarding the preapproval aspect of the application process.

Performance Goals

The Custom Incentive Program achieved fewer than planned savings in PY5. This was not unexpected; the original goals were revised. Savings were likely lower in PY5 for these reasons:

- New participants were confused about when to submit the preapproval application. Though this was not listed as a concern by the survey respondents, program staff reported having received this feedback.
- Some measures are no longer included in the Prescriptive Equipment Program so customers applied for incentives through the Custom Incentive Program. These projects, such as VFD measures, tended to have lower energy savings.

Communication

Communication between PPL Electric's program staff, the implementer (EPower Solutions), and Cadmus has been going well. Bi-weekly meetings discussing each project and its status keeps everyone informed.

New in PY5 was the requirement that participants receive approval prior to proceeding with purchase and installation of projects. Baseline data collection was also required before equipment was installed, which could slow the process for some projects. However, at the beginning of PY5, customers were unaware of these requirements.

The primary communication challenge has been helping customers understand the application process and timing involved with each step. To improve communication and minimize confusion, program staff and implementation staff are developing a "Welcome Packet" to clearly describe expectations and requirements for program participation.

Implementer staff turnover at the end of PY4 disrupted program operations. The internal processes appear to be largely back on track as the new engineer has gained experience with the program and established procedures.

Cadmus reviewed process flow maps that diagram roles and responsibilities and program activities and determined that these program processes are functioning well. **Figure 59** shows how customers learn about the program. **Figure 60** presents the quality control steps. The final two charts—**Figure 61** and

Figure 62—present the overall process for participation in two steps. (See these figures at the end of this chapter.)

Program Changes and Outcomes

There were several changes to the program in PY5. In PY5, preapproval was required prior to installation, and incentives for technical studies were eliminated.[29] In addition, the incentive rates, cost-effectiveness requirements, and incentive limits for combined heat and power (CHP) and non-CHP projects were changed for PY5 (**Table 19**).

Table 19. Program Changes

	Phase II	PY5	PY6	PY7
Incentive Rate (non-CHP)	$0.10 / kWh	$0.08 / kWh	$0.10 / kWh	$0.10 / kWh
Incentive Rate (CHP)	$0.10 / kWh	$0.05 / kWh	$0.10 / kWh	$0.10 / kWh
Minimum TRC (non-CHP)	1.0	1.1	1.1	1.1
Minimum TRC (CHP)	1.0	1.25	1.25	1.25
Maximum Incentive/site/yr	$500,000	$250,000	$500,000	$500,000
Preapproval	Not needed	Required before installation	Required before equipment purchase	Required before equipment purchase
Allow online signatures	*Not available*	*Allowed*	*Allowed*	*Allowed*
Measures in TRM eligible	Yes	Yes	No	No
Technical Studies	Incentives	Not promoted or incented	Not promoted or incented	Not promoted or incented

Program staff reported that customer confusion about the preapproval requirement may have led to lower energy savings in PY5. This confusion was further demonstrated by one of the partial participant survey respondents. This respondent expressed dissatisfaction because it was not clear to why the project did not pass the TRC requirement and receive approval.

To address these challenges, PPL Electric is considering several process improvements. These include:

- Implementing a goal to schedule a conference call with the customer within a defined number of days from receipt of the application. The intent of the call is for all parties to obtain sufficient understanding of the project so that the site-specific evaluation, measurement, and verification plan (SSMVP) can be drafted and site-specific goals made for the pre-installation site visit.
- Following up any significant phone calls between the implementer and the customer with an e-mail documenting the decisions made and actions required.

[29] Beginning in PY6, PPL Electric requires that customers receive preapproval prior to purchasing equipment.

- Providing an explanation to any customer whose incentive is rejected.
- Streamlining the nondisclosure agreement (NDA) form in the approval process for customers who wish to protect sensitive data with an additional customer-specific NDA.

Program Tracking

At least every two weeks, PPL Electric and EPower Solutions carefully track forecasted program savings via an analysis of projects in the queue. They carefully monitor program spending and achievements, which enables staff to have a granular understanding of the program's progress toward planned savings. Cadmus found program data are being tracked effectively and consistently, without major gaps. Projects loaded into the database are complete and have enough information to determine project eligibility.

Factors impacting the program's realization rate are largely based on the PY5 portfolio of projects, specifically the relative contributions of large and small projects and not data tracking systems or processes. Some custom projects are complex, evolve slowly over time, and involve multiple iterations of calculations. Although large projects undergo a more rigorous verification process (before the incentive is fully paid), these projects typically have a realization rate of 100%. Because most of the projects in PY5 were smaller (and included in the small strata) with more variable realization rates, this impacted the program's overall realization rate. More details on the program's impact evaluation are contained in the *"PY5 Final Annual Report."*

Large custom projects often require a long development time. No projects could be carried over from Phase I; therefore, the number of completed and paid large projects was far lower in PY5 than in prior years. Based on the projects in the queue for PY6 and PY7, there is reason to believe that the number of large savings projects will return to higher levels. **Table 20** contains the number of large projects the program processed in all of Phase I, PY5, and anticipated in PY6 and PY7.

Large projects are defined as having an estimated savings in excess of 500,000 kWh/yr, though some projects below this threshold are also selected into the large strata. All projects in the large strata are verified. A random sample of projects in the small stratum are verified.

Table 20. Comparison of Participation by Project Size across Years

Phase/Project Year	Large Projects	Small Projects
Phase I	78	196
PY5	2	56
PY6 and PY7 Queue	20	44

Satisfaction

Overall satisfaction with the Custom Incentive Program was high in PY5. All 11 program participants responding to the survey rated their overall satisfaction with the program as either *very satisfied* (6 out of 11) or *somewhat satisfied* (5 out of 11).[30] Overall satisfaction increased in PY5 compared to PY4 (96%) and PY3 (95%).

Cadmus asked survey respondents about their experiences with the application process, the data collection process, and other aspects of the program. In general, responses in PY5 indicated that the program processes are functioning smoothly but survey respondents said the main challenges were with the application process and communication. This was also supported by comments from the program and implementer staff.

Satisfaction with Communication

Of the 13 survey respondents (including two respondents whose projects were cancelled), seven stated they worked with EPower Solutions and four with their PPL Electric key account manager (KAM) throughout the process. All but one of the respondents who worked with EPower Solutions said they were *very* or *somewhat satisfied* and added that EPower Solutions helped them fill out their application, analyze usage data, and design their project.

Respondents who worked with their PPL Electric KAM said they were *very* or *somewhat satisfied* with their experience and said the most important assistance was that the KAMs were available to answer questions.

One respondent who represented a large industrial manufacturing organization expressed dissatisfaction.[31] This person was *not satisfied at all* with EPower Solutions and reported its representatives did not understand the respondent's business and were not experienced enough with industrial manufacturing.

Three out of 13 respondents said they had concerns before they submitted their application. One was concerned about receiving the money, one was concerned about not having sufficient usage data, and one was concerned about the time it would take to receive the incentive check. However, these concerns were subsequently addressed, and the participants reported satisfaction with the program.

Satisfaction with Prequalification Application

Overall, survey respondents were satisfied with the prequalification application process. However, three of 13 respondents said they were *not too satisfied* with some element of the process. One said the application was too complicated and required too much math, and another (the large industrial

---

[30] We did not ask partial participants about their overall satisfaction.

[31] One respondent representing a large industrial manufacturing company expressed dissatisfied throughout the survey. PPL Electric is aware of his/her feedback and is working with him/her to improve the program experience.

manufacturing company) repeated the opinion that EPower Solutions did not understand the particular business well enough to provide assistance effectively. The third respondent, one of the two whose projects were cancelled, said PPL Electric could have been more helpful and provided more details about how the project could have received approval.

All program participants who could answer the question about the time it took for their project to receive approval said they were *very* or *somewhat satisfied*. Six of the 11 participants responding to the survey said it took less than four weeks to receive approval for their project, two said between four and six weeks, and three did not know how long it took.

None of the program participants encountered any delays or difficulties with the prequalification or approval process, and they received approval for all aspects of their projects.

Energy Management

Survey respondents provided information about energy reduction goals, resource allocation, and their interest in further energy management training, indicating that most participants in the Custom Incentive Program have adopted an energy management approach to reducing energy within their businesses. This adoption of energy management components may help the program achieve the objective to encourage a "whole facility" approach to energy efficiency.[32]

A majority of survey respondents (9 out of 13) said their company had goals for reducing energy consumption. Of these nine, five said the company goal was to reduce energy consumption by a specified percentage, one said the goal was to reduce energy costs by a specific dollar amount, one said the goal was to achieve LEED certification, and two did not know the goal (details in **Table 21**).

Table 21. Energy Management Goals

Response	Number of Responses
Percentage Energy Reduction Goal	**5**
10% reduction	2
10% reduction year over year	1
20% reduction by 2015	1
5% reduction	1
Dollar Amount Reduction Goal	**1**
Save $100,000 annually	1
LEED Certification	**1**
Don't know	**2**

Source: Questions H5 and J5. "What is your company's energy reduction goal?" (n=9)

[32] Included in Cadmus' approved EM&V plan.

Almost half of the respondents (6 out of 13) said they have allocated resources for energy management training in the past year. Four of these six also have energy reduction goals. Ten of the 13 respondents said they would be interested in attending energy-management training if it was offered or sponsored by PPL Electric.

Benchmarking Against Other Programs

Cadmus benchmarked PPL Electric's nonresidential C&I Custom Incentive Program with similar programs offered by other utilities to help PPL Electric enhance its program design.

We reviewed evaluations completed for the ComEd Business Custom Program in Illinois,[33] the Custom Incentives Energy Efficiency Incentive Program conducted by the FirstEnergy companies,[34] the DP&L Non-Residential Custom Rebate Program in Ohio,[35] the PECO Smart Equipment and Smart Construction Incentives programs for custom projects,[36] and a C&I custom rebate program conducted by a Southwest utility.[37]

Process evaluations have been published for PPL Electric's C&I Custom Incentive Program and the C&I custom rebate programs administered by ComEd and DP&L. Cadmus conducted a process evaluation for the Southwest utility, but the results of this evaluation have not been made public.

Marketing and Outreach Strategies

PPL Electric's emphasis on outreach through utility-contractor relationships aligns with the best practices observed in comparable programs. According to participant surveys and similar to PPL Electric, trade ally marketing or contact was the largest contributor to customer awareness for the ComEd and DP&L custom programs.

---

[33] Gunn, R. *Energy Efficiency / Demand Response Plan: Plan Year 3 (6/1/2010-5/31/2011). Evaluation Report: Smart Ideas for Your Business Custom Program.* May 2012. Prepared by Navigant Consulting for Commonwealth Edison Company.

Gunn, R. *Energy Efficiency / Demand Response Plan: Plan Year 4 (6/1/2011-5/31/2012).* Evaluation Report: Smart Ideas for Your Business Custom Program. February 2013. Prepared by Navigant Consulting for Commonwealth Edison Company.

[34] CLEAResult. "FirstEnergy Pennsylvania Customer Incentives." Accessed August 2014. http://www.energysavepa-business.com/efficiency-improvements/custom.

[35] The Cadmus Group, Inc. *2011 Evaluation, Measurement, and Verification Report*. May 2012. Prepared for Dayton Power and Light.

The Cadmus Group, Inc. *2012 Evaluation, Measurement, and Verification Report*. May 2013. Prepared for Dayton Power and Light.

[36] Navigant Consulting, Inc. *Final Annual Report for the Pennsylvania Public Utility Commission For the Period June 2012 through May 2013, Program Year 4.* November 2013. Prepared for PECO Energy Company.

[37] For reasons of confidentiality, this program is referenced anonymously.

ComEd and DP&L conducted full marketing campaigns, which involved billboards, commercials, and/or billing inserts. However, ComEd found that radio commercials and billboards are not an effective way of marketing the program. None of the DP&L customers surveyed in 2011 cited program marketing materials when asked how they became aware of the program.

Both ComEd and the Southwest utility found direct contact from program staff was effective. ComEd KAMs specifically targeted large customers, and most of the surveyed Southwest utility's customers reported that they learned about the program through utility staff or KAMs.

PPL Electric has used utility staff or KAMs to raise awareness of the program in past years but this has decreased in PY5 according to program staff, implementation staff, and participant survey results.

Market Barriers and Solutions to Overcome Challenges

For all of the programs Cadmus reviewed in the benchmarking study, overall customer satisfaction was relatively high. Evaluations of the custom rebate programs noted the following customer concerns and implementation challenges:

- **Expensive or challenging baseline calculation process.** Participants in the Southwest utility's custom rebate program thought the baseline calculations required prior to approval were onerous and imposed a significant burden on would-be participants. The participants often did not have the tools and expertise required for these calculations available in-house, and they also reported difficulty communicating with utility M&V experts who used highly technical language. Similarly, participants in the ComEd program found that establishing a baseline was a challenge, although they were satisfied with the support of trade allies through this process.
- **Complicated application process.** A consistent recommendation across utilities was to further simplify the application process. A number of the programs noted that this process was overly complex. ComEd customers emphasized the importance of working with trade allies who were familiar with the application process, the Southwest utility's customers requested that applications be moved to electronic submission, and the FirstEnergy utilities were considering suggestions to improve application clarity for its C&I and GNI programs. To supplement our research of these programs, we reviewed the 2013 evaluation of the PECO Smart Equipment Incentives programs for C&I and GNI sectors,[38] which suggested that an example of a completed custom rebate application should be provided to prospective participants. We also reviewed program materials for the Consolidated Edison (Con Ed) Custom Program, which makes an Application and Incentive Calculation Tool, XACT, available to participants upon request. This

[38] Navigant Consulting, Inc. *Final Annual Report for the Pennsylvania Public Utility Commission for the Period June 2012 through May 2013 Program Year 4.* Prepared for PECO Energy Company. November 15, 2013. Available online: https://www.peco.com/CustomerService/RatesandPricing/RateInformation/Documents/PDF/New%20Filings/PECO%20Act%20129%20PY4%20Annual%20Report%20Fin%2011%2015%202013.pdf.

tool standardizes the format of savings calculations, and the program website notes that it reduces the amount of time needed to obtain preapproval.[39]

- ***Concerns about rebate amount and uncertainty surrounding rebate amount.*** *ComEd and the* Southwest utility both noted complaints about the size of the rebate and concerns about the uncertainties involved in determining the final incentive payment. ComEd recently introduced an "Early Commitment" option for large projects that reduce electric consumption by at least 500 MWh. If approved, these projects are guaranteed an incentive rate of $0.06/kWh saved in the first year.[40]

Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-6** of the report titled *"PY5 Annual Report."*

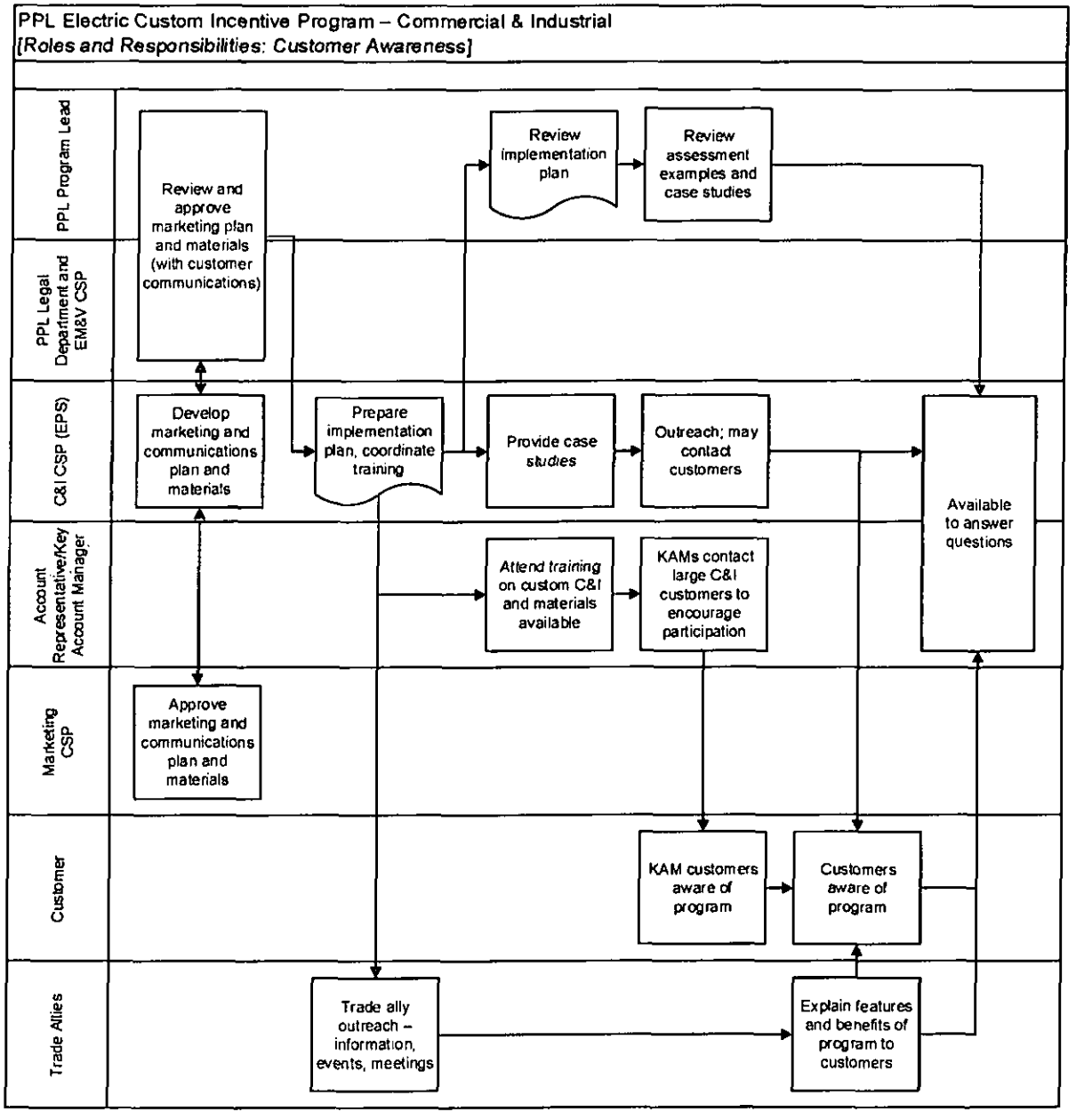
Process Map

Figure 59 through **Figure 62** illustrate the process maps for this program.

[39] Con Edison. "Energy Efficiency Business: Custom Program." Accessed September 2014: https://www.conedci.com/Custom.aspx.

[40] ComEd. "Customer Incentives Provide You With Innovative Energy Savings: Customizing Energy Efficiency to your business." Accessed August 2014: https://www.comed.com/business-savings/programs-incentives/Pages/custom-projects.aspx.

Figure 59. Custom Incentive Program Customer Awareness



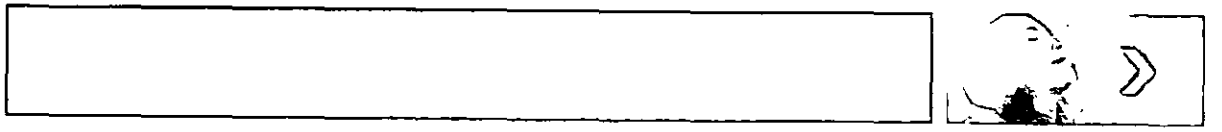


Figure 60. Custom Incentive Program QA/QC

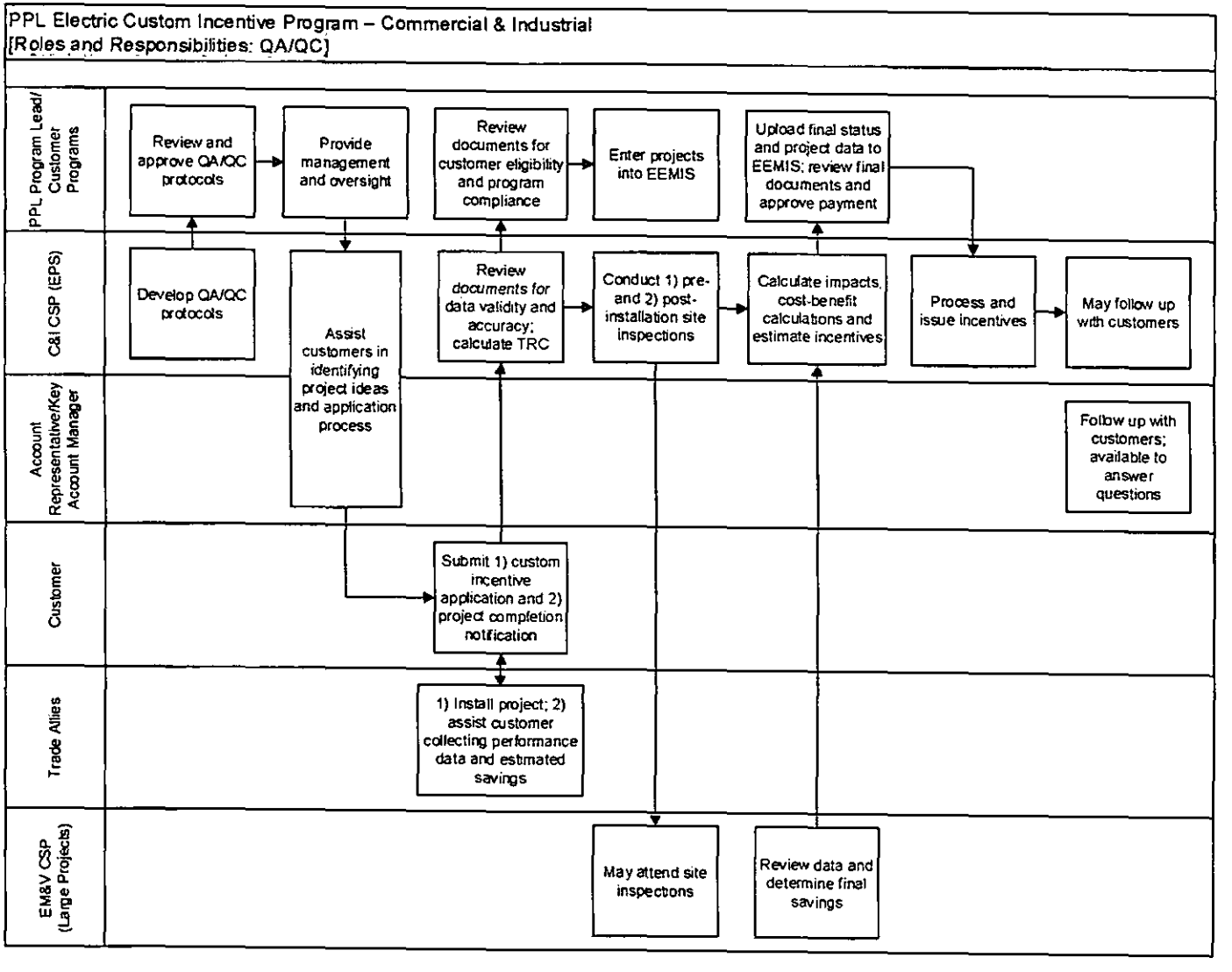
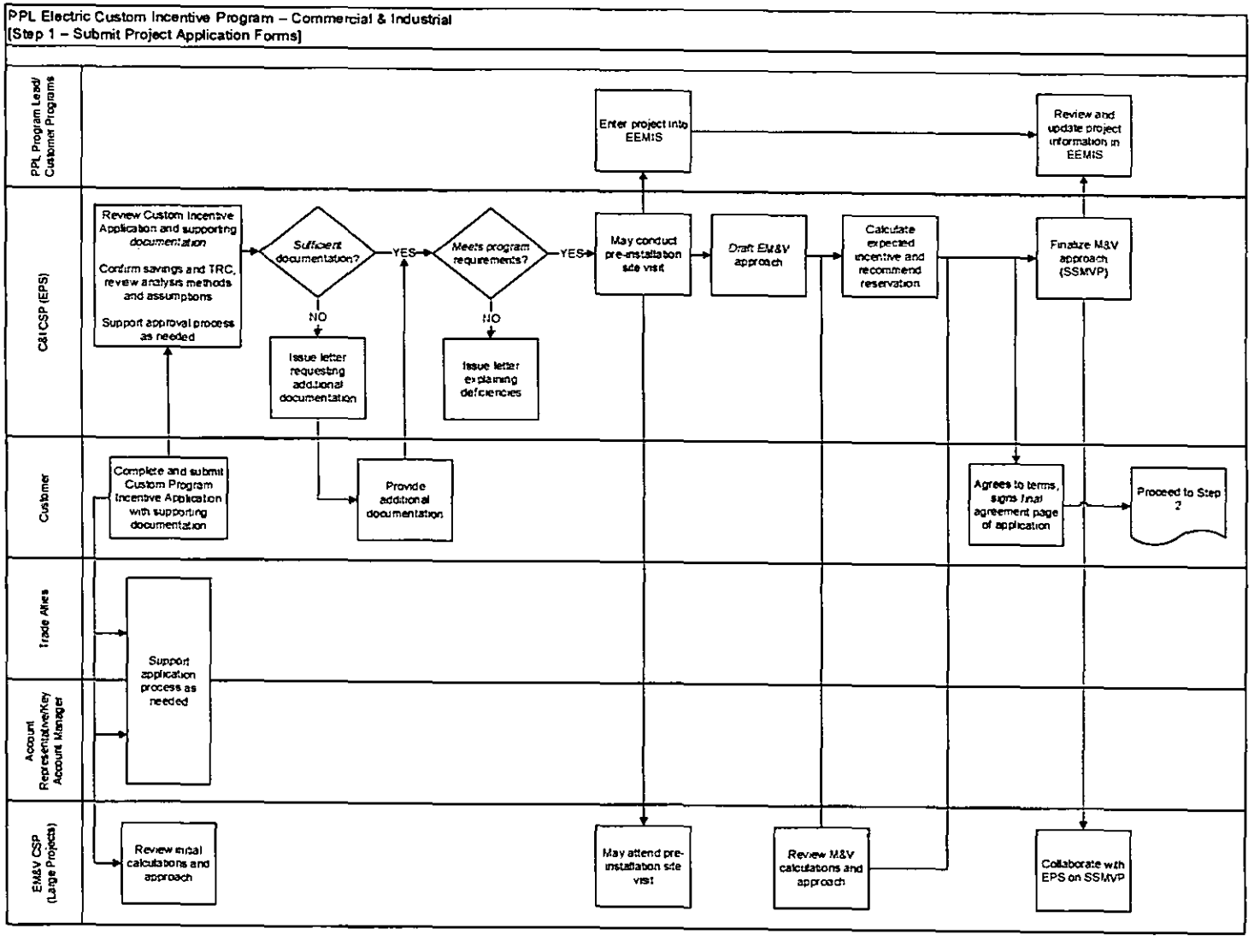


Figure 61. Custom Incentive Program Step 1



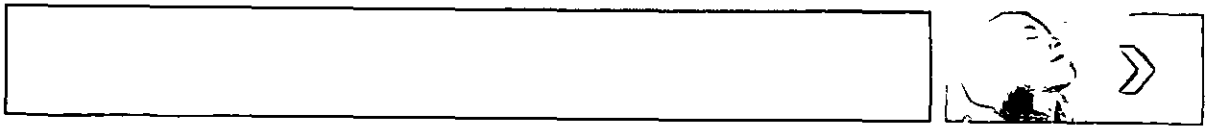


Figure 62. Custom Incentive Program Step 2

Act 129 Winter Relief Assistance Program

For the Act 129 Low-income Winter Relief Assistance Program (WRAP), Cadmus conducted these PY5 process evaluation activities:

- Program staff and implementer interviews (n=1)
- Program literature review and benchmarking
- Database and QA/QC review of records
- Process map development

Achievements Against Plan

In PY5, the WRAP achieved 77% of its planned MWh/year savings,[41] 73% of its planned MW savings, and 86% of its annual participation target (**Table 22**).

At the end of PY5 (May 31, 2014), WRAP had achieved:

- 27% of its 10,519 MWh/year three-year planned savings
- 26% of its 1.29 MW three-year planned demand reduction
- 29% of its three-year participation target of 10,000 units.

Table 22. WRAP Program Savings

	PY5 Verified Savings	PY5 Planned Savings	Percentage of PY5 Planned Savings	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/year	2,810	3,655	77%	10,519	27%
MW	0.33	0.45	73%	1.29	26%

There are several possible reasons why the program achieved fewer of its planned savings for PY5. These include:

- Difficulty identifying candidates for baseload services
- Need to serve potential baseload job candidates under Low-Income Usage Reduction Program (LIURP) because customers needed new water heaters
- Approval of additional full cost jobs too late in the program year to conduct the jobs
- Limited pool of customers who qualify for a heat pump water heater
- Evaluated kWh savings per year per baseload job were 91% of the reported kWh savings per year per Baseload job
- Delay in recording savings for jobs completed in PY5 but not uploaded into EEMIS until PY6

[41] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania Public Utility Commission (PUC) on April 7, 2014, Table J6, p. 81.

These are discussed in further detail in later sections of this report.

Program Delivery

The Act 129 Low-Income WRAP supplements and operates in tandem with PPL Electric's Universal Services Program Low-Income Winter Relief Assistance Program (USP WRAP). Both programs are designed to reduce electric consumption and improve living comfort for low-income customers.

USP WRAP targets low-income residential customers whose income is at or below 200% of the federal poverty level.

Act 129 WRAP operates in largely the same manner but targets low-income customers whose income is at or below 150% of the federal poverty level and seeks to reach:

- New participants,
- PPL Electric customers who received WRAP assistance in the past and may be in need of further WRAP services, and
- Customers who may not have been eligible for low-income assistance in the past due to eligibility rules, such as requiring at least one year of pre-participation kWh usage data.

The program is available to customers in existing single-family housing and existing multifamily housing (with three or more dwelling units) where 50% or more of the tenants are low-income-qualified.

The WRAP programs are designed to operate seamlessly, so that customers are not aware if they are receiving services through USP WRAP or Act 129 WRAP. Funding sources, budgets and expenditures for the two WRAP programs are tracked separately. Both programs are managed by the same PPL Electric program manager, and tracking data for both programs are stored in the WRAP V database system. Participant data for Act 129 WRAP participants are uploaded from the WRAP V system to EEMIS, the Act 129 participant tracking database.

Income-eligible customers receive a free energy audit and their home is evaluated for eligible energy-saving measures. The program uses a preapproved list of measures along with other criteria to determine if appliances and other large equipment can be replaced cost-effectively.

PPL Electric works with community-based organizations to implement the program. These organizations either use in-house contractors or outsource the installation of the energy-saving measures. Outdated and inefficient equipment in customer homes is replaced with program-qualifying energy-efficient equipment.

WRAP also offers energy education to encourage customers to conserve energy. In the unlikely event a structure requires minor health and safety repairs before services can be provided, contractors make the repairs so that the agencies implementing the program do not have to deny services altogether.

WRAP provides low-income customers with two types of service, also known as "jobs"—baseload (customers without electric heat and without electric water heater) and full-cost (customers with an electric water heater and electric heat).

All services and measures are provided to income-qualified customers at no cost. Baseload measures include:

- Energy education
- Installation of efficient lighting (such as LEDs)
- Refrigerator replacement
- Air conditioner replacement
- Dehumidifier replacement
- Changing or cleaning of heating and cooling filters
- Dryer venting (electric dryer)
- Power strips and smart plugs

In addition, PPL Electric offers a heat pump water heater (HPWH) at no cost to qualified low-income customers with electric water heating.

The Cadmus team developed a process flow map diagramming roles and responsibilities and program activities. **Figure 63** diagrams the program process. **Figure 64** shows the QA/QC processes. (These figures are located at the end of this chapter.)

Program Changes and Outcomes

In PY5, PPL Electric revised the program design for Act 129 WRAP. The EE&C Plan filed in 2013 limited Act 129 to 3,000 baseload jobs per year and 200 HPWH installations. The revised plan approved in April 2014 added 400 full-cost jobs to the WRAP's three-year portfolio (200 of these full-cost jobs were added to PY5).

PY5 also marked a change in the program design from Phase I, which offered low-cost jobs to customers with electric water heat. Beginning in PY5, these jobs were no longer offered under Act 129 WRAP; instead customers qualifying for low-cost jobs were served under the sister program, the USP's Low Income Usage Reduction Program (LIURP), an offering outside of Act 129.

Although the program manager reported that communication with WRAP contractors was smooth and that contractors were meeting their production goals, the program struggled to meet its participation targets for these reasons:

- Leads for baseload jobs dried up in the middle of the year.
- Interagency coordination offered fewer opportunities than expected. PPL Electric works cooperatively with:
  - ***State of Pennsylvania agencies*** *to identify potential baseload job recipients, but state* agency funding was reduced in PY5, so PPL Electric did not receive as many referrals.
  - **UGI Utilities, the gas utility**, to identify homes with gas heat where PPL Electric can offer baseload measures to provide a whole-house service. UGI conducts only 300 jobs statewide and has a higher usage threshold for program qualification, so PPL Electric had fewer opportunities to identify baseload job candidates. Some gas customers who should have qualified use electric space heaters as a secondary heat source; this lowered their gas usage and they failed to meet UGI's participant usage threshold.
- More homes identified for services were occupied by renters than anticipated, requiring the cooperation of landlords, which took additional time and effort to obtain approval for services.
- Many homes initially classified for baseload jobs needed new water heaters. These jobs had to be reclassified as low-cost jobs, which were then not eligible for the Act 129 program and were served within LIURP.
- Program staff reviewed prior WRAP participants (through 2013) to identify potential candidates to receive a HPWH, but PPL Electric could only replace the water heater if it was at least seven years old, which limited the pool of eligible customers.
- *The revised EE&C Plan was approved too late in the program year for PPL Electric to identify* potential full-cost customers, schedule program services, conduct site inspections, and report savings to meet the revised PY5 savings target. The program manager reported that there was a surplus of full-cost job referrals, so progress toward planned savings should improve in PY6 and PY7.

Program Tracking

PPL Electric is currently developing a new WRAP tracking database called LEAP, which stands for "Low-Income Energy Assistance Programs." Implementing the LEAP tracking database should help facilitate program tracking data extraction and data analysis. Detailed information about measures installed, such as the measure quantity, information about existing heating and cooling equipment, and the number of residents in the home, are stored in the current WRAP V database; however, when Act 129 data are uploaded into EEMIS, the measure quantities are not uploaded, as savings for WRAP are deemed by job type, not by the number of measures installed.

Benchmarking Against Other Programs

Cadmus researched similar programs offered by other EDCs in Pennsylvania to compare program cost-effectiveness using the TRC statistic.

PY4 Cost-Effectiveness

***Table 23** compares the PY4 financial summaries and cost-effectiveness published in the PY4 Final Annual* Reports for the seven Pennsylvania EDCs. All dollars are in thousands. Three low-income programs were cost-effective in PY4—PPL Electric, Duquesne Light, and PECO. None of the FirstEnergy programs were cost-effective.[42] *Each EDC's program offering is summarized after* **Table 23.**

Table 23. Summary of PY4 Pennsylvania Low-Income Program Costs and Benefits[1]

Benefit-Cost Category	PPL	Duquesne Light	PECO	Met-Ed	Penelec	Penn Power	West Penn Power	
							LIEEP	JUMMP
Number of Participants	3,643	6,396	10,106	1,411	2,755	0	630	4,398
Verified Gross MWh/Year	5,738	13,713	27,270	1,096	1,324	0	522	3,178
Annual kWh Savings/Participant	1,575	2,144	2,698	777	481	0	829	723
Total EDC Costs	$7,010	$648	$5,323	$1,266	$1,567	$42	($649)	$3,674
***Average EDC Cost Per* Participant**	$1.92	$0.35	$0.53	$0.89	$0.56	$0.00	$0.85	$0.84
Total TRC Costs	$7,010	$2,209	$5,323	$1,255	$1,553	$41	$535	$3,674
Total TRC Benefits	$8,871	$5,846	$20,099	$1,170	$1,329	$0	$374	$3,401
TRC Ratio	1.27	2.6	3.78	0.93	0.86	0.00	0.70	0.93

[1] Costs and participant counts from PY4 Final Annual Reports.

Additional details about TRC costs and TRC benefits are available in **Table 26** at the end of this chapter.

Duquesne Light

Duquesne Light's PY4 Low Income Energy Efficiency Program (LIEEP) was cost-effective with a TRC of 2.6.[43] However, **Table 24** shows that 76% of the verified gross energy savings for this program comes from the low-income allocation from the upstream lighting program.

[42] FirstEnergy companies in Pennsylvania are Met-Ed, Penelec, Penn Power, and West Penn Power.

[43] Navigant Consulting, Inc. and Duquesne Light. *Final Annual Report to the Pennsylvania Public Utility Commission for the Period June 2012 through May 2013 Program Year 4.* Pennsylvania Public Utility Commission. November 15, 2013. Page 26.

Table 24. Duquesne Light – Savings Contribution by Measure Stratum

Stratum	Verified Gross Energy Savings (MWh)	Percent of Total Verified Gross Energy Savings (MWh)
LI REEP Kits	1,641	12%
LI REEP Rebate	18	0%
LI RARP	350	3%
LI Refrigerator Replacement	759	6%
LI SEP	74	1%
Opower	382	3%
LI Upstream Lighting	10,489	76%
Total	**13,713**	

These savings have lower program costs attached to them, which drives the LIEEP TRC well over 1.0. Additionally, Duquesne Light runs its low-income programs as part of its regular residential programs, so program management costs are spread over multiple programs and are lower.

Duquesne Light's Phase I EE&C Plan projected that the program would be cost-effective over the course of Phase I, with an estimated TRC of 2.3.[44]

PECO

PECO's Low-Income Energy Efficiency Program LEEP, with a TRC of 3.78, was the most cost-effective program of the Pennsylvania EDCs in PY4.[45] In PECO's PY4 Final Annual Report, the increased cost-effectiveness is attributed to "an increase in Total Lifetime Energy Benefits and a 19% decrease in costs as compared to PY3."[46] The report adds that "the majority of participants received basic measures and CFLs,"[47] and the proportion of program energy savings due to CFLs increased from 46% in PY3 to 63% in

[44] Duquesne Light. *Energy Efficiency and Conservation and Demand Side Response Plan*. Pennsylvania Public Utilities Commission. Docket No. M-2009-2093217. July 1, 2009. Page 40.

[45] Navigant Consulting, Inc. for PECO Energy Company. *Final Annual Report for the Pennsylvania Public Utility Commission for the Period June 2012 through May 2013 Program Year 4*. Pennsylvania Public Utility Commission. November 15, 2013. Page 96.

[46] Ibid., Page 95.

[47] Ibid., Page 76.

PY4 and these "are generally cost-effective measures."[48] PECO projected that this program would be cost-effective in its Phase I EE&C Plan, with an expected TRC for the Phase of 1.71.[49]

FirstEnergy Utilities – Met-Ed, Penelec, and Penn Power

None of these FirstEnergy utilities' low-income programs were cost-effective in PY4. In spite of running identical programs across each of the three utilities "to capitalize on economies of scale and to maximize administrative efficiencies,"[50] the reported TRCs ranged from 0.70 to 0.93. Savings values in PY4 were derived from a billing analysis of prior years' WARM participants and were lower than values used in previous years, which were derived from an analysis of LIURP participant billing histories. Costs were higher in PY4 than in previous years because the bulk of participation was through the WARM Plus Program, which provides comprehensive weatherization services.

Generally, the three FirstEnergy EDC's programs had lower total TRC costs than PPL Electric's WRAP, but their TRC benefits were lower still than PPL Electric's. In their Phase I EE&C plans, Met-Ed, Penelec, and Penn Power estimated cost-effectiveness for the Phase of 0.74,[51] 1.06,[52] and 0.99,[53] respectively.

Penn Power did not have any participants in its WARM Program in PY4.

FirstEnergy Utilities – West Penn Power

Neither West Penn Power's LIEEP nor its Joint Utility Usage Management Program (JUUMP) was cost-effective in PY4, with TRCs of 0.70 and 0.93, respectively. Although JUUMP served over 700 more participants than PPL Electric's WRAP, for total TRC costs of approximately half of those spent on WRAP, this program produced total TRC benefits of less than 40% of those provided by WRAP. West Penn Power's PY4 Final Annual Report notes that TRC values were within "reasonable ranges."[54] West Penn

---

48 Navigant Consulting, Inc. for PECO Energy Company. *Final Annual Report for the Pennsylvania Public Utility Commission for the Period June 2012 through May 2013 Program Year 4.* Pennsylvania Public Utility Commission. November 15, 2013. Page 95.

49 PECO Energy Company. *PECO Energy Efficiency and Conservation Plan (Program Years 2009 – 2012).* Pennsylvania Public Utilities Commission. July 1, 2009. Page 45.

50 GDS Associates, Inc., Nexant, Mondre Energy and Syntil, Inc. *Act 129 Statewide Evaluator Annual Report Program Year 1: June 1, 2009 – May 31, 2010.* Pennsylvania Public Utility Commission. December 15, 2010. Page 63.

51 Metropolitan Edison Company. *Energy Efficiency and Conservation Plan.* Pennsylvania Public Utilities Commission. Docket No. M-2009-2092222. December 22, 2009. Page 126.

52 Pennsylvania Electric Company. *Energy Efficiency and Conservation Plan.* Pennsylvania Public Utilities Commission. Docket No. M-2009-2112952. December 22, 2009. Page 127.

53 Pennsylvania Power Company. *Energy Efficiency and Conservation Plan.* Pennsylvania Public Utilities Commission. Docket No. M-2009-2112956. December 22, 2009. Page 118.

54 ADM Associates, Tetra Tech, NMR Group, and West Penn Power Company. *Final Annual Report to the Pennsylvania Public Utility Commission for the Period June 2012 through May 2013 Program Year 4.* Pennsylvania Public Utility Commission. Docket No. M-2009-2093218. January 6, 2014. Page 91.

Power's Phase I EE&C Plan estimated a cost-effectiveness of 1.2 for JUUMP. LIEEP was not included in the Phase I EE&C Plan.

PPL Electric

PPL Electric's PY4 WRAP was cost-effective with a TRC of 1.27. Although **Table 24** shows PPL Electric had the second highest total TRC benefits of all Pennsylvania EDCs, it also had the highest total TRC costs. PPL Electric reports aggregate costs into two categories—management and EDC incentives to participants. Other EDCs break costs out by the categories, as shown in **Table 23**, so it is not clear what is driving PPL Electric's higher costs. Regardless, PPL Electric's total TRC costs were higher than other EDCs in PY4 and in Phase I.

PPL Electric does not report measure quantities in EEMIS, so it is not possible to comment on the proportion of WRAP savings provided by CFLs. However, these data are available in the LIURP WRAP V database (master tracking data base). PPL Electric projected that this program would be cost-effective in its Phase I EE&C Plan, with an expected TRC for the Phase of 1.05.[55]

Phase I Cost-Effectiveness

Table 25 compares the Phase I financial summaries published in the PY4 Final Annual reports for the seven Pennsylvania EDCs. All dollars are in thousands.

Table 25. Summary of Phase I Pennsylvania Low-Income Program Finances ($1,000)[1]

Benefit-Cost Category	PPL	Duquesne Light	PECO	Met-Ed	Penelec	Penn Power	West Penn Power	
							LIEEP	JUMMP
Number of Participants	13,292	14,393	32,240	9,378	20,762	4,908	11,906	8,711
Verified Gross MWh/Year	19,473	39,589	79,892	5,728	7,375	2,271	11,578	6,793
Phase I kWh Savings /Participant	1,465	2,751	2,478	611	355	0	972	780
Total EDC Costs	$29,225	$2,351	$18,949	$3,891	$5,115	$918	$7,552	$4,605
Average EDC Cost Per Participant	$2.20	$0.16	$0.59	$0.41	$0.25	$0.00	$0.63	$0.53
Total TRC Costs	$25,634	$4,372	$18,949	$3,843	$5,054	$912	$7,552	$4,605
Total TRC Benefits	$24,506	$18,501	$57,835	$5,479	$6,471	$1,741	$5,193	$4,076
TRC Ratio	0.96	4.2	3.05	1.43	1.28	1.91	0.69	0.89
TRC Ratio Projected in Phase I EE&C Plan	1.05	2.3	1.71	0.74	1.06	0.99	1.2	N/A

[1] Costs and participant counts from PY4 Final Annual Reports.

[55] PPL Electric Utilities Corporation. *Energy Efficiency and Conservation Plan*. Pennsylvania Public Utilities Commission. Docket No. M-2009-2093216. January 30,, 2012. Page 99.

Five of the seven low-income programs—Duquesne Light, PECO, Met-Ed, Penelec, and Penn Power—were cost-effective in Phase I. PPL Electric WRAP and both West Penn Power programs were not cost-effective in Phase I, although PPL Electric WRAP was very close with a TRC of 0.96.

Although PPL Electric's WRAP had the third-highest MWh savings per participant and the second-highest total TRC benefits of all seven EDCs, the program also had the highest total TRC costs. This is primarily driven by the $18,182,000 posted in the "EDC Incentives to Participants" cost category. Cadmus notes that the two EDCs with the highest TRCs—PECO and Duquesne Light—posted $0 and $915,000 in this category, respectively. More detailed information about the values posted in this category was not available.

Additional details about TRC costs and TRC benefits for Phase I are available in **Table 27** at the end of this chapter.

Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-7** of the report titled *"PY5 Annual Report."*

Process Map

Figure 63 and **Figure 64** contain the process maps for this program.

Figure 63. LI WRAP Process Map – Program Process

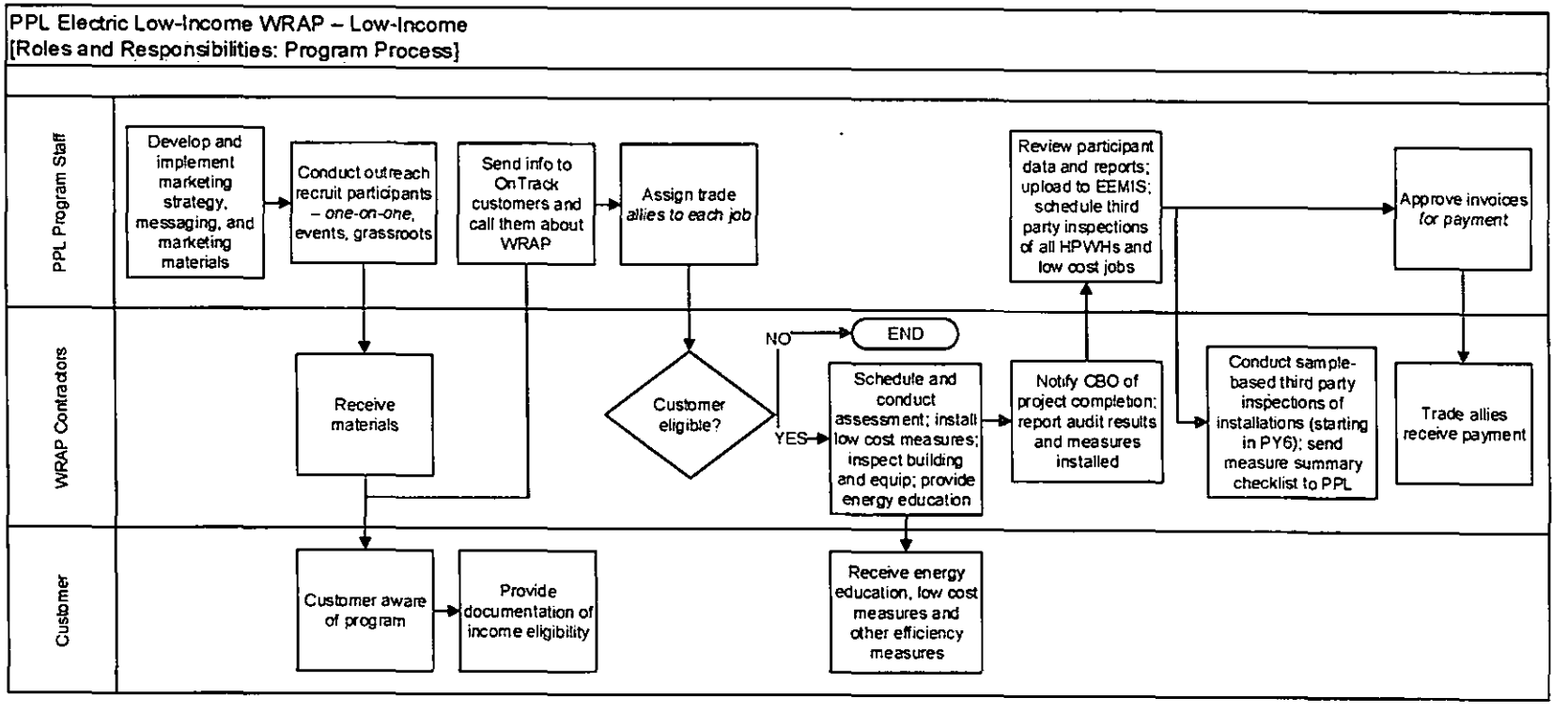
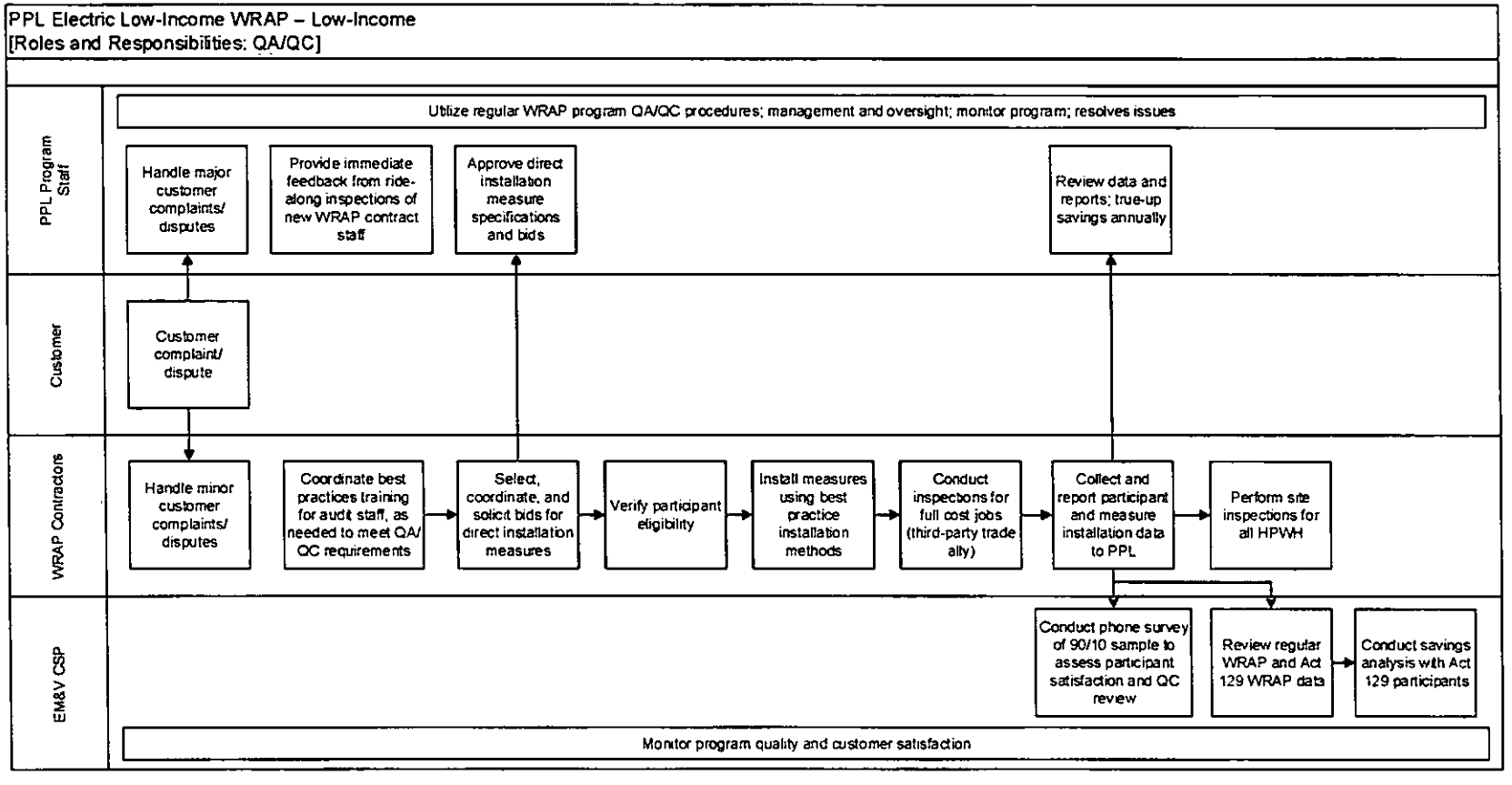


Figure 64. LI WRAP Process Map – QA/QC



Cost-Effectiveness Tables

A summary of TRC costs and TRC benefits for PY4 are in **Table 26. Table 27** *summarizes the TRC costs* and TRC benefits for Phase I.

Table 26. Summary of PY4 Pennsylvania Low-Income Program Finances ($1,000)[1]

Benefit-Cost Category	PPL Electric	Duquesne Light	PECO	Met-Ed	Penelec	Penn Power	West Penn Power	
							LIEEP	JUMMP
Number of Participants	***3,643***	***6,396***	***10,106***	***1,411***	***2,755***	***0***	***630***	***4,398***
Verified Gross MWh/Year	**5,738**	**13,713**	**27,270**	**1,096**	**1,324**	**0**	**522**	**3,178**
Annual MWh Savings/ Participant	**1.58**	**2.14**	**2.70**	**0.78**	**0.48**	**0.00**	**0.83**	**0.72**
EDC Incentives to Participants	$0	$256	$0	$950	$1,261	$6	N/A	N/A
EDC Incentives to Trade Allies	$0	$0	$0	$0	$0	$0	N/A	N/A
Subtotal EDC Incentive Costs	**$0**	**$256**	**$0**	**$950**	**$1,261**	**$6**	**$0**	**N/A**
Design & Development	$0	$0	$0	$1	$1	$0	N/A	N/A
Administration	$0	$0	$873	$81	$86	$0	$56	$180
Management	$7,010	$266	$285	$141	$128	$29	N/A	N/A
Marketing	$0	$17	$550	$5	$6	$1	$3	$9
Technical Assistance	$0	$0	$3,377	$10	$12	$1	-$723	$3,445
Subtotal EDC Implementation Costs	**$7,010**	**$283**	**$5,085**	**$238**	**$233**	**$31**	**-$664**	**$3,634**
EDC Evaluation Costs	$0	$75	$239	$68	$59	$4	$15	$40
SWE Audit Costs	$0	$34	$0	$11	$14	$1	N/A	N/A
Total EDC Costs	$7,010	$648	$5,323	$1,266	$1,567	$42	-$649	$3,674
Participant Costs	$0	$832	$0	$0	$0	$0	N/A	N/A
Total TRC Costs	**$7,010**	**$2,209**	**$5,323**	**$1,255**	**$1,553**	**$41**	**$535**	**$3,674**
Total Lifetime Energy Benefits	$8,653	$5,846	$19,107	$1,027	$1,220	$0	$344	$3,115
Total Lifetime Capacity Benefits	$218		$420	$143	$109	$0	$30	$286
Total TRC Benefits	**$8,871**	**$5,846**	**$20,099**	**$1,170**	**$1,329**	**$0**	**$374**	**$3,401**
TRC Ratio	**1.27**	**2.6**	**3.78**	**0.93**	**0.86**	**0.00**	**0.70**	**0.93**

[1] Costs and participant counts from PY4 Final Annual Reports.

Table 27. Summary of Phase I Pennsylvania Low-Income Program Finances ($1,000)

Benefit-Cost Category	PPL Electric	Duquesne Light	PECO	Met-Ed	Penelec	Penn Power	West Penn Power	
							LIEEP	JUMMP
Number of Participants	**13,292**	**14,393**	**32,240**	**9,378**	**20,762**	**4,908**	**11,906**	**8,711**
Verified Gross MWh/Year	**19,473**	**39,589**	**79,892**	**5,728**	**7,375**	**2,271**	**11,578**	**6,793**
Phase I MWh Savings/ Participant	**1.47**	**2.75**	**2.48**	**0.61**	**0.36**	**0.46**	**0.97**	**0.78**
EDC Incentives to Participants	$18,182	$915	$0	$2,950	$4,153	$741	$6,349	$371
EDC Incentives to Trade Allies	$0	$0	$0	$0	$0	$0	N/A	N/A
Subtotal EDC Incentive Costs	**$18,182**	**$915**	**$0**	**$2,950**	**$4,153**	**$741**	**$6,349**	**$371**
Design & Development	$0	$153	$0	$8	$10	$1	$40	$25
Administration	$0	$0	$2,854	$242	$242	$42	$362	$353
Management	$11,041	$856	$1,276	$357	$396	$84	N/A	N/A
Marketing	$0	$120	$922	$19	$25	$4	$21	$24
Technical Assistance	$0	$0	$13,304	$41	$50	$13	$707	$3,734
Subtotal EDC Implementation Costs	**$11,043**	**$1,119**	**$18,356**	**$667**	**$723**	**$144**	**$1,130**	**$4,136**
EDC Evaluation Costs	$0	$170	$594	$226	$179	$28	$74	$98
SWE Audit Costs	$0	$137	$0	$48	$61	$6	N/A	N/A
Total EDC Costs	$29,225	$2,351	$18,949	$3,891	$5,115	$918	$7,552	$4,605
Participant Costs	$0	$2,054	$0	$0	$0	$0	N/A	N/A
Total TRC Costs	**$25,634**	**$4,372**	**$18,949**	**$3,843**	**$5,054**	**$912**	**$7,552**	**$4,605**
Total Lifetime Energy Benefits	$23,808	$18,501	$53,788	$4,750	$5,804	$1,579	$4,856	$3,771
Total Lifetime Capacity Benefits	$698		$2,122	$729	$667	$161	$337	$305
Total TRC Benefits	**$24,506**	**$18,501**	**$57,835**	**$5,479**	**$6,471**	**$1,741**	**$5,193**	**$4,076**
TRC Ratio	**0.96**	**4.2**	**3.05**	**1.43**	**1.28**	**1.91**	**0.69**	**0.89**
TRC Ratio Projected in Phase I EE&C Plan	**1.05**	**2.3**	**1.71**	**0.74**	**1.06**	**0.99**	**1.2**	**N/A**

[1] Costs and participant counts from PY4 Final Annual Reports.

Residential Home Comfort Program

For the Residential Home Comfort Program, the PY5 process evaluation activities were these:

- Participant surveys (n=164)
  - Equipment (n=75)
  - Audit (n=72)
  - Weatherization (n=17)
- Program staff and implementer interviews (n=2)
- Program literature review and benchmarking
- Database and quality assurance/quality control (QA/QC) review of records
- Process map review

Achievements Against Plan

In PY5, the Residential Home Comfort Program achieved 68% of its planned MWh/year savings,[56] 200% of its planned MW savings, 28% of its annual audit participation target, 23% of its annual weatherization participation target, and 52% of its annual efficient equipment participation target (**Table 28**).

At the end of PY5 (May 31, 2014), the Residential Home Comfort Program had achieved:

- 19% of its 12,739 MWh/year three-year planned savings
- 56% of its 1.78 MW three-year planned demand reduction
- 9% of its three-year participation target of 6,000 home audits
- 8% of its three-year participation target of 1,800 weatherization measures
- 27% of its three-year participation target of 6,700 efficient equipment units

Table 28. Residential Home Comfort Program Savings[1]

	PY5 Verified Savings	PY5 Planned Savings	Percentage of PY5 Planned Savings	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/year	**2,410**	3,541	68%	12,739	19%
MW	**1.0**	0.500	200%	1.78	56%

[1] Pennsylvania Public Utility Commission. *PPL Electric Utilities Corporation Energy Efficiency and Conservation Plan Act 129 Phase II, Docket No. M-2012-2334388.* Compliance filing April 7, 2014.

There are several possible reasons why the program achieved fewer than planned PY5 MWh savings. These include:

- Very low audit and weatherization participation in the first quarter of PY5.

[56] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania PUC on April 7, 2014, pp. 59.

- Low interest in the audit component of the program reduced the pool of candidates eligible for weatherization rebates, as weatherization rebates are contingent upon receiving a program audit.
- Low awareness of program rebates.
- No applicants for the new construction rebate (PPL Electric anticipated 720 homes in Phase II; one third of the Phase II total would be 240 homes in PY5).
- Approval of the manufactured homes component too late in the program year to market and process rebates (PPL Electric set MWh and MW planned savings, anticipating 200 homes in Phase II).

These are discussed in further detail in later sections of this report.

Program Delivery

The Residential Home Comfort Program offers a wide range of energy-efficient measures and rebates for new construction and the retrofitting of existing homes. The program also offers education and services so customers can customize solutions to improve their home's energy efficiency. The PY5 program involved four program components:[57]

- **Audit** - offers customer rebates for a professional comprehensive home energy audit or a less comprehensive walk-through assessment for $50. Customers who choose the comprehensive audit select an auditor and pay the market price. The cost varies by auditor; PPL Electric estimates audits cost about $500. Customers are eligible for a $250 rebate if they have both main source electric heat *and* central air conditioning or $125 if they have either main source electric heat *or* central air conditioning. The comprehensive audit includes diagnostic testing, such as a blower door test.
- **Weatherization** - is based on recommendations from the audit and offers rebates for duct sealing and insulation.
- **Energy-efficient equipment** - offers rebates for the installation of high-efficiency heat pumps, ductless mini-split heat pumps, and pool pumps.
- **New homes** - encourages construction of energy-efficient new homes by offering a $2,000 rebate to builders for installing a specific package of measures. These measures are seasonal energy efficiency rating (SEER) 16 air source heat pump (ASHP), HPWH with an energy factor greater than or equal to 2.3, an ENERGY STAR refrigerator and dishwasher, ceiling insulation

[57] PPL Electric plans to offer the Manufactured Homes component in PY6.

with an R-value greater than or equal to
R-49, and wall insulation with an R-value greater than or equal to R-20+5.[58]

Although there are multiple components, the program has only two data-processing tracks:

- **Walk-through assessment track**, in which customers pay $50 directly to the audit contractors (CLEAResult employees).
- **Rebate track**, in which customers arrange for a service to be conducted or a measure to be installed, pay the full cost of the service or measure, and then apply for a rebate to cover all or a portion of the cost. The service or measure can be a comprehensive audit, ceiling insulation, an ASHP or other equipment, or appliances in a new home. The process for submitting and processing the rebate is the same.

Cadmus developed process flow maps diagramming roles and responsibilities and program activities (see **Figure 66** through **Figure 70** at the end of this chapter). **Figure 66** diagrams the roles and responsibilities of program stakeholders as they relate to customer awareness. The next four charts show program activities related to the walk-through assessment (**Figure 67**), the comprehensive audit (**Figure 68**), installation of efficient measures (**Figure 69**), and PPL Electric's quality control process (**Figure 70**).

Program Objectives

The objectives of the Residential Home Comfort Program are to:

- Encourage customers to take a holistic view of energy efficiency
- Promote construction of energy-efficient new homes
- Educate construction industry professionals about the benefits of energy-efficient new homes
- Provide customers with audits, surveys, and energy-saving solutions
- Provide immediate energy savings to customers by offering free direct install measures
- Obtain total energy savings of approximately 12,700 MWh/year

The program provides builders and customers with one point of entry. CLEAResult implements the program.

Performance Goals

At the end of PY5, PPL Electric had achieved fewer than its overall MWh savings for this program; however, it is only slightly below its participation goal for the efficient equipment component. Cadmus

[58] "R-20+5" means R-20 cavity insulation plus R-5 insulated sheathing. See IECC 2009 Section 402.1.1 Insulation and Fenestration Criteria. Available online at: http://publicecodes.cyberregs.com/icod/iecc/2009/icod_iecc_2009_4_sec002.htm

notes that PPL Electric's PY5 planned energy savings include savings for new construction, but no rebates for new construction were reported in PY5.

Savings for the ASHP and ductless heat pump (DHP) measures represented 75% of the program's overall energy savings in PY5. Early pilot applications of the new Home Energy Rating System (HERS) Option rebate of the new construction component show larger than expected savings that have the potential to push savings toward the Phase II MWh goal. A level of builder interest in the HERS Option that resulted in just half of the Phase II participation target would ensure that PPL Electric achieves its planned energy savings both annually and for Phase II. Ultimately, the number of rebates for heat pumps and new construction will determine if PPL Electric is successful in achieving its planned energy savings for the Residential Home Comfort Program.

Program Changes and Outcomes

The Residential Home Comfort Program is new in Phase II. It is a hybrid that combines two Phase I programs—the residential Home Energy Assessment and Weatherization Program and the HVAC rebate component of the Efficient Equipment Program—and it also includes a new construction component.

In April 2014, PPL Electric filed a revised EE&C plan with the Pennsylvania Public Utilities Commission (PUC),[59] in which it added new rebates to customers and training and equipment for contractors. These are:

- A bonus rebate of $500 is available to customers who follow through and install recommended insulation and duct sealing measures within 180 days of the audit.
- A rebate for customers who are on PPL Electric's Residential Thermal Storage (RTS) rate and who upgrade their heating system to an ASHP or DHP of SEER 15 or greater.
- Two new rebates are offered in the new construction component—a manufactured homes rebate and a performance-based "HERS Option" new construction rebate.[60] These rebates will launch in PY6.
- The revised plan offers thermal imaging guns and training on how to use them to contractors certified by the Building Performance Institute (BPI).

PPL Electric has implemented the majority of Cadmus' prior Phase I recommendations for program improvement, including improving data entry processes, creating a trade ally network, increasing the rebate for installing weatherization measures, and making eligibility for weatherization rebates contingent upon receipt of a PPL Electric walk-through assessment or comprehensive energy audit.

PPL Electric has not yet implemented but is considering the PY3 recommendation to research and convey information to its customers about additional sources of financial assistance, such as financial

---

[59] PPL Electric. *PPL Electric Utilities Corporation Energy Efficiency and Conservation Plan Act 129 Phase II*. Pennsylvania Public Utilities Commission. Docket Number M-2012-2334388. April 7, 2014.

[60] Home Energy Rating System. More information available online at: http://www.resnet.us/hers-index

institutions and other organizations that offer loans or grants, to help increase the percentage of audit participants who go on to install weatherization upgrades.

Program Tracking

This section describes the factors affecting the program's realization rates during PY5 and PPL Electric's systems and processes to track data and monitor the program. Except for the savings from the direct install efficiency measures offered to customers at the time of the audit, savings for all other efficiency measures in the Residential Home Comfort Program are calculated using algorithms provided in the 2013 Pennsylvania TRM.[61] The major factors affecting the program's realization rate were:

- ***Rebates with incorrectly assigned measure codes.*** In the records review, Cadmus noted one weatherization measure with a measure code that did not account for the savings from heating, which were considerable. We recalculated the savings using algorithms for the equipment and information provided; this correction raised the realization rate.
- ***Input parameters and programming of rebate algorithms.*** Cadmus calculated savings using input values found on the rebate applications and in the tracking data for a sample of program participants and was able to reproduce savings calculated by the program implementer. The two program measures that provided the majority of program savings—ASHP and DHP—both had realization rates of 100%. The accuracy in data entry and programming of rebate algorithms for these two measures was the primary driver of the program realization rate of 102%. Several other measures with lower overall savings than heat pump measures had realization rates greater than 100%; this was due to large differences in the parameter values provided via data gathering from the defaults provided in the TRM that were used to calculated *ex ante* reported and adjusted savings.

Participation

Participation by quarter varied by program component. Participation by quarter is shown in **Table 29** and represents the number of participating homes for the audit and weatherization component and the number of units installed for the efficient equipment component.

Table 29. PY5 Residential Home Comfort Program Participation by Quarter

Quarter	Audit (n=555)	Weatherization (n=88)	Efficient Equipment – HVAC (n=1,752)	Efficient Equipment – Pool Pumps (n=70)
Q1	3%	1%	13%	39%
Q2	27%	30%	49%	36%
Q3	34%	42%	22%	9%
Q4	36%	27%	15%	17%

[61] Pennsylvania Public Utilities Commission. *Technical Reference Manual.* June 2013.

Participation in the audit and weatherization component was slow to start and very low in the first quarter of PY5. Only 3% of the PY5 annual audit participation and 1% of the annual weatherization participation occurred in the first quarter (Q1). Nearly half of all program ASHPs and DHPs were installed in Q2. Approximately three-quarters of program pool pumps were installed during the first half of PY5 (which is logical due to seasonality).

Satisfaction

Efficient Equipment

Overall satisfaction with the Residential Home Comfort Program was high among efficient equipment rebate recipients in PY5. Ninety-six percent of the respondents who received rebates for equipment rated their satisfaction as *very satisfied* or *somewhat satisfied*; and 42% have recommended the program to a friend, relative, or colleague.

When asked to rate satisfaction with program measures, processes, and the rebate, 99% of participants surveyed said they were *very satisfied* or *somewhat satisfied* with the energy-efficient measures they purchased. Eighty-five percent rated their satisfaction with the rebate application forms as *very satisfied* or *somewhat satisfied*.

Although the benchmarking analysis showed that PPL Electric's ASHP rebate levels are low compared to those offered by other Pennsylvania EDCs, 88% of participants were *very satisfied* or *somewhat satisfied* with the amount of the rebate, and only three of the 75 respondents suggested a higher rebate would have improved their experience with the program. When asked what PPL Electric could do to improve their program experience, participants asked for shorter rebate processing times, online or e-mail-able rebate forms that are more user-friendly and easier to fill out, and the ability to check the status of the rebate.

Audit and Weatherization

Overall satisfaction with the audit and weatherization component of the program was high in PY5. Ninety percent of respondents rated their overall satisfaction as *very satisfied* or *somewhat satisfied*. Forty-two percent said they had recommended the program to a friend, relative, or colleague, and nearly half (49%) had recommended the program to somebody else. Ninety-six percent of audit participants said they were *very satisfied* or *somewhat satisfied* with the auditor who conducted their home energy survey or comprehensive audit. Auditors treated customers and their homes with respect (100%) and arrived on time for the audit (99%). Audit participants found the personalized home energy report provided as part of the audit *very useful* (55%) or *somewhat useful* (36%). Some audit participants used the audit to confirm decisions they had already made about weatherizing their home.

Seven percent of all respondents to the audit and weatherization surveys stated they would like to see improved rebate processing and delivery times. Of this 7%, only four respondents provided follow-up comments expressing great dissatisfaction with the length of time. All four of these respondents had

comprehensive audits and two installed recommended weatherization upgrades. The audits and measure installation dates for these four program participants were in the first part of the program year.

The PPL Electric and CLEAResult program managers identified rebate processing time as a program bottleneck during the first half of the program year and worked to address the issues causing the bottleneck. Some of the delays were due to incomplete information on the rebate application or missing items in the required supporting documentation. PPL Electric reported seeing improvements in rebate processing time, and no survey respondents with installation dates in the later months of the program year expressed dissatisfaction with rebate processing times. CLEAResult's goal for rebate processing is to respond in less than the four to six weeks stated on the rebate forms, and applications with no incomplete information were processed in two to three weeks. CLEAResult tracks processing time from receipt of the rebate application to when data is uploaded to PPL Electric to receipt of funding from PPL Electric and, finally, to when the rebate is paid. (See **Figure 68** at the end of this chapter.)

Audit Conversion Rate

No savings accrue from the audits alone; savings are realized when participants act on the recommendations made by the auditors and install the recommended efficiency upgrades. The percentage of audit participants following through with recommended installations is denoted as the conversion rate and is a key metric of program success.

As part of the telephone survey of audit participants, customers who received recommendations for wall insulation, attic insulation, and/or duct sealing were asked if they installed any of the upgrades recommended by the auditor, and 40% reported they had installed the upgrades. Looking at the conversion rates by survey type, 36% of Home Energy Survey participants and 44% of the comprehensive audit participants reported they had installed one or more of the upgrades recommended by the auditor. All three of these conversion rates are an increase from the 9% conversion rate from audits to weatherization installations reported in the PY3 process evaluation report.[62] The current overall and comprehensive audit conversion rates are approaching rates in the 50% range observed by other audit and weatherization programs.[63]

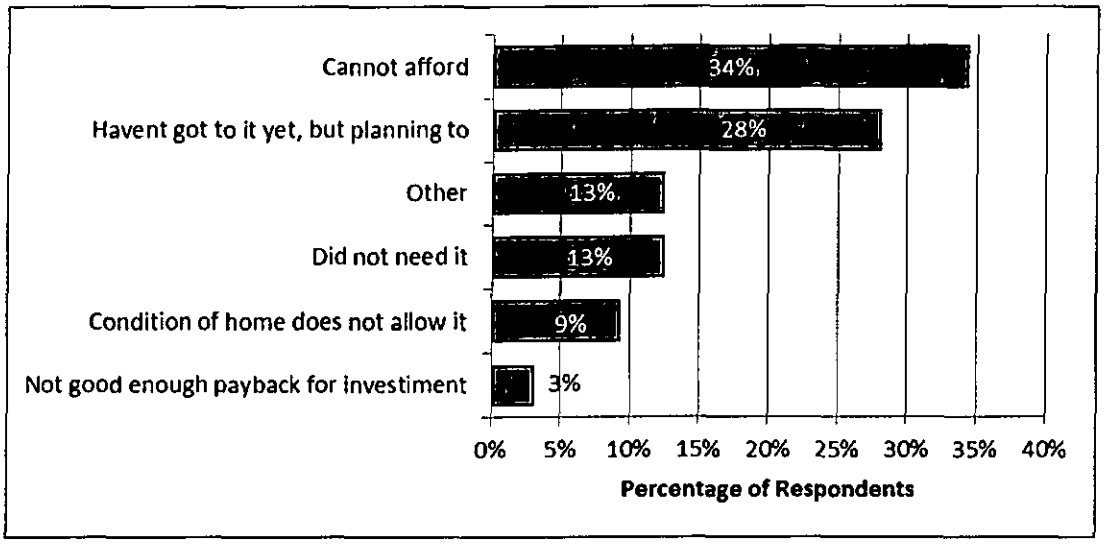
For the 60% of audit participants who reported they had not followed through with installation of the recommended upgrades, **Figure 65** shows the reasons given for not installing the recommended weatherization measures. The "other" responses were largely related to circumstances outside of the program's influence, such as the home was for sale, awaiting financing, or waiting on the builder/contractor.

---

[62] Cadmus. *Process Evaluation Report - PPL Electric Utilities EE&C Plan Program Year 3.* November 15, 2012. p. 33.

[63] Ibid, p. 34.

Figure 65. Reasons Customers Did Not Install the Upgrades



Source: Question H5. "Can you tell me more about why you have not made the upgrades?" This was a multiple response question. Percentages may add up to more than 100%. (Audit respondents n=40)

Marketing and Outreach

CLEAResult marketed the Residential Home Comfort Program using multiple strategies. To market the audits, it conducted a calling campaign with the goal of contacting 2,000 people a week. CLEAResult called 4,500 people a week and followed up with a direct mail item the week after the call. Later in the program year, it switched tactics and mailed out the direct mail information first and then followed up with a call. PPL Electric provided CLEAResult with a list of approximately 179,000 high-use customers. CLEAResult geomapped these homes to identify older homes (more than 25 years old) and conducted neighborhood mapping to target homes with income levels that would be more likely to have discretionary funds available to spend on an audit and/or the weatherization upgrades. CLEAResult continued to work during the program year to develop a focused approach to marketing the audit and weatherization component of the program.

CLEAResult also developed tri-fold marketing materials that provide information about all of the rebates available to PPL Electric customers. These are made available to contractors to hand out at trade and home shows and during sales opportunities. CLEAResult developed fliers describing PPL Electric's programs for contractors to mail out. Additionally, it attended trade shows to promote PPL Electric's programs, providing the opportunity to reach out to additional contractors.

The PPL Electric program manager attended Pennsylvania business association meetings to reach out to builders. The program manager also worked with builders at home shows and other builder trade groups. PPL Electric bought ads in builder magazines and marketed the program in trade ally newsletters. It advertised the program to customers in the "Connect" newsletter and the Nickel Ads, and it developed yard and tent signs to place at homes where efficiency upgrades were occurring. It also marketed the equipment rebates by arranging for the rebate forms to be included in the box in which

the equipment was delivered. The PPL Electric program manager noted that by the middle of PY5, program marketing was not yet in full swing but was still ramping up.

Efficient Equipment

As part of the participant telephone surveys, Cadmus asked participants how they heard about the Residential Home Comfort Program. Of the participants who received a rebate for installing equipment, the top two ways were from a contractor, installer, builder, or remodeler (65%) and from a PPL Electric e-mail (16%).

Only 30% of participants in the equipment cohort were aware of any other PPL Electric rebate programs. These participants said they were aware of rebates for appliance recycling (18%), refrigerators (18%), LEDs (18%), CFLs (14%), weatherization (14%), efficiency assessment (9%), and pool pumps (5%).

Audit and Weatherization

The primary ways participants who received an audit or installed weatherization measures heard about the program were from a contractor or vendor (22%) or through a PPL Electric bill insert or newsletter (22%). Just over one-third (35%) of participants were aware of any other PPL Electric rebate programs. These participants said they were aware of rebates for appliance recycling (33%), refrigerators (20%), heat pump water heaters (13%), LEDs (5%), ductless mini-split heat pumps (5%), pool pumps (3%), air source heat pumps (3%), and renewable energy (3%).

Benchmarking Against Other Programs

Efficient Equipment

PPL Electric's incentives for ASHP are the lowest of the three Pennsylvania EDCs. Its rebate for DHP is the most generous and increases depending on the level of SEER installed. FirstEnergy utilities and Duquesne Light provide approximately $100 per DHP system installed. PECO does not provide incentives for installing DHP systems.

Amended federal conservation standards for minimum SEER and heating seasonal performance factor (HSPF) will take effect in PY6.[64] These amended standards apply to residential central heat pump units manufactured on or after January 1, 2015. Customers will still be able to install units that meet the current federal standards as long as distributors have them in stock, so the effects of the legislation may not be apparent for several months, or until the beginning of PY7.

Table 30 presents the existing and amended federal conservation standards for minimum SEER and HSPF for residential heat pumps installed in Pennsylvania.

[64] Code of Federal Regulations, 10 CFR 430.32(c) (2). Full text available online: http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR.

Table 30. Amended Federal Conservation Standards for Heat Pumps

Product Class	SEER		HSPF	
	Existing	Amended	Existing	Amended
Split-system heat pumps	13	14	7.7	8.2
Single-package heat pumps	13	14	7.7	8.0

When the new standards go into effect, PPL Electric incentives for ASHP will be only 1 SEER above baseline.

PPL Electric's pool pump rebate program already incorporates many program best practices, such as *requiring installation in in-ground pools only by a qualifying, trained professional who calibrates the* pump after installation. PPL Electric is changing its program to exclude new pool installations, which means that savings over baseline efficiency will be maximized. The rebate amount of $150 is in line with other Pennsylvania EDCs. We also noted some minor program changes to facilitate participation.

Audit and Weatherization

PPL Electric's weatherization rebates appear to be in the same dollar range as the other programs, both in and out of Pennsylvania. Its audit cost structure is also similar; however, PPL Electric customers must pay the full market price of the comprehensive audit out-of-pocket, which may be a barrier to customer participation. PPL Electric provides a low first-cost option for cost-conscious customers—the $50 Home Energy Survey.

Many organizations also offer information about financing the cost of the efficiency upgrades. NYSERDA offers discounts on the efficiency upgrades of 10% and a loan interest rate of 3.49% to 3.99%. The Board of Public Utilities of New Jersey offers zero-interest financing with caps on the amount financed determined by total energy savings tier. These loans are available where utility financing is not available. New Jersey utilities will offer 0% loans or on-bill repayment up to $10,000 for Tier 3 projects and $5,000 for Tier 2 projects to underwrite the non-rebated portion of the customer cost for Home Performance with ENERGY STAR (HPwES) jobs in their service territories. The New Jersey Clean Energy Program will offer 0% loans for HPwES work for any customers where a utility loan program is not in place.[65] Sacramento Municipal Utility District offers its customers a 5.50% APR on an unsecured loan to finance efficiency upgrades made under its Home Performance Program.

The Energy Trust of Oregon does not buy down the interest rate on loans, but it works with local lenders (its "lending allies") who are committed to sustainable business practices and agree to offer specialized lending options to customers meeting the Energy Trust of Oregon's eligibility criteria. Lending allies

[65] New Jersey's Clean Energy Program. "Rebates and Promotions." Accessed September 2014: http://www.njcleanenergy.com/main/rebates-and-promotions/rebates-and-promotions

enter an agreement with the Energy Trust of Oregon to provide affordable financing options to qualified customers. The Energy Trust of Oregon provides information about its lending allies on its website.[66]

New Construction

In PY6, PPL Electric introduced a new rebate in the new construction component of the Residential Home Comfort Program toward the purchase of ENERGY STAR manufactured homes. Cadmus conducted benchmarking research on rebate programs for the manufactured home segment of the new construction market. All of the utilities offering downstream rebate programs we reviewed provide rebates toward the purchase of a new, efficient manufactured home. Rebate amounts range from $500 to $1,000, with $750 as the most common rebate amount. Flathead Electric Co-op and Idaho Power offer additional incentives to manufactured home sales consultants. For each qualifying home sold, Flathead Electric Co-op pays $150 and Idaho Power pays $200.

In PY6, PPL Electric introduced a $1,200 customer incentive toward the purchase of a new manufactured home, with an additional $300 incentive for customers who also purchased an ASHP or A DHP with a SEER 15 or greater. Both of these incentives are higher than any offered in the comparison programs; however, we note that PPL Electric's program is operating in a new market and all of the comparison programs are operating in the Northwest where such programs are well-established and there is a large market for manufactured homes.

Most programs require an ENERGY STAR compliance certificate and home serial number to receive a rebate. (Although Flathead Electric Co-op's program materials specify Northwest Energy Efficient Manufactured [NEEM] rather than ENERGY STAR compliance, the program materials available on its website have not been updated since 2008.) Flathead Electric Co-op is the only utility that requires an on-site inspection once the home has been sited and its appliances installed.[67]

Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-8** *of the report titled "PY5 Annual Report."*

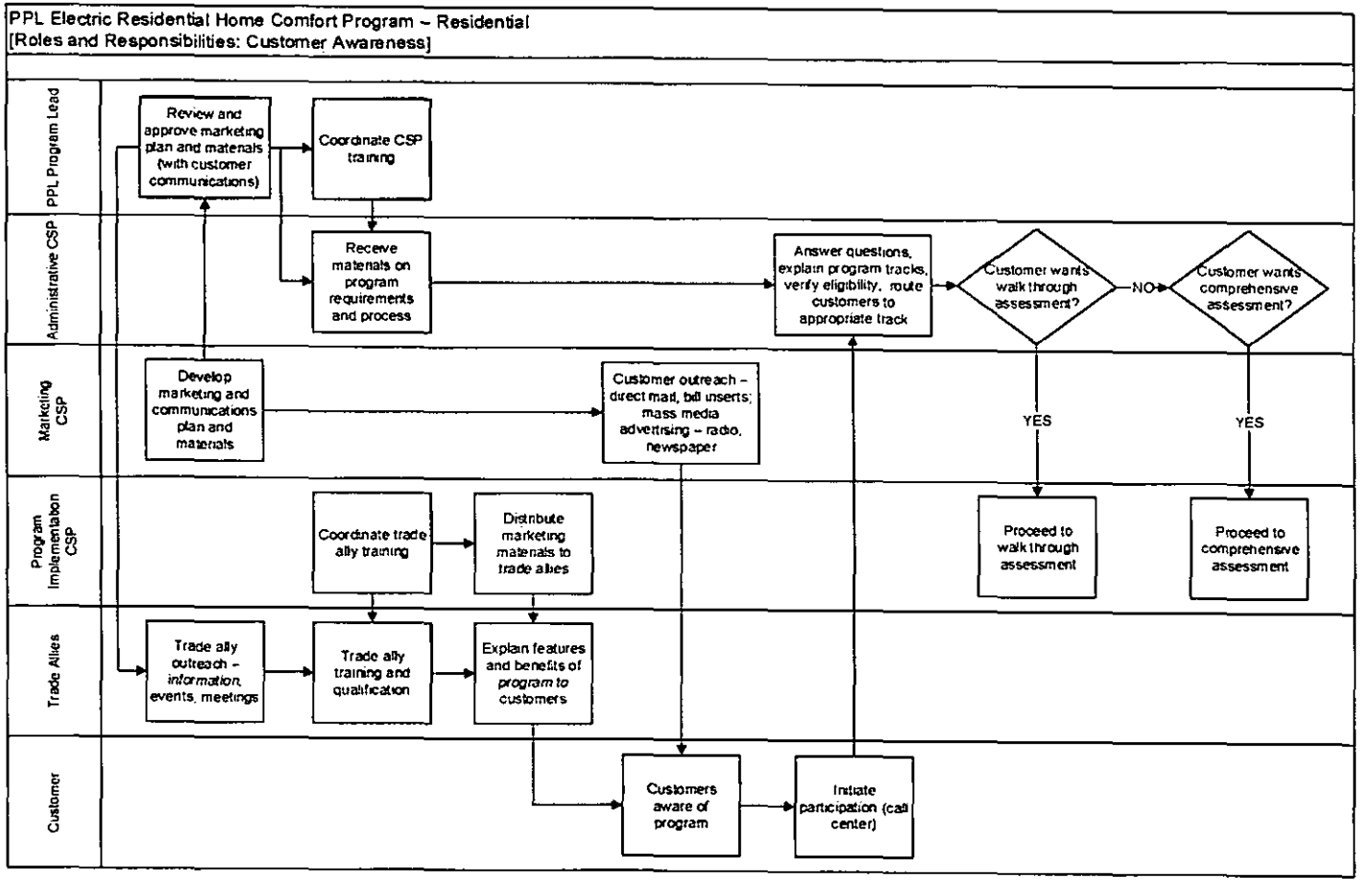
---

[66] Energy Trust of Oregon. "Energy Trust Lending Allies." Accessed September 2014: http://energytrust.org/shared-resources/info/lending-allies/

[67] Flathead Electric. *Duct Sealing Program*. September 2013. http://www.flatheadelectric.com/energy/PDF/DuctSealingForm.pdf

Process Map

Figure 66. Residential Home Comfort Program Customer Awareness



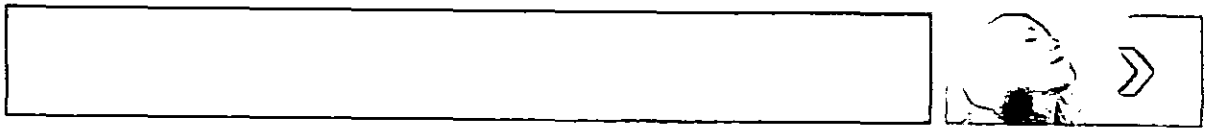


Figure 67. Residential Home Comfort Program Walk-Through Assessment

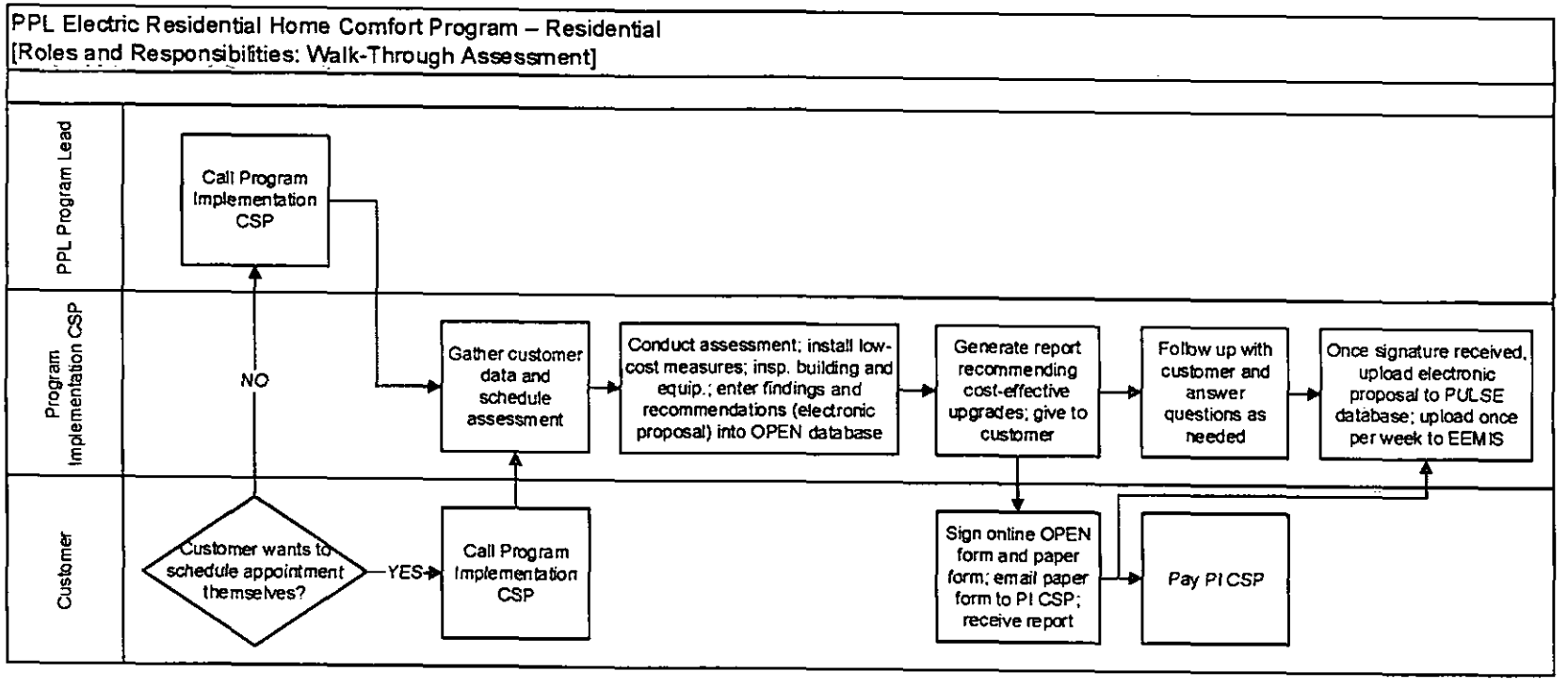


Figure 68. Residential Home Comfort Program Comprehensive Audit

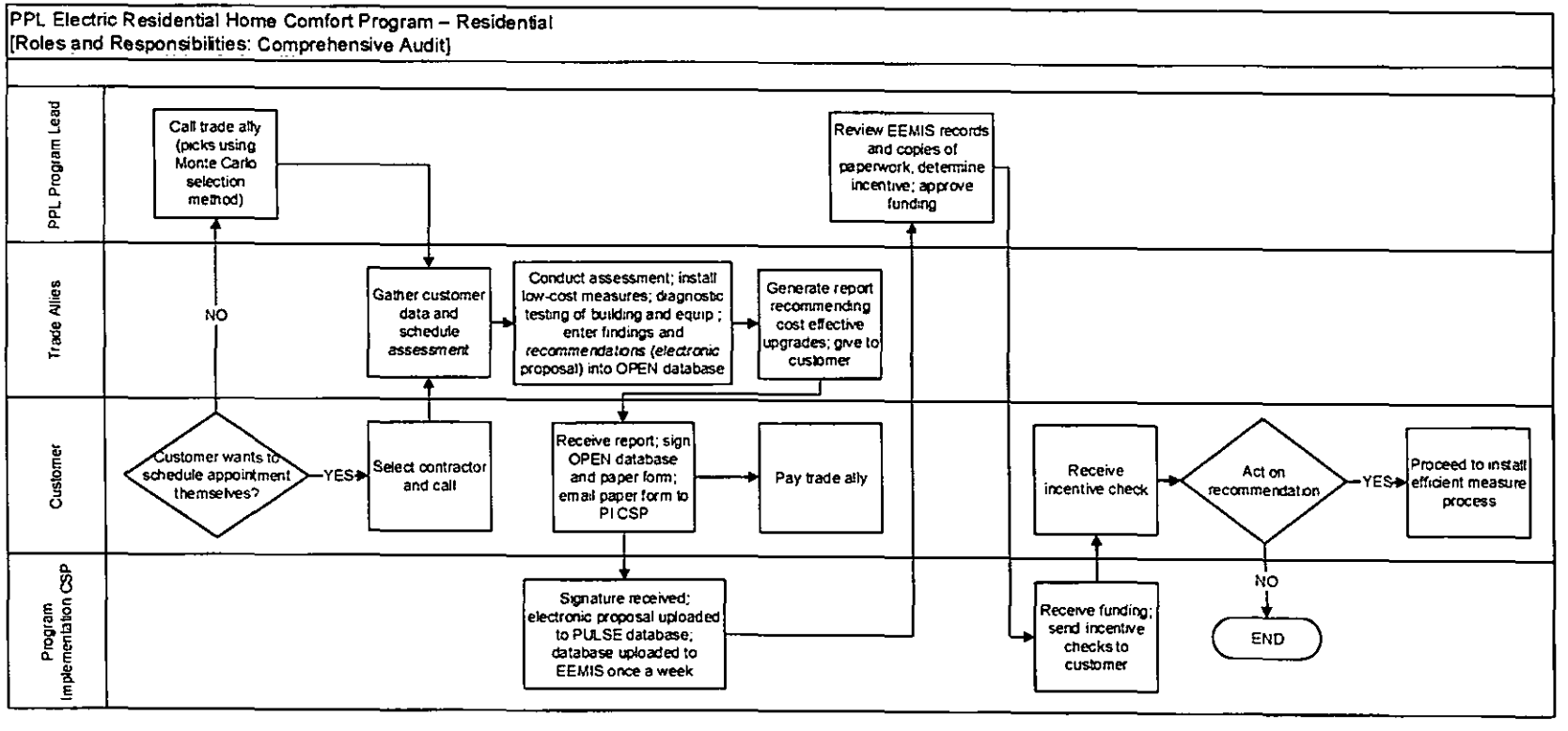


Figure 69. Residential Home Comfort Program - Efficient Equipment

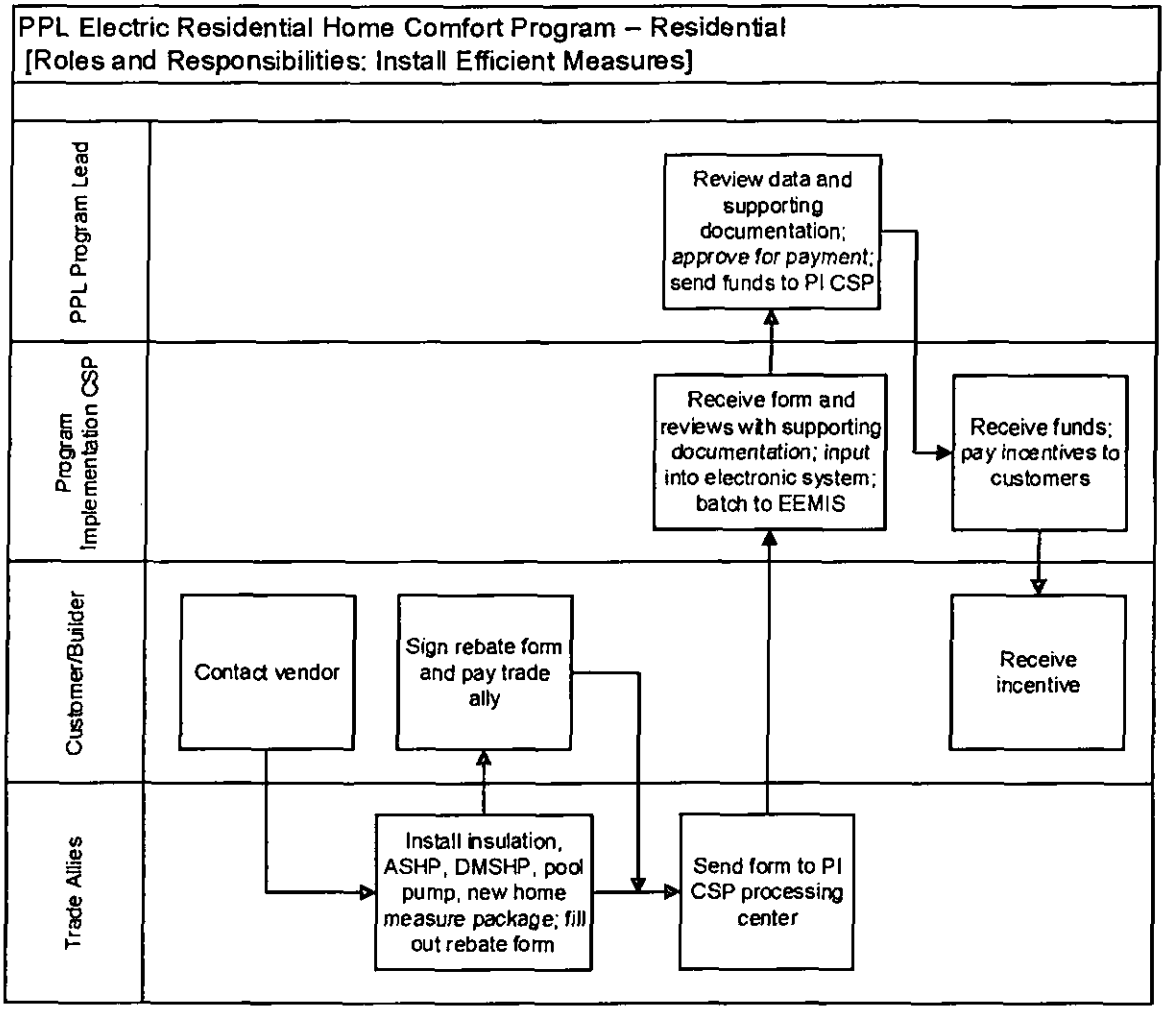
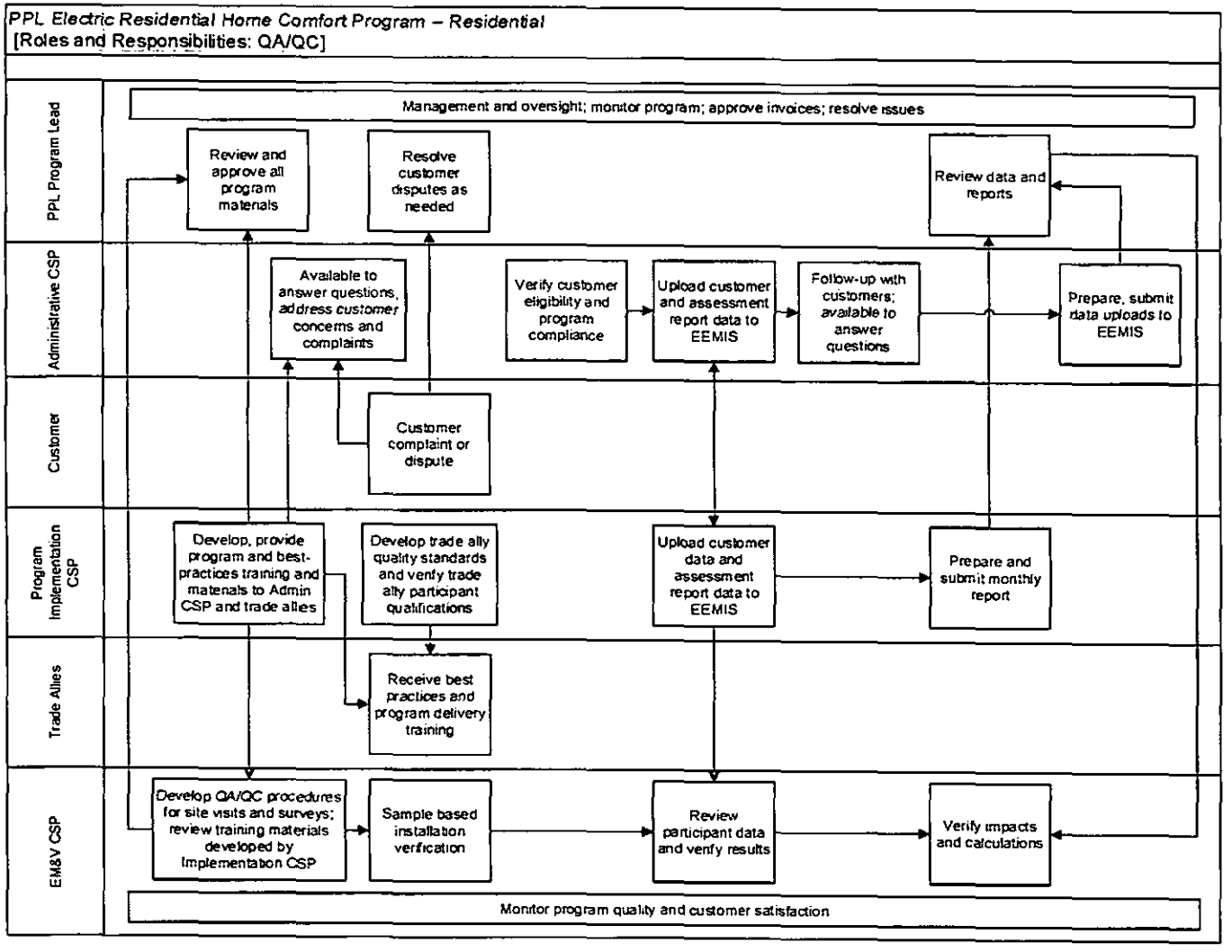


Figure 70. Residential Home Comfort Program QA/QC



E-Power Wise Program

For the E-Power Wise Program, the PY5 process evaluation activities were these:

- Program staff and implementer interviews (n=2)
- Interviews with community based organizations (n=5)
- *Paper surveys for energy-efficiency kit participants (n=387)*
- Program literature review and benchmarking
- Database and QA/QC review of records
- Process map development

Achievements Against Plan

The E-Power Wise Program achieved fewer than its PY5 planned MWh/year savings. The program exceeded its MW reduction and participation targets. As shown in **Table 31**, at the end of PY5 (May 31, 2014), the E-Power Wise Program had achieved:

- 45% of its 3,379 MWh/hr three-year planned savings
- 62% of its 0.42 MW three-year planned demand reduction
- 34% of its three-year distribution target of 7,900 kits

Table 31. E-Power Wise Program Savings

Unit	PY5 Verified Savings/ Participants	PY5 Planned Savings/ Participants	Percentage of PY5 Planned Savings/ Participants	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/yr	1,525	1,756	87%	3,379	45%
MW	0.26[1]	0.22	118%	0.42	62%
Participants	2,715	2,700	100.4%	7,900	34%

[1] Includes line loss of 8.33%

There are several possible reasons why the program achieved fewer than its planned MWh savings and exceeded its MW reduction goal for PY5. These include:

- *Low installation rates among measures with higher savings, such as high-efficiency* showerheads.
- Four duplicate accounts that had previously received savings for the program lifetime during Phase I; the accounts were assigned zero savings, which had a small effect on overall program savings.

- Updated behavior savings methodology resulting in demand savings that exceeded planning expectations.[68]

The factors affecting the MWh changes are discussed in further detail in later sections of this chapter.

Program Delivery

The E-Power Wise Program delivers energy-efficiency kits to income-qualifying customers—households that are at or below 150% of the federal poverty level—via direct mail and through community-based organizations (CBOs or agencies). The kits include direct install measures, such as CFL light bulbs and low-flow showerheads, as well as energy education in a program manual called the Quick Start Guide that presents energy-efficiency tips and installation guidelines.

In PY5, Cadmus interviewed the PPL Electric program manager and the program manager from the implementer, Resource Action Programs (RAP), to understand their perspectives about how the program operates, the delivery methods that are working well, and any areas where challenges occurred during the year. Both program managers agreed that the overall program goal is to educate PPL Electric's low-income customers about energy education and how to lower energy use.

Customers can contact PPL Electric's customer service line to request an energy conservation kit by mail. Because customers who are sent energy-efficiency kits via direct mail receive no interaction or verbal energy education, the program relies on the agency delivery channel to present more specific energy education to participants.

RAP managers train agency staff members how to distribute the kits, and these agency staff members conduct energy workshops or one-on-one training at locations convenient to the targeted customer segment. Agencies receive an incentive to offset the administrative costs of the training and kit distribution.

Overall, both program managers are very satisfied with program performance in PY5. The direct mail delivery channel experienced a higher rate of participation in PY5 than in PY4, which RAP believes may be due to changing the time of year when outreach occurred. Previously, RAP sent program mailers in late fall and winter. In PY5, it sent mailers in the summer because other programs were more successful reaching customers at this time of year. In addition, one agency staff member said she noticed a slight decrease in the number of kits requested through the agency since the direct mail delivery channel was implemented. **Table 32** shows the participation in PY5 compared to PY4.

[68] Details on the methodology can be found in the *"PY5 Final Annual Report"* and associated appendices.

Table 32. E-Power Wise Program Participation in PY4 and PY5

	PY4			PY5		
	Agency	Direct Mail	Program Total	Agency	Direct Mail	Program Total
Total Participants	1,735	705	2,440	1,600	1,115	2,715
Returned Surveys	86	90	176	199	188	387

Some agencies are more engaged in the program than others. For example, in PY5, 18 agencies were involved but only nine were driving participation. One challenge for the program is to encourage the less active agencies to distribute more kits and to deliver in-depth energy education to clients. The RAP program manager noted that often the first hurdle is to explain the concept and benefits of energy efficiency to agency staff members so they can more effectively translate this information to customers. RAP has attempted to encourage more engagement by increasing the incentive amount per kit and awarding a $50 gift card to active agency staff.

The PPL Electric program manager noted a challenge with the rising cost of the kits. The kits are distributed at no cost to low-income clients but the cost-per-kWh savings has increased. With the addition of LEDs and removal of CFLs from the kits in PY6, the PPL Electric program manager is concerned that the return on investment will decrease. PPL Electric is reviewing options for other measures to keep the kits cost-effective and to raise customer interest, but it has found most measures are too expensive and/or are not currently included in the Pennsylvania TRM.

Process Map

Cadmus developed and reviewed a process flow map diagramming the program roles, responsibilities, and activities—from the PPL Electric program lead to the customer, which is shown in **Figure 73**. Two other process flow maps are **Figure 74**, which shows the Direct Mail Delivery path managed between PPL Electric and RAP, and **Figure 75**, which shows the overall program delivery and the responsibilities of PPL Electric management, the implementer, and the agencies. (All of these figures are at the end of this chapter.)

During the review of the program process, we determined that the direct mail delivery enrollment card was missing home type and total occupancy data collection questions. PPL Electric updated the direct mail enrollment card to include this information for PY6. Overall, the program process is very streamlined.

Agency Implementation

Cadmus conducted interviews with participating agency staff members (n=5) to learn more about how the agencies deliver the program to its clients and the challenges associated with distributing energy-efficiency kits and energy education. Staff members reported that their agencies are recruited by RAP to participant in the program via direct outreach. Agencies are chosen by the services they provide and county in which they are located.

Agency staff members attend training conducted by RAP via a webinar once a year, during which they learn how to properly explain the measures included in the kit to a client and what energy-related behavior changes clients can make in their homes. The agency is responsible for marketing and distributing the kits to clients at workshops or one-on-one meetings. Only one staff member reported conducting group workshops; instead, most client interaction is in one-on-one meetings.

During the one-on-one meetings, agency staff meets with clients who need to reduce their energy burden. Staff confirms that the client is qualified to receive a kit by verifying income level and checking the RAP data portal for a client account number; if one has been issued, the client has received a kit in the past. Once eligibility is confirmed, staff reviews the kit contents and the Quick Start Guide to show the client how to install the measures and discuss ways to reduce energy in their home.

The kit also conveys information about additional PPL Electric programs. Agency staff members said they review these other program offerings with clients, especially the WRAP, the only Act 129 program, and the Operation Help and OnTrack programs. Three agency staff members noted that providing energy education is sometimes challenging because *"clients may have difficulty understanding the concepts"* or, in some cases, staff does not always *"dedicate enough time to discuss the topics during the one-on-one meetings."* Although the kit contents and installation guidelines are reviewed thoroughly with clients, agency staff members indicated that the energy education materials often do not receive the *"in-depth level of review"* they would like to see.

Cadmus reviewed the RAP training slides used to train agency staff members. The slides contain an introduction to the program, tips for implementing the program successfully, and details on the kit items so agency staff can translate that information to clients during one-on-one meetings. The presentation lists the new kit items for PY6, including LEDs and the 7-Plug Smart Strip, but it does not go into detail about the water conservation measures, furnace whistle, or LED nightlight. Although many agencies have participated in the program in the past, by not including details on the specific benefits for installing all items in the kit some staff members may be ill-equipped to discuss the measures in detail with clients.

Agency Marketing and Outreach

The E-Power Wise Program conducts little direct marketing beyond leaving posters and flyers in the participating agencies' waiting room. Most marketing to kit recipients is word of mouth from others who received them from an agency.

On the other hand, the agencies that distributed the most kits in PY5 conducted additional outreach such as hosting booths at street fairs and hanging flyers in churches and community poster boards at grocery stores.

Agency Satisfaction

Program satisfaction is high among agencies. All five interviewed agencies reported being *very satisfied* with the following program components:

- Training session provided by RAP
- Communication with RAP
- Communication with PPL Electric
- Contents of the kit
- Kit incentive amounts
- Overall experience with the E-Power Wise Program

Two agencies gave a *somewhat satisfied* ranking for two categories concerning the amount and content of energy education provided to clients. Both said they *"sometimes get busy and do not take much time to review"* the components of the energy education materials. However, they acknowledged that their reported level of satisfaction with this aspect of the E-Power Wise Program had more to do with internal practices and outreach strategies than with the contents in the kit.

Program Tracking

This section describes factors affecting the E-Power Wise Program's realization rates during PY5 and PPL Electric's systems and processes to track data and monitor the program.

Low Installation Rates

Overall, the program experienced an energy savings realization rate of 82%. Measure-level ISRs drive the program's realization rate. **Table 33** shows the PY4 and PY5 measure installation rates for both the E-Power Wise Program and the Student and Parent Energy-Efficiency Education Program for PY5 only. Both of these programs distribute energy-efficiency kits.

The E-Power Wise program experienced higher ISRs for all measures compared to the Student and Parent Energy-Efficiency Program, with the exception of the smart strip installed by the Innovation students in secondary grades. Water-conservation measures were installed almost twice as often by E-Power Wise Program participants than by the Student and Parent Energy-Efficiency Program participants. The E-Power Wise Program lighting measures experienced the highest ISRs compared to the Student and Parent Energy-Efficiency Program, but these measures were installed more often than other measures in both programs.

Most measures in the E-Power Wise kits had lower ISRs in PY5 than in PY4. The drop in ISRs was relatively small for CFLs, LED nightlights, and bathroom faucet aerators but was substantial for kitchen faucet aerators and low-flow showerheads. Additionally, the ISR of 63% for smart strips was fairly small for a measure that constitutes nearly one-third of the total reported savings for the E-Power Wise Program.

Table 33. Cross-Program Installation Rate Comparison

Measures	Overall E-Power Wise Program ISR[1]		Student and Parent Energy-Efficiency Education Program PY5			
	PY4	PY5	Bright Kids	Take Action	Innovation	Parent Workshop
Furnace Whistle	-	50%[2]	-	47%	-	-
Smart Strip	-	63%[3]	-	-	80%	54%[3]
CFLs	92%	89%	73%	60%	67%	87%
Faucet Aerator - Bathroom	69%	66%	-	-	36%	-
Faucet Aerator - Kitchen	88%	69%	-	35%	-	-
Showerhead	85%	68%	-	31%	34%	-
LED Nightlight	94%	90%	88%	80%	-	90%

[1] ISRs weighted by program delivery channel.

[2] TRM stipulates an ISR of 47%. Overall program weighted ISR from participant surveys was 50%.

[3] TRM algorithm does not account for ISR, so value is for comparison purposes only. This was given to teachers during the workshop. The value is for the residential installation of smart strips. Commercial use installation (i.e., in the classroom) was also allowed in this program.

Duplicate Records Contained in EEMIS

Each quarter, Cadmus reviews the EEMIS database to determine if its records are accurate and consistent with the RAP database and participants' original applications. Duplicate energy-efficiency kits, inaccurate account numbers, and other data-quality issues can impact data accuracy.

In the review of the PY5 Q4 RAP data recorded in the EEMIS database, Cadmus found four duplicate account numbers (the RAP data are independent of the EEMIS data). Duplicate account numbers may appear in the database multiple times and, as defined here, are not eligible to receive verified savings in PY5 because these accounts previously received savings for the program lifetime during Phase I. Therefore, Cadmus assigned zero savings to these accounts, which resulted in a small impact on the reported savings value.

PPL Electric and RAP have worked together over the last few program years to develop solutions to avoid distributing duplicate energy-efficiency kits. One solution involves an online database that agencies can access to determine if the participant account number already appears in the RAP database and the client is therefore ineligible to receive a kit. This process has helped the overall program tracking, and agency staff reportedly appreciates the additional program resource.

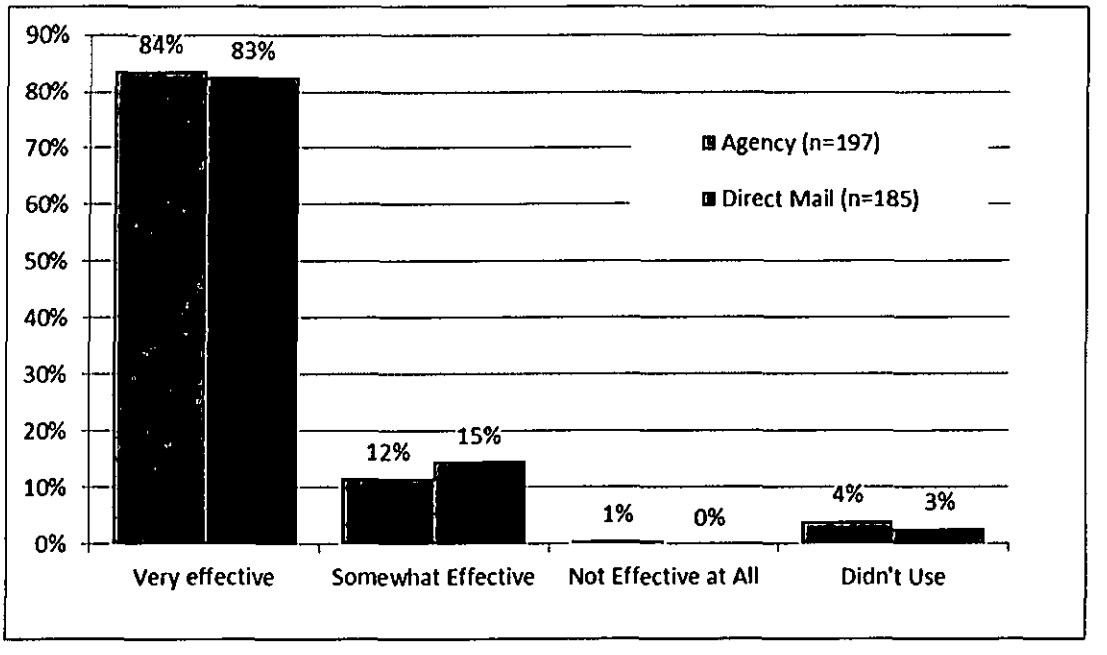
To maintain sufficient participation to meet the program goals, PPL Electric and RAP management speak bi-monthly about kit distribution status and possible program changes. Currently, the program is on track to meet its three-year target, and therefore staff reports that this system to track program progress is working effectively.

Participant Survey Findings

In each kit, PPL Electric and RAP include a paper survey that participants can complete and return via mail. The survey is intended to assess measure installation and the effectiveness of the kit materials. Cadmus found that responses were consistent for both direct mail and agency delivery channels.

The survey asked participants how effective the Quick Start Guide was in helping them install the measures. Participants could choose to say that the guide was *very effective, somewhat effective, not effective at all,* or that they *didn't use* the guide. As shown in **Figure 71**, over 80% of participants said the guide was *very effective*.

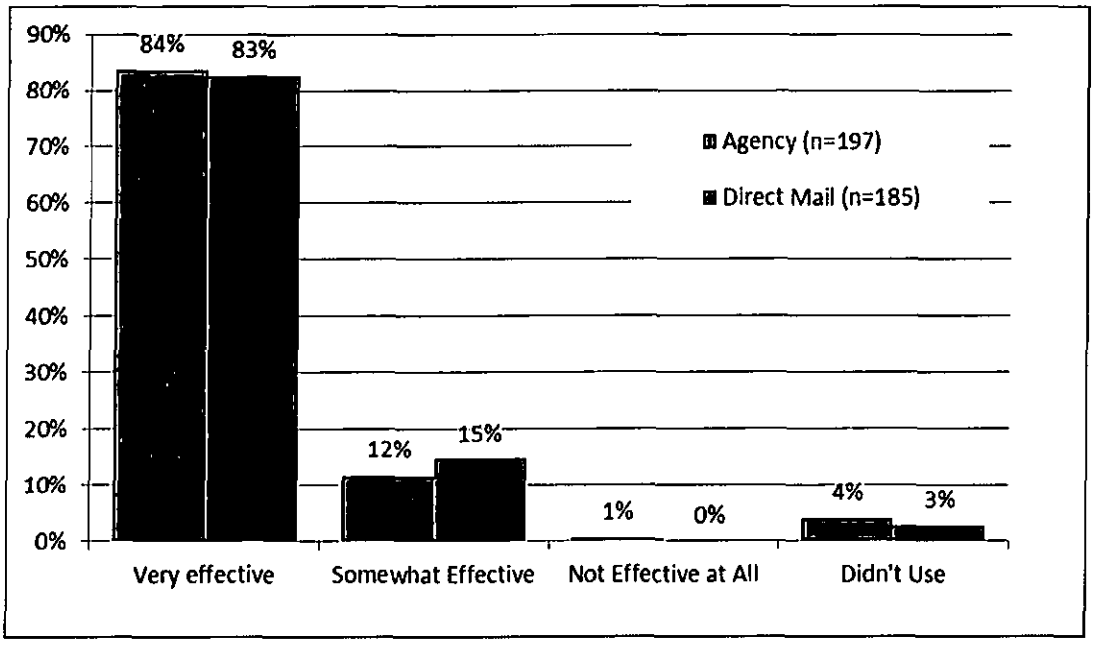
Figure 71. Effectiveness of Quick Start Guide



Source: Question 25. "How effective was the PPL Electric Utilities E-PowerWise Quick Start Guide in helping you install the items in your Kit? (agency n = 197; direct mail n=185)

The survey asked participants to rate how much they learned about saving energy and money after reading the Quick Start Guide and installing measures in the kit. Participants could choose to say they *learned a lot,* they *learned a little*, or they learned *nothing* from the Quick Start Guide. As shown in **Figure 72**, over 85% of participants in both delivery channels said they *learned a lot* about saving energy and money in their homes after they completed reading the Quick Start Guide and installing the measures.

Figure 72. Energy Efficiency Knowledge Gained from Program



Source: Question 26. "Now that you have completed the PPL Electric Utilities E-PowerWise Quick Start Guide, how much have you learned about saving energy and money in your home?" (agency n = 197; direct mail n=186)

Benchmarking Against Other Programs

Cadmus compared the E-Power Wise Program's delivery channels and outreach strategies with similar programs by reviewing evaluations that have been completed for the Iowa Utility Association,[69] Xcel Energy in Colorado,[70] Public Service Company of New Mexico (PNM),[71] and Pennsylvania Electric Company (Penelec).[72]

---

[69] Cadmus. *Iowa 2013 Energy Wise Program*. Prepared for Iowa Utility Association. 2013.

[70] Cadmus. *Colorado Energy Savings Kits Program Evaluation*. Prepared for Xcel Energy. 2012. Available at: https://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/CO-DSM/CO-2012-Energy-Savings-Kits-Final-Evaluation.pdf

[71] Public Service Company of New Mexico (PNM). *PNM Energy Efficiency Program 2013 Annual Report*. 2014. Available at: https://www.pnm.com/documents/396023/1284062/2013+EE+Program+Annual+Report/cba48ad4-e96b-4832-8ad7-a45e3330bfc4

[72] ADM Associates, Tetra Tech, NMP Group. *Final Annual Report to the Pennsylvania Public Utility Commission for the Period June 2012 through May 2013 – Program Year 4*. Prepared for Pennsylvania Electric Company. 2013. Available at: https://www.pplelectric.com/~/media/pplelectric/save%20energy%20and%20money/docs/act129_phase2/py4annualreportrevised11514redline.pdf

Satisfaction and Kit Measures

In PY3 of PPL Electric's E-Power Wise Program, Cadmus conducted a phone survey with program participants. At least 90% of respondents reported high satisfaction ratings with each of the program components they were asked to rate, including "overall experience with the kit," the "Quick Start Guide," "energy-saving items in the kit," and the "process to request a kit." This high level of satisfaction was similar to the other programs we reviewed.

In addition to rating satisfaction with the general program experience, Xcel Energy participants were asked to rate their satisfaction with the items in the energy-efficiency kit. Participants reported high satisfaction with CFLs (90%) and slightly lower satisfaction for the water measures (87% for showerheads and aerators). Similar to E-Power Wise Program participants, Xcel Energy respondents gave lower satisfaction ratings for showerheads and aerators because they did not like the low water pressure and leakage issues. E-Power Wise Program participants also reported leaks and an inability to fit to existing pipes and to remove the existing showerhead or aerator. In Iowa, the community action associations reported hearing multiple requests for window insulator kits from participants and, in response, the Iowa Utility Association recently redesigned the kit to add a plastic window insulator package that can cover up to five windows.

Overall, the energy-efficiency kits we reviewed contain a similar mix of measures, with one exception. The Iowa Energy Wise Program's kits also includes rope caulk and window insulation. Xcel Energy and PNM focus on lighting and water conservation measures.

PNM's selection of measures is limited, but it does offer three kit options with different measure quantities and CFL and LED wattages. The customer can select one of the three kits via an online intake form based on the customer's personal preference.[73] The website instructs customers to choose the kit that is best suited for their needs, which allows for a tailored kit distribution approach that focuses on the customer's preference for specific measures. For example, a family that finds its electricity bill is high may choose the kit with more lighting measures and a family who finds that it is spending too much on its water bill may choose the kit with more water conservation measures.

In addition, there are multiple energy savings kit options available through other online resources that contain many of the same measures available through the kit programs we reviewed. A few resources, however, contain additional kit items for electric fuel source homes. One such resource is Niagara Conservation.[74] It provides multiple kit offerings tailored toward saving energy and water. These energy savings kits include different measures based on the water heat fuel source. For example, the electric fuel source kits do not contain any water measures but do contain draft stopper gaskets that fit inside

---

[73] PNM. "Choose Your Kit." Accessed October 2014. http://www.pnmeasysavings.com/choose-your-kit.php

[74] Niagara Conservation. "Energy EcoKits/Energy Saving Kits." Accessed October 2014. http://www.niagaraconservation.com/energy_conservation/products/ecokits

light switch and outlet coverings. The draft stopper gaskets are a good introduction to the benefits of air sealing without having to install a full air sealing measure, such as a window covering.

Outreach Strategies

PPL Electric has an informational website about the E-Power Wise Program and items offered in the energy-efficiency kits. The website contains links to installation guidelines for each of the kit items and a list of all participating agencies. PPL Electric conducts very little marketing to its customers. The only materials provided to agencies are promotional posters and flyers. Agencies therefore rely heavily on word of mouth as the primary form of marketing for the program. Although word of mouth is effective to reach new participants, the agencies that distribute the most kits also conduct outreach by posting flyers at community centers and bringing example kits to various events such as farmers markets.

Xcel Energy does not promote its program through any marketing channels other than distributing kits to LIHEAP-qualified customers. Xcel Energy considered other options for identifying additional low-income customers, including obtaining U.S. Census Bureau data to identify geographic areas with a concentration of low-income households and asking community agencies to distribute kits. Penelec conducted outreach to customers via direct mail and e-mail, radio, newspaper, and television advertisements. Participants reported they preferred receiving information by direct mail and/or e-mail. Community action associations in Iowa promote the program to clients by displaying posters, word of mouth, and referrals from colleagues or community partner organizations.

With the direct mail delivery approach, customers do not receive any interaction or verbal education, so most utilities rely on the kit and its contents to market the benefits of the program and encourage customers to install the measures. For example, Xcel Energy's corporate communications staff has worked with a design team to create effective visuals, from the kit request card to kit packaging and contents.

Included in the PPL Electric energy savings kit is a Quick Start Guide that informs participants about the money and energy-saving potential gained from installing the kit items. It also contains information on the energy-saving benefits from changing behaviors, such as washing laundry in cold water. The Quick Start Guide is colorful and succinct, but it does contain some inconsistencies. For example, each section contains a dollar amount that the kit item and behavior change actions could save a participant annually. *There are some sections where the highlighted dollar amount is not the same as the savings* information in the text. Correcting these consistency errors will help participants understand the possible savings associated with the measure installations.

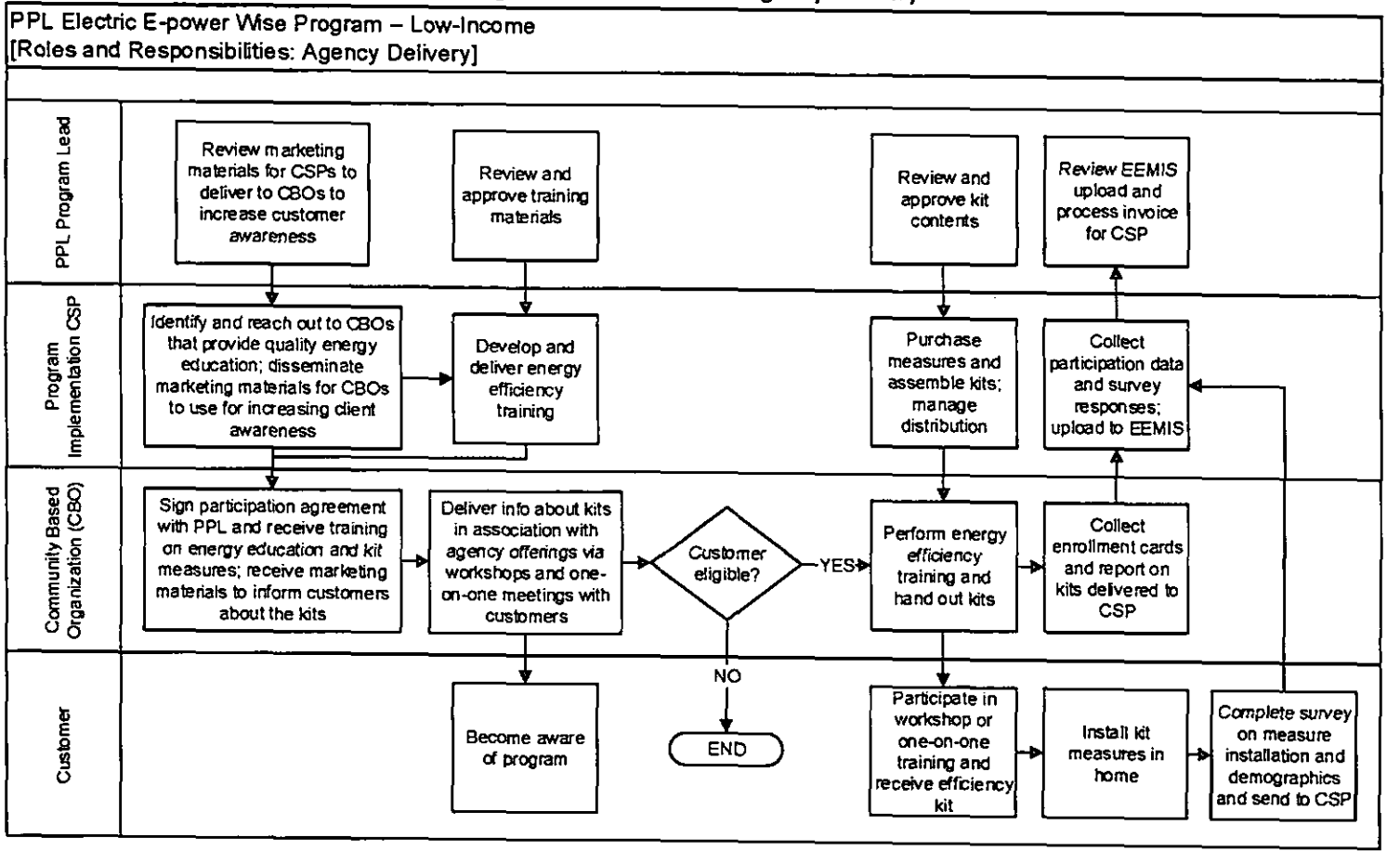
Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-9** of the report titled *"PY5 Annual Report."*

Process Map

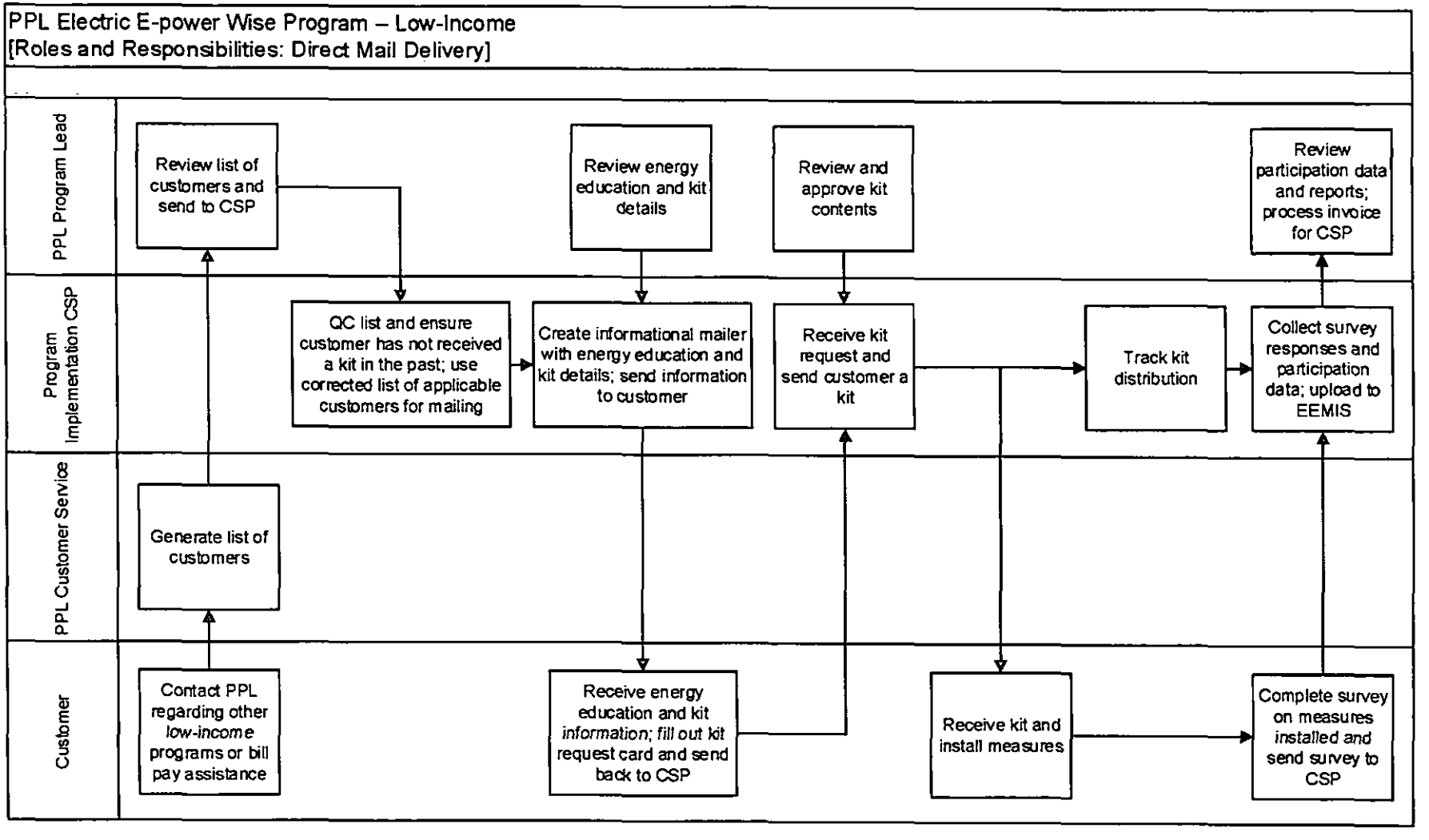
Figure 73 contains the agency delivery process map for the E-Power Wise Program.

Figure 73. E-Power Wise Agency Delivery



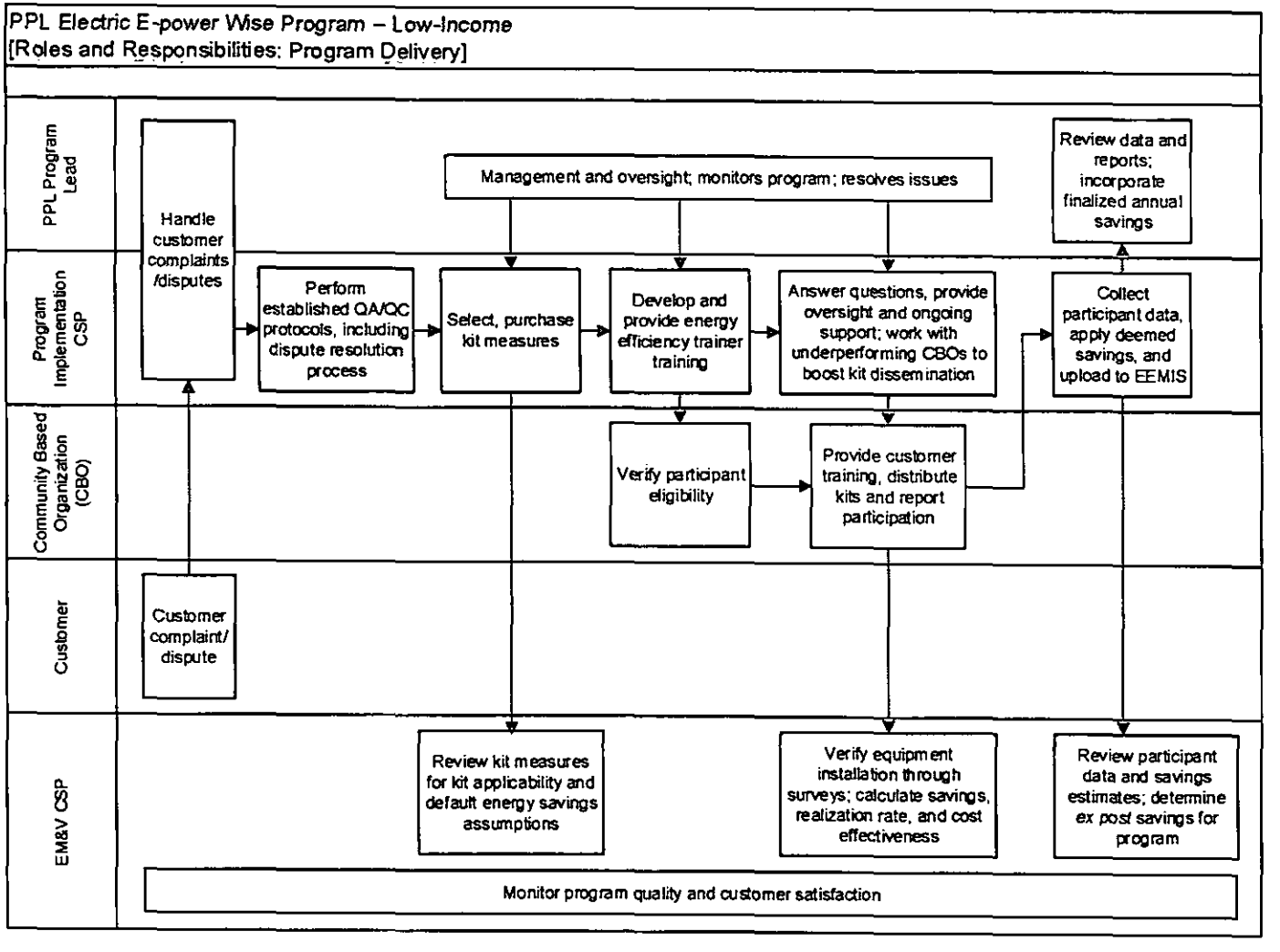
The Direct Mail Delivery path for the E-Power Wise Program in shown in **Figure 74**.

Figure 74. E-Power Wise Direct Mail Delivery



The overall program delivery and management responsibilities for the E-Power Wise Program are shown in **Figure 75**.

Figure 75. E-Power Wise Program Delivery



Master Metered Low-Income Multifamily Housing Program

For the Master Metered Low-Income Multifamily Housing (MMMF) Program, the PY5 process evaluation activities were these:

- *Participant property owners and operator decision-makers (n=8)*
- Participant tenant leave-behind surveys (n=42)
- Program staff and implementer interviews (n=1)
- *Program literature review and benchmarking*
- Database and QA/QC review of records
- Process map development

Achievements Against Plan

In PY5, the program achieved 116% of its planned MWh/yr savings and 67% of its planned MW reduction target.[75]

At the end of PY5 (May 31, 2014), MMMF had achieved:

- 30% of its 1,757 MWh/hr three-year planned savings
- 17% of its 0.25 MW three-year planned demand reduction

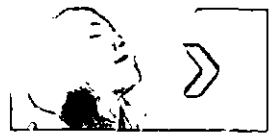
Table 34. MMMF Program Savings [76]

	PY5 Verified Savings	PY5 Planned Savings	Percentage of PY5 Planned Savings	PY5-PY7 Planned Savings	Percentage of PY5-PY7 Planned Savings
MWh/yr	2,039	1,757	116%	6,886	30%
MW	0.168	0.25	67%	.99	17%

The primary reason the program exceeded planned MWh/yr savings was differences between reported and *ex post* verified savings. The shortfall in achieved MW savings was due to the installation of measures with lower demand reductions than expected.

These differences are discussed in detail in the "PY5 Final Annual Report."

[75] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania PUC on April 7, 2014, Table S6, pp. 154.



Program Delivery

The MMMF Program targets energy-efficiency improvements in master metered multifamily low-income housing buildings. For this new program offering in the Phase II portfolio, eligible multifamily buildings must have five or more residential units, be PPL Electric customers, and their tenants must be income-eligible (meeting low-income definitions of 150% of the federal poverty level). The targeted sectors include government, nonprofit, and low-income. The program targets decision-makers, i.e., multifamily property owners and operators of multifamily buildings.

The program provides a free walkthrough audit of master metered multifamily buildings and prepares a report showing the potential savings of recommended measures. Customers may qualify for direct installation and prescriptive efficiency measures. In some cases, custom measures may be recommended as part of the audit. Qualified buildings may receive financial incentives through the MMMF Program. Program participants may also qualify for rebates through other PPL Electric programs for prescriptive and custom measure offerings. The incentives help offset the incremental costs between high-efficiency and baseline measures.

The implementer, SmartWatt Energy, manages the program, handling the initiation, planning, and completion of customers' energy projects.

Marketing

SmartWatt manages all program marketing. Marketing activities center on active recruitment of prospective buildings with advertisements distributed to multifamily stakeholders (i.e., housing finance agencies, housing authorities, and property associations). PPL Electric helped support SmartWatt's efforts by identifying potentially eligible customers. From the implementer's perspective, this marketing approach is successful, primarily because the one-on-one contact allows SmartWatt staff to develop relationships with property owners and operators and encourage an ongoing dialogue about energy efficiency that can translate into multiple projects completed throughout Phase II.

A notable example of marketing success was the publication of a case study of an early PY5 Q2 project in the U.S. Department of Housing and Urban Development (HUD) Northeastern Regional newsletter.

Building Audit and Retrofit

SmartWatt manages building auditing and the installation of high-efficiency measures, performing this work directly or with support from qualified subcontractors. In PY5, the vast majority of installed measures were lighting—both in common areas and tenant units. Although the active recruitment approach has been successful in capturing program savings so far, given the relatively limited number of program-eligible customers and perceived availability of savings in building improvements (beyond lighting), PPL Electric has encouraged SmartWatt to pursue savings in additional areas.

Tenant Education

A key objective for the MMMF Program is to educate customers about energy efficiency. Prior to beginning any retrofit, SmartWatt conducts an energy education seminar with building tenants, during

which it introduces its staff, shares ways tenants can save energy, and explains the work being done in the building. Program staff reports these seminars have been successful; however, low tenant turnout was a concern throughout PY5.

Retrofit Documentation and Measurement and Verification

SmartWatt is responsible for completing the required measure documentation for each project—which depends on the measure type and location. For example, an Appendix C lighting Excel file must be completed for projects receiving a rebate for retrofitting common area lighting. SmartWatt also performs M&V and data management of eligible installed measures, as appropriate, and handles all rebate processing and payment.

PPL Electric and SmartWatt staff members we interviewed reported observing very minor discrepancies in three early invoice packages. They subsequently revised protocols for reviewing and processing invoice materials. To ensure quality control, the new protocols stipulate that three SmartWatt staff members will review all invoice materials prior to submission to PPL Electric.

Cadmus developed process flow maps diagramming roles and responsibilities and program activities which are presented at the end of this chapter in **Figure 77** and **Figure 78**. **Figure 77** diagrams the customer participation process. **Figure 78** shows the customer participation process.

Program Changes and Outcomes

The MMMF Program was established in PPL Electric's Phase II Revised EE&C plan and began offering incentives in late 2013.[77] Program implementation has remained unchanged since inception. A significant program change in terms of measures installed was the transition from direct install medium screw base CFLs to LEDs. PPL Electric has implemented this approach across all of its residential programs starting in PY6.

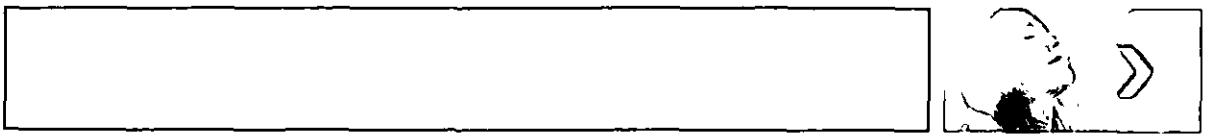
In addition, although most PY5 energy savings and demand reductions came from lighting retrofits, SmartWatt, with encouragement from PPL Electric, has begun exploring other non-lighting improvements, such as HVAC tune-ups, that can be made in multifamily buildings.

According to both program and implementation staff, established program processes are effective and only minor updates occurred in PY5. Other program changes involved a staffing change in the PPL Electric team, offering strategies such as gift card raffles to encourage more tenant participation in energy education seminars, and revising protocols for reviewing and processing to address very minor inconsistencies observed in some early invoice packages.

Program Tracking

To ensure that the program meets or exceeds the planned savings filed with the Pennsylvania PUC but does not face issues of oversubscription, SmartWatt works closely with PPL Electric to monitor

[77] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania PUC on April 7, 2014.



marketing levels, the number of audits performed, and the number and scope of projects completed. Overall, this process has been successful; *ex ante* claimed kWh saving are within 2% of PY5 energy savings.

Through impact-related evaluation activities, Cadmus also found that data-tracking operates smoothly and reporting processes are well documented. However, as with any new program, there are some areas that could be improved, such as:

- Inconsistencies in how direct install T8s and LEDs are reported in EEMIS where data are provided by the implementers.
- Identifying customers with projects that will be completed in stages so evaluation can occur after more than one stage is complete—therefore increasing the effectiveness of the evaluation activities and reducing the risk of customer fatigue.

Program data for the MMMF program is tracked in EEMIS in two tables. Measure-level information for each completed project is uploaded into one or both tables, depending on the type(s) of measures installed. Generally, one table contains information for common area lighting improvements and the other contains direct install improvements made in tenant units (e.g., CFLs and faucet aerators) and common areas (e.g., beverage machine controls and smart strips). These tables contain different fields; the common area lighting table provides information on the equipment replaced as part of the retrofit.

Through our review of these data, we found inconsistencies in the types of retrofits that were recorded and summarized in each tracking table. For example, as part of five separate projects completed in PY5, T12 lighting replaced T8s in approximately 300 tenant kitchen areas. Data for one of the five retrofits were summarized in the direct install table in Q2, data for a second retrofit were summarized in the common area lighting table in Q3, and data for three retrofits were summarized in the direct install table in Q4. **Table 35** provides additional detail.

Table 35. Example: Reporting Inconsistencies for T12 to T8 Retrofits Data

Quarter	Direct Install (Smart Strips, CFLs, etc.)	Common Area Lighting
Q2	1 retrofit	
Q3		1 retrofit
Q4	3 retrofits	

Because the two EEMIS tables contain different fields—with the common area lighting system providing information on the equipment replaced as part of the retrofit—more information was available for the project completed in Q3 than in the other two quarters. As part of the impact evaluation, Cadmus followed up with the implementer to determine the necessary inputs to calculate savings for these measures. Another measure where this appeared to be an issue was medium screw base LEDs installed in tenant units.

Upfront costs represent the primary barrier for multifamily customers considering energy-efficiency retrofits, so PPL Electric encourages customers to leverage their financing option and complete projects in stages as funds are available. For example, participants might retrofit lighting on the exterior of the building and in parking lots, and then several months later treat halls and stairwells in the interior of the building. Both these retrofits would have been identified during the initial facility audit.

During verification site visit sampling for projects Q3 and Q4, Cadmus identified several facilities with completed projects already visited in Q2. Because of concerns around customer fatigue, we elected not to include these projects in the Q3/Q4 verification sample and visited an alternate facility. Developing an internal process whereby customers completing projects in stages are identified early and communicated to Cadmus could facilitate more efficient sampling while reducing the risk of customer fatigue.

Satisfaction

Survey respondent satisfaction with the program is very high and in line with anecdotal data collected during site visits. All seven property decision-makers who responded to questions about program satisfaction reported they were *very satisfied* with the MMMF Program overall. They also reported the same level of satisfaction with these program elements:

- The overall quality of the work performed by the contractor in the common areas (n=7)
- The performance of the equipment installed by the contractor in the common areas (n=7)
- Contractor interaction with tenants during equipment installation and energy education seminars (n=6)[78]
- The performance of the equipment installed by the contractor in the tenant apartments (n=6)
- The overall quality of the work performed by the contractor in the tenant apartments (n=6)

Tenant respondents reported similar high levels of satisfaction, although a few indicated dissatisfaction with CFLs. They noted these reasons:

- *"The bulbs perform poorly in touch lamps."*
- *"[The CFLs] are too dim for reading."*
- *"I had CFL bulbs before the workshop in my apartment."*

Respondents did not express in writing the reason for their dissatisfaction with other measures or program elements.

[78] One respondent received only common-area improvements at the property.

Tenant Education

All decision-makers reported the SmartWatt staff conducted a tenant education seminar in their building(s) prior to beginning work. They said tenant participation at the seminars ranged widely (between 5% and 50% of tenants). When asked what steps SmartWatt could take to encourage more participation, respondents suggested:

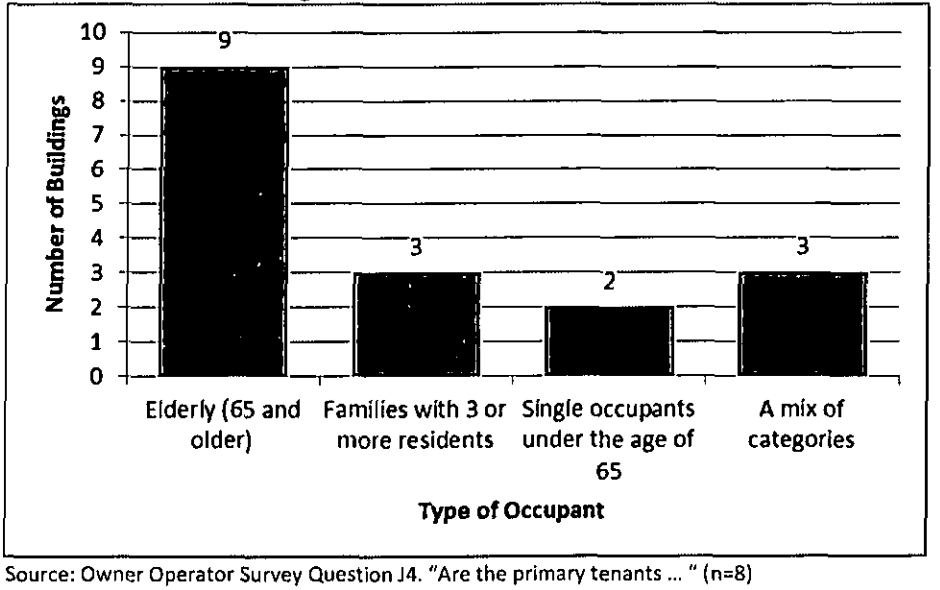
- *"Coffee and doughnuts."*
- *"Food and prizes or drawings."*
- *"It's hard to say. This building is for elderly residents and they really don't care. I don't know what would help."*
- *"The refreshments were nice but anytime you can offer more free stuff it will help."*

Despite lower-than-anticipated tenant participation at some energy-education events, the seven decision-makers who were present during the events agreed that the seminars adequately prepared tenants for the upcoming improvements to their apartments and the property.

Tenant Characteristics and Building Demographics

Roughly half of the participating buildings discussed in the property manager interviews cater specifically to occupants 65 years of age or older.[79] **Figure 76** shows tenant age and number of people occupying the unit.

Figure 76. Tenant Characteristics



Source: Owner Operator Survey Question J4. "Are the primary tenants ... " (n=8)

[79] One of the responses categorized as "Elderly (65 and older)" was 62 or older. Because most of those tenants were elderly, the response was recoded as "Elderly (65 and older)."

Property managers/owners interviewed reported using natural gas for space heating and water heating at fourteen of 17 properties. One property used electricity to heat both tenants' apartments and their water, and two properties used a combination of fuels.

Electricity costs are included in the rent at nearly all properties (16 of 17) and water costs are included in the rent at all 17 properties, which means the cost benefits accruing from energy-efficiency and water-efficiency improvements will be realized by property owners, not tenants.

Benchmarking Against Other Programs

Cadmus benchmarked the Master Metered Low-Income Multifamily Housing Program (MMMF) with similar programs—PECO, Con Edison, New York State Electric and Gas (NYSEG) and Rochester Gas and Electric (RG&E), Wisconsin Focus on Energy, and Entergy Arkansas. We reviewed recent program materials, websites, and third-party evaluation reports, focusing on program measure offerings, tenant education, and program satisfaction.

Program Measure Offerings

All programs offer participants different measures. The most common direct install measures are CFLs, showerheads, and faucet aerators. PPL Electric is the only utility to offer customers direct install T8 retrofits, exit signs, and vending machine controls. Only one other program—the Multifamily Direct Install Program offered by NYSEG and RG&E—currently offers directly installed medium screw base LED bulbs.

Most programs reviewed also offer multifamily customers prescriptive and/or custom measures to offset the cost of improvements in building common areas and to achieve deeper savings in tenant units. PPL Electric is the only utility to offer its customers rebates for appliances; however, we found no projects issued appliance rebates in PY5.

Tenant Education

Of the programs reviewed, only PPL Electric's MMMF Program and PECO's Smart Multifamily Solutions Program conduct any formal customer education. PECO, however, focuses on raising awareness of energy efficiency among property owners and operators.

Program Satisfaction

Cadmus' review of findings from recent process evaluations conducted for the five programs indicated that customers (property owners, operators, and tenants) are generally satisfied with the program overall as well as with individual components. Responses to comparable questions posed during the PY5 process evaluation of the MMMF Program indicate PPL Electric customers are equally or more satisfied than customers in the other programs.

Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-10** of the report titled *"PY5 Annual Report."*

Process Maps

Figure 77. MMMF Customer Awareness Process

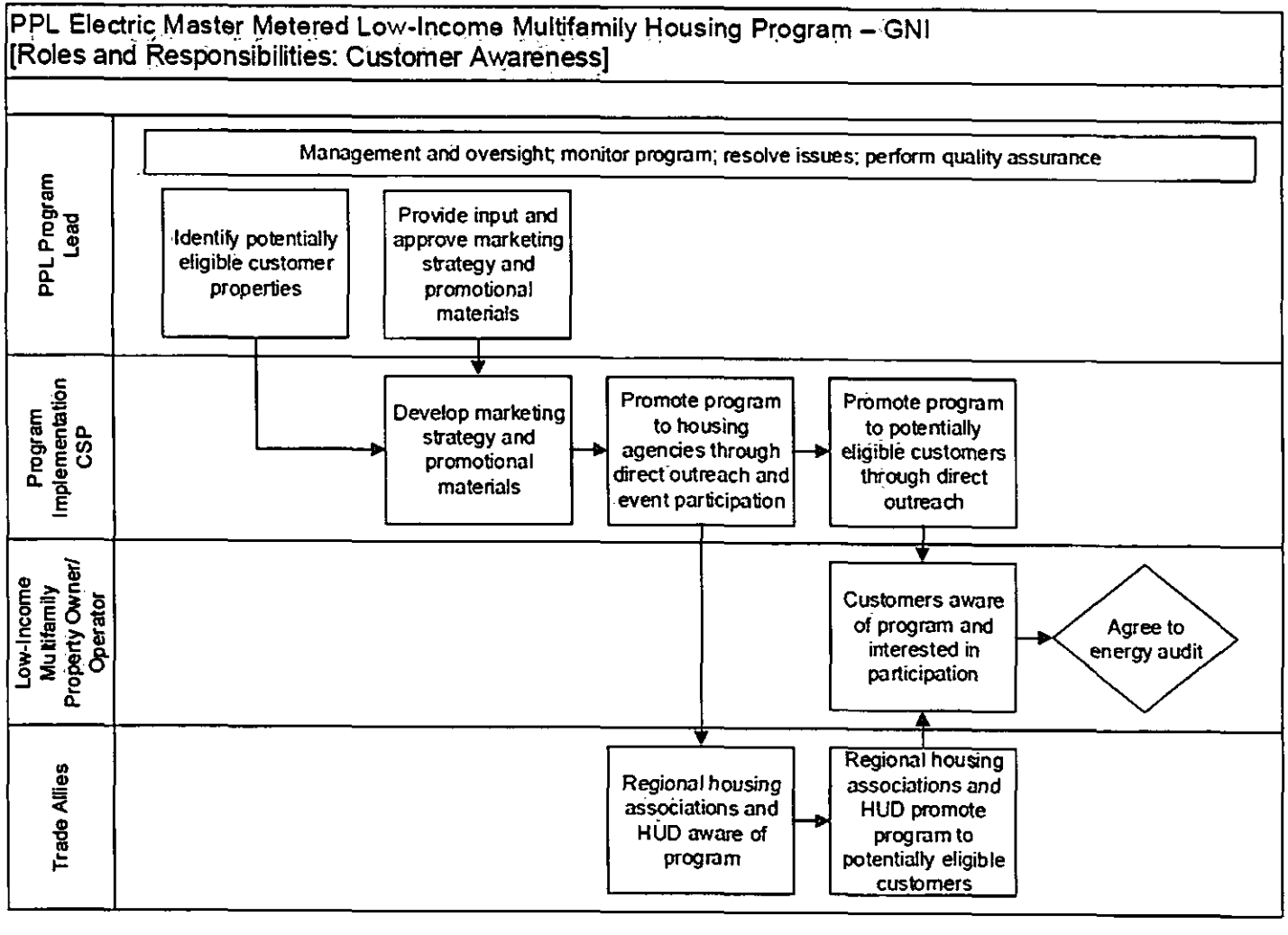
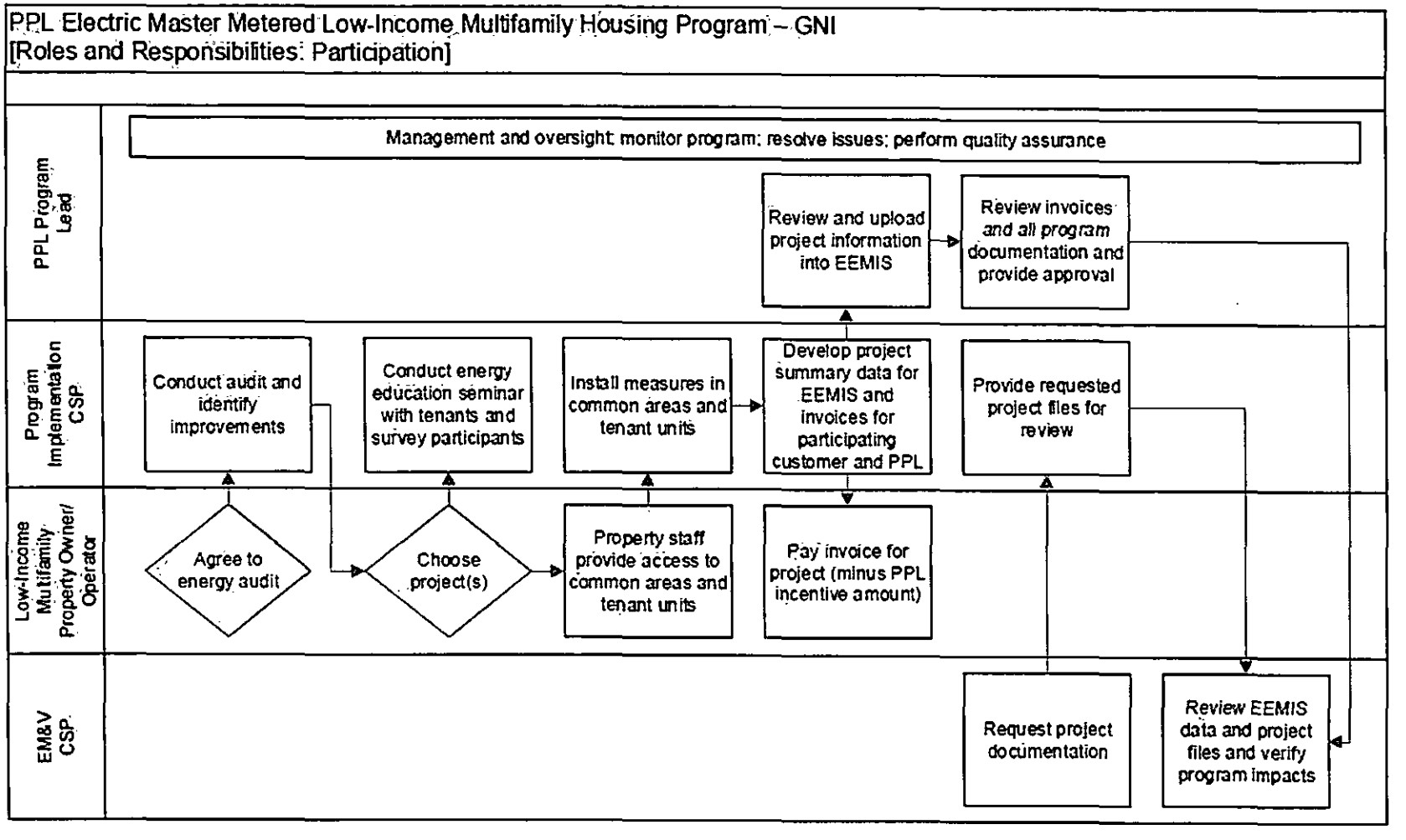


Figure 78. MMMF Customer Participation Process



Residential Energy-Efficiency Behavior & Education Program

Phase II of the Residential Energy-Efficiency Behavior & Education Program launched in October 2014 of Program Year 6 (PY6). No program activity occurred during PY5. This process report documents and facilitates the plan for program implementation during the next two years, PY6 through PY7.

Cadmus conducted the following process evaluation activities:

- Program staff and implementer interviews (n=4)
- Process map development
- Benchmarking research

Program Goals

The program has set savings and participation targets for Phase II, as shown in **Table 36**. Of the 128,000 customers selected as participants, about 79,000 customers will be new to the program while 49,000 customers will be legacy participants from PY4.

Table 36. Residential Energy-Efficiency Behavior & Education Program Goals[80]

Planning Targets	PY5	PY6	PY7	Total
Planned Savings (MWh/yr)	--	13,318	32,205	**32,205**
Participation Target *(number of participants)*	--	128,000	128,000	**128,000**

In addition to the savings and participation targets, PPL Electric indicated it wished to achieve a high customer satisfaction as an internal goal.

Program Design and Delivery

PPL Electric's Residential Energy-Efficiency Behavior & Education Program informs customers about their home energy consumption and encourages them to initiate no- to low-cost energy-saving behaviors. Customers are mailed bi-monthly home energy reports. Each report contains the customer's household energy consumption data, comparisons to neighbor consumption data, and three energy-saving tips.

The program does not provide any financial incentives for participating. Instead, the program's objective is for customers to gain the awareness, knowledge, and motivation to save energy and achieve cost savings on their monthly utility bills.

The program uses an experimental design called a randomized control trial, wherein customers are randomly assigned to either a treatment group (recipients of home energy reports) or a control group (non-recipients). For PY6 through PY7, the Residential Energy-Efficiency Behavior & Education Program

[80] *Planned savings are based on PPL Electric's revised EE&C Plan* (Docket No. M-2012-2334388) filed with the Pennsylvania Public Utility Commission on April 7, 2014, Table G5 and Table G6, pp. 65.

will operate with 128,000 customers in the treatment group and 12,600 customers in the control group. Customers in the treatment group are automatically enrolled in the program. These customers can choose to opt out by contacting the program's Customer Service Representatives (CSR) call center whose phone number will be provided in every home energy report. Customers in the control group will not be made aware of the home energy reports.

PPL Electric has contracted with Opower, as implementer, to select the eligible customers for the program, and produce and distribute the home energy reports. Cadmus provided the random assignment of the eligible customers to the treatment or control group.

Customer Selection Process and Criteria

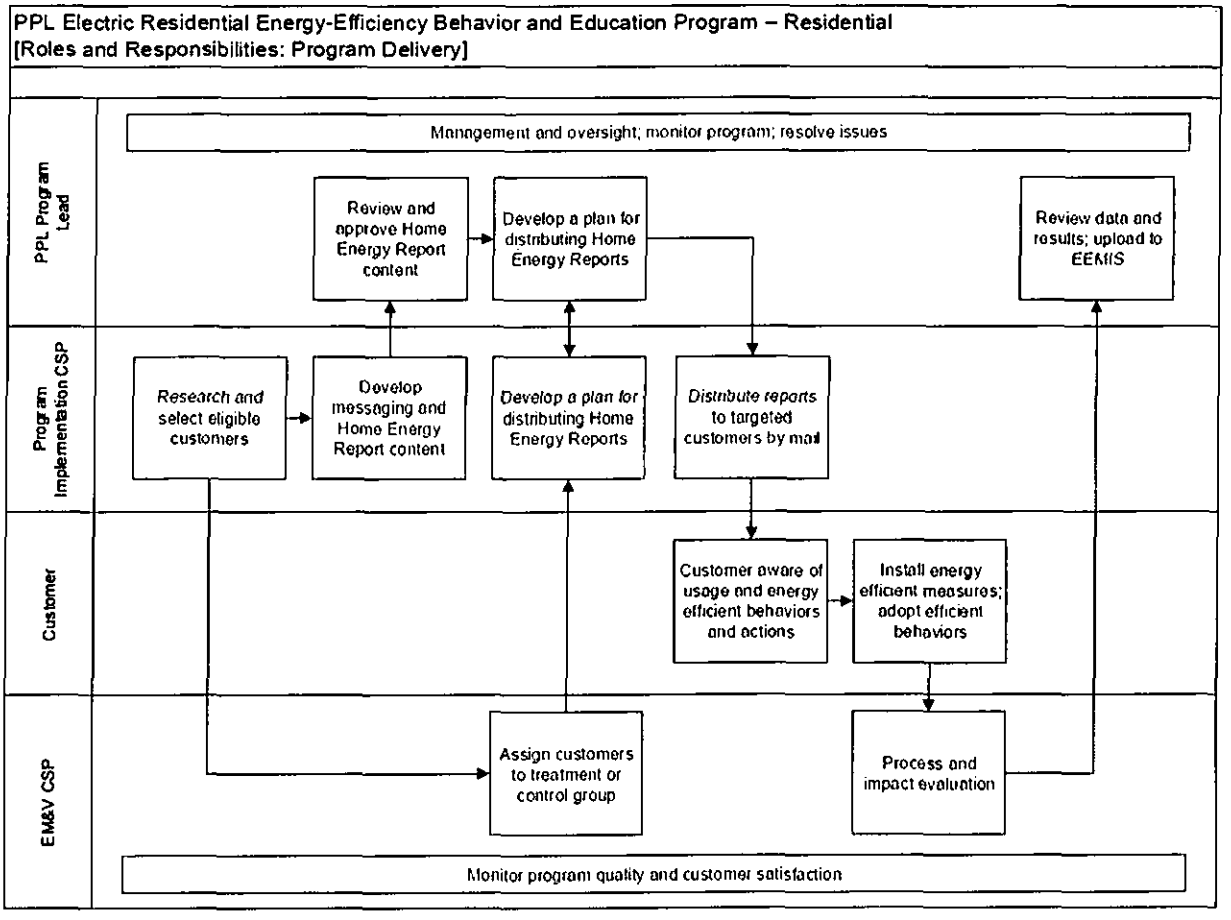
To determine the population of eligible customers for participation, Opower described its customer selection process and criteria as the following:

1. Review customer billing data history for the previous 13 to 18 months.
2. Remove ineligible accounts such as accounts with no names, accounts with multiple service points, and accounts with unknown rate codes.
3. Collect weather data, housing site data, and demographic data from a third-party source.
4. Narrow down to customers deemed as high-energy users.

Process Map

After interviewing the program staff and the implementer, Cadmus prepared a process map of the program delivery described above. **Figure 79** also presents the roles and responsibilities assigned to each of the program actors.

Figure 79. Residential Energy-Efficiency Behavior & Education Program Process Map



Program Changes and Recommendation Outcomes

PPL Electric and Opower noted four changes made to the Phase I program in preparation for Phase II:

- Unlike in PY4, no demand savings goal was established for PY6 and PY7.[81]
- Because there will be no demand savings goal, the energy-saving tips aimed at demand savings have been removed from the tips library.[82]
- Energy-saving tips about CFLs have been updated and replaced with information about LEDs in the tips library.

[81] There was no program activity during PY5. Phase II Act 129 does not require a compliance target for demand reduction.

[82] The tips library is the database that the implementeruses to generate the energy-saving tips for the home energy reports.

- In addition to the bi-monthly mailed home energy reports, the program will begin delivering *monthly e-mailed home energy reports in November 2014; some 36,000 customers who have* provided e-mail addresses to PPL Electric will receive e-mailed home energy reports. E-mailed reports will only feature the neighbor comparison component; they are meant to provide more up-to-date information on the neighbor comparison than a two-month delayed neighbor comparison found in the mailed reports.

In the PY4 evaluation, Cadmus recommended program staff consider the recommendations listed in **Table 37**. The program implemented two of the recommendations—educate participants more about the neighbor comparison and promote other Act 129 programs in the home energy reports. However, the program did not implement the recommendation to provide a means for participants to update their home information on the web; PPL Electric already offers its customers the Energy Analyzer online tool. Instead, PPL Electric and Opower have set up a CSR call center and an e-mail contact where participants can directly communicate details about their home.

Table 37. Residential Energy-Efficiency Behavior & Education PY4 Recommendation Outcomes

PY4 Recommendations	PY4 Recommendation Outcomes
Educate participants more about the construction and interpretation of the neighbor comparison.	*Implemented.* A brief description of the neighbor comparison will be included in the home energy reports. Additionally, e-mailed home energy reports will focus on the neighbor comparison and will provide more exposure to the neighbor comparison.
Continue to advertise other PPL Electric energy-efficiency program offerings in the home energy reports.	*Implemented.* Other Act 129 programs will continue to be promoted in the home energy reports.
Offer a way for participants to update details about their home on the web for more accuracy in the neighbor comparison.	*Rejected but with alternative in place.* Although the implementer offers a web portal delivery channel for the home energy reports, PPL Electric has decided not to offer the web portal. Instead, PPL Electric and the implementer have set up a call center and an e-mail contact where participants can provide details about their home.

Program Challenges

PPL Electric and Opower identified two program areas where they anticipate challenges may occur in Phase II:

- ***Customer dissatisfaction and opt-outs.*** Although PPL Electric will have the CSR call center handle customer opt-outs, complaints, and questions to help maintain high satisfaction, some program attrition is typical. The program will not replace customers who opt out or move out, which could reduce the number of program participants and impact achieved savings. However, Opower has over-selected the number of participants by 5% at the start of the program in anticipation of attrition.

- ***New e-mail delivery channel.*** Both PPL Electric and Opower mentioned the various logistical challenges of setting up a new e-mail delivery channel, such as collecting e-mail addresses, the timing of the e-mails, and coordination with the mailed home energy reports. Additionally, PPL Electric and Opower expressed concerns about the messaging overload and the potential for confusion that customers receiving e-mailed reports may experience; PPL Electric currently e-mails general energy-saving tips to all of its customers on a quarterly basis. However, PPL Electric and Opower have determined that the quarterly e-mails would not conflict with the e-mailed home energy reports due to the e-mailed report's focus on the neighbor comparison.

Marketing and Outreach

Due to its experimental design, PPL Electric does not promote the Residential Energy-Efficiency Behavior & Education Program. Instead, the home energy reports act as a self-marketing tool and promote other energy-efficiency (Act 129) programs offered by PPL Electric.

Depending on the energy-saving tips tailored to the customer, the following programs may be promoted in the home energy reports:

- Appliance Recycling
- Residential Retail (in-store LED discounts and in-store rebates for efficient equipment)
- Residential Home Comfort (rebates on audits, weatherization, and efficient equipment)

The first home energy reports were mailed to customers in October 2014 and included a welcome letter that explains the report content and the vocabulary used in the reports. After the first letter, Opower will deliver reports to customers every other month.

Benchmarking Against Other Programs

Cadmus benchmarked PPL Electric's PY4 Residential Energy-Efficiency Behavior & Education Program against three Opower behavior programs offered by other utilities. Cadmus researched Progress Energy Carolinas' (PEC's) Residential Energy Efficiency Benchmarking Program,[83] AEP Ohio's Home Energy Reports Program,[84] and ComEd's Home Energy Reports Pilot.[85]

---

[83] Navigant. *Program Year 1 (2011-2012) EM&V Report for the Residential Energy Efficiency Benchmarking Program*. December 2012. Prepared for Progress Energy Carolinas. Available at: http://opower.com/company/library/verification-reports?year=2012

[84] Navigant. *Home Energy Reports Program 2012 Evaluation Report.* May 2013. Prepared for AEP Ohio. Available at: http://opower.com/company/library/verification-reports?year=2013

[85] Navigant. *Energy Efficiency/Demand Response Plan Year 3: Evaluation Report for Home Energy Reports.* May 2012. Prepared for Commonwealth Edison Company. Available at: http://opower.com/company/library/verification-reports?year=2012

Impact Metrics

Cadmus reviewed program energy savings and the TRC ratio. Compared to the other programs, PPL Electric's program achieved the highest annual savings per participant (388 kWh) and the highest TRC ratio (3.11). **Table 38** shows the savings and TRC ratio for PPL Electric's program and the three comparison programs.

Table 38. Impact Metrics Comparison of Other Opower Behavior Programs

Utility	Program Name	Start Year	Evaluation Period	Number of Participants (Treatment)	Verified Gross Savings MWh/yr	Annual kWh Savings per Participant	TRC
PPL Electric	**Residential Energy-Efficiency Behavior & Education Program**	**2010**	**June 2012–May 2013**	**93,924**	**36,470**	**388.3**	**3.11**
Progress Energy *Carolinas*	Residential Energy Efficiency Benchmarking Program	2011	August 2011–July 2012	50,129	11,229	224.0	N/A
AEP Ohio	Home Energy Reports Program	2010	2012	197,646	53,174	377.0	2.3
ComEd	Home Energy Reports Pilot	2009	June 2010–May 2011	45,171	13,479	282.0	0.39

Source: Cadmus 2013; Navigant 2012-2013.

PPL Electric's program outperformed the other programs in energy savings because it targeted high-energy use participants. When stratified by energy use, the comparison programs' results show that high-use participants saved 1.6% to 2.1% annually, compared to low-use participants who saved 0.9% to 1.7% annually.

Cadmus researched the persistence of savings for legacy participants.[86] Although PPL Electric's PY4 program contained legacy participants, we did not analyze the savings persistence as part of this evaluation. Evaluation results from ComEd's legacy participants showed a statistically significant savings increase of 38% from the program's first year (230 kWh per participant) to second year (317 kWh per participant). However, results from AEP Ohio's legacy participants showed a statistically significant savings decrease of 31% from the program's first year (640 kWh) to second year (442 kWh). Notably, AEP Ohio's legacy participants consisted of high-energy users only; therefore, savings may be harder to sustain with high-energy users.

[86] *The program evaluations from ComEd and AEP Ohio contained legacy participants and compared savings* between PY1 and PY2. PEC's program did not have legacy participants as the evaluation was for PY1.

Participation and Opt-Outs

According to Opower, home energy report programs typically have an attrition rate of about 1%, including opt-outs and move-outs. PPL Electric's program reported the lowest opt-out rate of 0.3% (**Table 39**). The evaluations for the three comparison programs did not investigate participants' reasons for opting out, but survey results from PPL Electric's PY4 evaluation showed that those participants who opted out chose to do so because they distrusted the neighbor comparison.

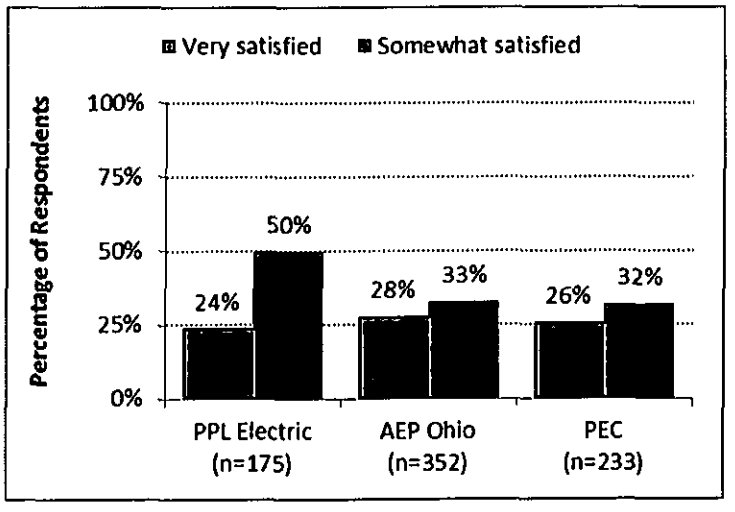
Table 39. Opower Behavior Program Opt-Outs

Program Name	Opt-Out Rate
PPL Electric Residential Energy-Efficiency Behavior & Education Program	**0.3%**
AEP Ohio Home Energy Reports Program	0.4%
Progress Energy Carolinas Residential Energy Efficiency Benchmarking Program	0.7%
ComEd Home Energy Reports Pilot	N/A

Participant Satisfaction

The majority of surveyed participants from PPL Electric's PY4 program and the comparison programs reported they were satisfied with the home energy reports, although more participants reported being *somewhat satisfied* than being *very satisfied*. As shown in **Figure 80**, PPL Electric had the largest percentage of satisfied participants overall (74%), but the smallest percentage of *very satisfied* participants (24%); this *very satisfied* percentage was similar to the other programs.[87]

Figure 80. Comparison of PY4 Participant Satisfaction with Home Energy Reports



[87] No process evaluation was conducted for ComEd; therefore, no satisfaction data were available.

Report Delivery Channels

Opower offers mailed home energy reports, e-mailed home energy reports, and a web portal as delivery channels. All four evaluated programs reviewed mailed reports to participants on a bi-monthly basis. PEC and AEP Ohio's programs gave participants access to a web portal in addition to the mailed reports. None of the programs implemented the e-mail delivery channel. PPL Electric's PY6 program will implement the e-mail delivery channel.

Delivery Challenges

Mailed home energy reports engage and inform participants more effectively than a web portal. According to survey responses, 73% to 95% of the participants from AEP Ohio and PEC reported reading the mailed home energy reports. Although Cadmus did not document the readership level among PPL Electric PY4 program participants, almost all respondents (94%) said the mailed reports were easy to understand. In contrast, 18% of AEP Ohio's participants reported hearing about the web portal, and just 5% visited it. Only 1.9% of PEC's participants enrolled in the web portal.

Nevertheless, all four reviewed programs reported that participants distrusted the accuracy of the neighbor comparisons. AEP Ohio's evaluation reported that 37% of surveyed participants believed in the accuracy of the neighbor comparisons. Only 18% of PPL Electric participants believed that their neighbor comparisons were accurate.

Solutions to Delivery Challenges

To overcome these challenges, the comparison evaluations made the following recommendations:

- ***Confidence in neighbor comparisons.*** Clearly explain the selection of neighbor homes to help participants verify that their homes match context and physical home features. PPL Electric's program briefly describes the neighbor comparisons in its home energy reports.
- ***Web portal effectiveness.*** Proactively market the web portal to increase awareness. Offer games and contests to attract participants to enroll for the web portal. Track site traffic using web analytics to set appropriate baselines and goals. PPL Electric's program does not offer a web portal to participants, but some of these web portal recommendations may apply to its e-mail delivery channel.

Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-11** of the report titled *"PY5 Annual Report."*

Low-Income Energy-Efficiency Behavior & Education Program

The Low-Income Energy-Efficiency Behavior & Education Program, new to Phase II, is scheduled to launch in November 2014 of PY6. This process report documents and facilitates the plan for program implementation during the next two years, PY6 through PY7.

Cadmus conducted the following process evaluation activities:

- Program staff and implementer interviews (n=4)
- *Process map development*
- Benchmarking research

Program Goals

The program planned savings and participation targets for Phase II, as shown in **Table 40**. PPL Electric additionally indicated it wished to achieve a high customer satisfaction as an internal goal.

Table 40. Low-Income Energy-Efficiency Behavior & Education Program Plans

Planning Targets	PY5	PY6	PY7	Total
Planned Savings (MWh/yr)	--	3,150	8,325	**8,325**
Participation Planned (number of participants)	--	70,000	70,000	**70,000**

Program Design and Delivery

Like its residential counterpart, PPL Electric's Low-Income Energy-Efficiency Behavior & Education Program will inform customers about their home energy consumption and encourage them to initiate energy-saving behaviors. The main difference, however, is that the program is specifically for low-income households that are at or below 150% of the federal poverty level.

A home energy report will be mailed to customers bi-monthly. The mailed report will contain the customer's household energy consumption data, comparisons to neighbor consumption data, and three energy-saving tips.

Customers will not receive any financial incentives for participating in the program. Instead, the program's objective is for customers to gain the awareness, knowledge, and motivation to save energy and achieve cost savings on their monthly utility bills.

The program uses an experimental design called a randomized control trial in which customers are randomly assigned to either a treatment group (recipients of home energy reports) or a control group (non-recipients). For PY6 through PY7, the Low-Income Energy-Efficiency Behavior & Education Program will operate with 70,000 customers in the treatment group and 12,600 customers in the control group. Customers in the treatment group will be automatically enrolled into the program. These customers can choose to opt out by contacting the program's CSR call center whose phone number will be provided in

every home energy report. Customers in the control group will not be made aware of the home energy reports.

PPL Electric has contracted with Opower to select eligible customers for the program, and produce and distribute the home energy reports. Cadmus provided the random assignment of the eligible customers to the treatment or control group.

E-mail Delivery Channel

In addition to the bi-monthly mailed home energy reports, the program will begin delivering monthly e-mailed home energy reports in December 2014. E-mailed reports will only feature the neighbor comparison component, and they are meant to provide more up-to-date information on the neighbor comparison than a two-month delayed neighbor comparison found in the mailed reports. The number of customers receiving the e-mailed reports has yet to be determined.

Customer Selection Process and Criteria

To determine the population of eligible low-income customers for participation, Opower described its customer selection process and criteria as the following:

- Receive the list of customers that PPL Electric has identified as low-income.[88]
- Review customer billing data history for at least the previous three months.
- Remove ineligible accounts such as accounts with no names, accounts with multiple service points, and accounts with unknown rate codes.
- Collect weather data, housing site data, and demographic data from a third-party source.
- Narrow down to customers who meet the energy-usage criterion.[89]

Process Map

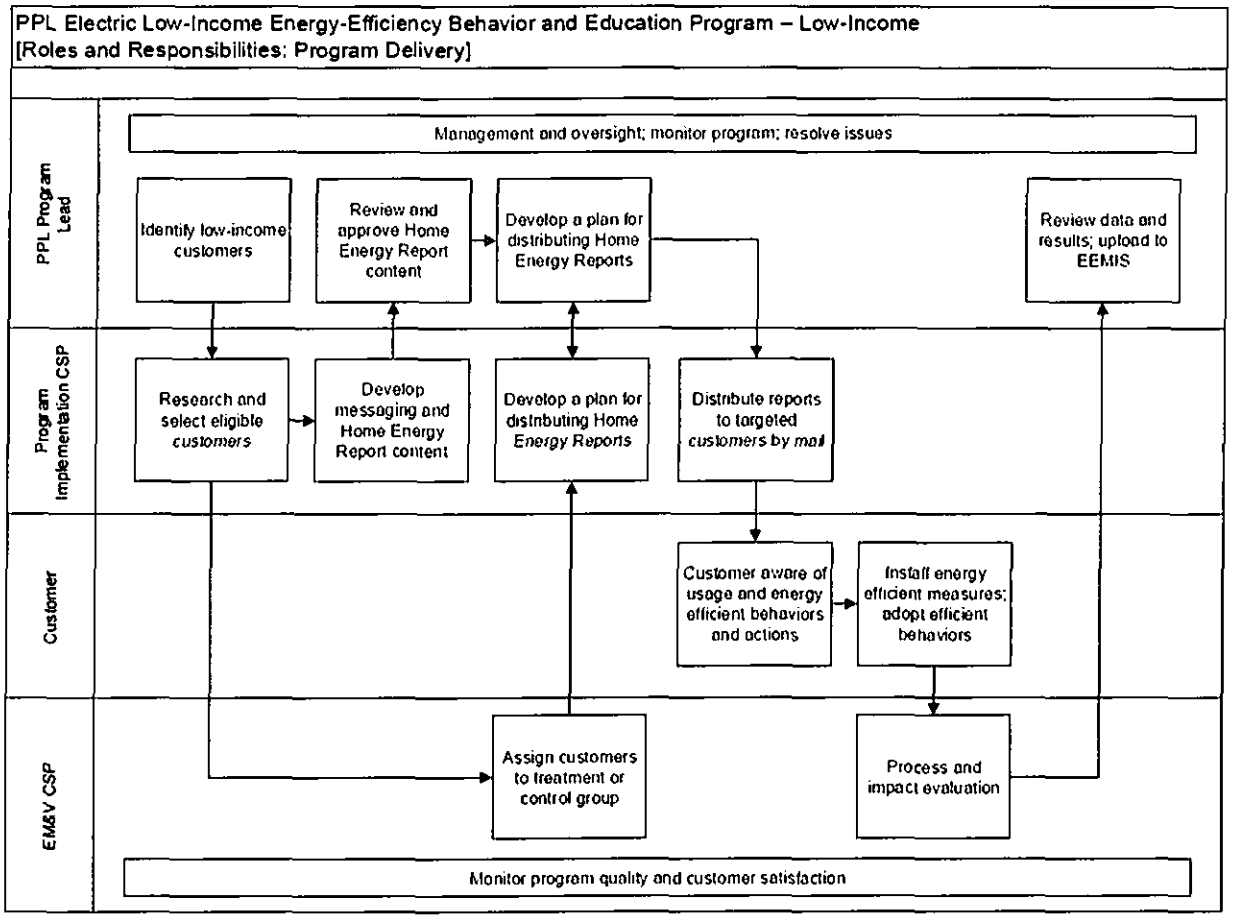
After interviewing the program staff and the implementer, Cadmus prepared a process map of the program delivery described above. **Figure 81** also presents the roles and responsibilities assigned to each of the program actors.

---

[88] PPL Electric identifies low-income customers through third-party data and previous participation in low-income programs such as Winter Relief Assistance Program (WRAP), Low-Income Home Energy Assistance Program (LIHEAP), and OnTrack Program.

[89] The implementer, Opower, stated that an energy-usage criterion will be applied when selecting the final customers as participants, but the energy-usage band(s)—high, medium-high, average—has yet to be determined.

Figure 81. Low-Income Energy-Efficiency Behavior & Education Program Process Map



Differences from Residential Energy-Efficiency Behavior & Education Program

Besides the income requirement, the Low-Income Energy-Efficiency Behavior & Education Program differs from the Residential Energy-Efficiency Behavior & Education Program in the following ways:

- The program's tips library will contain a subset of 80 energy-saving tips from the Residential Energy-Efficiency Behavior & Education Program's tips library that are most relevant to low-income households.[90]
- Tips will focus more on no-cost energy-saving behaviors than low-cost energy-saving behaviors.
- Other low-income and non-low-income Act 129 programs will be promoted in the home energy reports; the home energy reports for the Residential Energy-Efficiency Behavior & Education Program will not promote low-income Act 129 programs.

[90] The tips library is the database that the implementer uses to generate the energy-saving tips for the home energy reports.

Recommendation Outcomes

Cadmus made recommendations during the PY4 evaluation period to plan for program implementation. The program implemented two of the recommendations—communicate with stakeholders in low-income Act 129 programs and verify that eligible customers are low-income (**Table 41**). However, the program did not implement the recommendation on providing information about home energy reports prior to the start of the program; instead, the first home energy report mailed out will include a welcome letter that explains the content and vocabulary used in the report.

Table 41. Low-Income Energy-Efficiency Behavior & Education PY4 Recommendation Outcomes

Recommendations	Recommendation Outcomes
Educate participants about the home energy reports before the program starts.	*Rejected. The initial home energy report mailed out to customers will include a welcome letter than explains the report content and vocabulary used.*
Communicate with low-income stakeholders and advocates to keep them informed of the low-income energy-efficiency programs to secure support.	*Implemented.* PPL Electric staff has worked with other program managers on coordinating the cross-promotions and energy-saving tips for the home energy reports.
Verify that selected eligible customers are low-income households.	*Implemented.* PPL Electric determined customer eligibility using third-party data and enrollment in WRAP, LIHEAP, and OnTrack Program.

Program Challenges

PPL Electric and Opower identified several program areas where they anticipate challenges:

- ***Planned savings will be harder to achieve due to data discrepancy.*** PPL Electric and Opower are reexamining the baseline energy consumption of the low-income population to estimate potential energy savings. PPL Electric's revised EE&C Plan (Docket No. M-2012-2334388) filed with the Pennsylvania Public Utility Commission on April 7, 2014 (Table L5, pp. 95) projected the program's participation count at 50,000 customers. However, PPL Electric and Opower have decided to increase the participation count to 70,000 customers in order to meet its planned savings. PPL Electric will update the EE&C Plan.
- ***E-mail delivery channel.*** PPL Electric and Opower mentioned similar logistical challenges in setting up the e-mail delivery channel, such as the timing of the e-mails and coordination with the mailed home energy reports. In particular, the e-mail roll-out for the Low-Income Energy-Efficiency Behavior & Education Program has experienced a delay compared to the residential program because the final customers selected as participants are still being determined.
- ***Customer dissatisfaction and opt-outs.*** Although PPL Electric will have a CSR call center handle customer opt-outs, complaints, and questions to help maintain high satisfaction, some program attrition is typical. The program will not replace customers who opt out or move out, which could reduce the number of program participants and impact achieved savings. However, the

Opower over-selects the number of participants by 5% at the start of the program to deal with expected attrition.

Marketing and Outreach

No marketing or outreach is planned for the Low-Income Energy-Efficiency Behavior & Education Program. The home energy reports act as a self-marketing tool and also promote energy-efficiency (Act 129) programs offered by PPL Electric including other low-income programs. Depending on the energy-saving tips tailored to the customer, the following programs may be promoted in the home energy reports:

- E-Power Wise Program
- Winter Relief Assistance Program
- Appliance Recycling Program
- Residential Retail Program (in-store LED discounts and in-store rebates on efficient equipment)
- Residential Home Comfort Program (rebates on audits, weatherization, and efficient equipment)

The first home energy reports will be mailed to customers in November 2014 and will include a welcome letter that explains the report content and vocabulary used.

Benchmarking Against Other Programs

Currently, the Low-Income Energy-Efficiency Behavior & Education Program is the only stand-alone low-income Opower behavior program. Cadmus researched Progress Energy Carolinas' Residential Energy Efficiency Benchmarking Program,[91] AEP Ohio's Home Energy Reports Program,[92] and ComEd's Home Energy Reports Pilot[93]—three programs that investigated low-income participation within their general residential evaluation. Like PPL Electric's program, these three programs defined a low-income participant as having a household income at or less than 150% of the federal poverty level.

---

91 Navigant. *Program Year 1 (2011-2012) EM&V Report for the Residential Energy Efficiency Benchmarking Program.* December 2012. Prepared for Progress Energy Carolinas. http://opower.com/company/library/verification-reports?year=2012

92 Navigant. *Home Energy Reports Program 2012 Evaluation Report.* May 2013. Prepared for AEP Ohio. http://opower.com/company/library/verification-reports?year=2013

93 Navigant. *Energy Efficiency/Demand Response Plan Year 3: Evaluation Report for Home Energy Reports. May 2012.* Prepared for Commonwealth Edison Company. http://opower.com/company/library/verification-reports?year=2012

Energy Savings

Each of the three reviewed evaluations came to a different conclusion about how energy savings correlate to participant income level.

- ***Progress Energy Carolinas: Savings did not differ by income level.*** Progress Energy Carolinas' program results showed no statistical difference in energy savings between low-income participants and non-low-income participants. On average, a low-income participant saved 238 kWh during the year while a non-low-income participant saved 225 kWh. The number of low-income customers who participated in the program is not known.
- ***AEP Ohio: Savings were similar for low-income participants and advanced metering infrastructure (AMI) participants.*** AEP Ohio's program results showed that low-income participants saved about the same amount of energy as AMI participants. On average, a low-income participant saved 179 kWh during the year while an AMI participant saved 177 kWh. A total of 16,273 low-income customers participated in AEP Ohio's program.
- ***ComEd: High-energy usage group could suggest income-level savings differences.*** When the evaluation for ComEd's program restricted the analysis to only the high-energy usage group, savings appeared to differ by income level. On average, a low-income participant saved 361 kWh annually, a middle-income participant saved 601 kWh, and a high-income participant saved 467 kWh. However, due to the small sample size, ComEd's program evaluation could not conclude that the differences were statistically significant with a high degree of confidence. A total of 364 low-income customers participated in ComEd's program.

Participation and Opt-Outs

According to Opower, home energy report programs typically have an attrition rate of about 1%, including participants who have opted out of the program and moved out of the service region. Only one of the evaluations documented the opt-out rate among low-income participants. AEP Ohio's program experienced a 0.3% opt-out rate for low-income participants—the same rate observed for PPL Electric's Residential Behavior & Education Program.

Participant Action

One evaluation provided information on energy-saving actions taken among low-income participants. In PEC's program, a larger proportion of low-income surveyed participants (31%) reported taking action after receiving the home energy reports than non-low-income surveyed participants (15%). Twenty-five percent of PEC's low-income surveyed participants also reported taking equipment-based actions compared to 8% of non-low-income surveyed participants. However, these survey findings contradict the results observed in the impact analysis of PEC's program whereby no significant differences were found in energy savings between low-income participants and non-low-income participants.

Report Delivery Channels

Opower offers mailed home energy reports, e-mailed home energy reports, and a web portal as delivery channels. All three comparison programs provided participants with mailed reports on a bi-monthly basis. PEC and AEP Ohio's programs also gave participants access to a web portal but their evaluations did not publish participation data on use of the web portal by income level. None of the three programs implemented the e-mail report delivery channel. Currently, PPL Electric is considering implementing the e-mail delivery channel for its Low-Income Behavior & Education Program.

Delivery Challenges

As stated in the benchmarking research for the Residential Energy-Efficiency Behavior & Education Program, mailed home energy reports engage and inform participants more effectively than a web portal. More importantly, mailed reports equalize access to energy-efficiency information across income levels. Low-income participants have less access to the Internet and Internet-enabled devices than non-low-income participants, so e-mailed reports and a web portal may be less effective channels by which to reach and engage them.

Market Barriers

Although none of the evaluated programs explored barriers specific to low-income customers, Opower's recent white paper identified low awareness of energy efficiency as the main barrier.[94] Opower stated that low-income utility customers were less aware of energy-efficiency programs than customers from the general population and that this was typical in households with English as a second language and limited access to the Internet. Both circumstances make it difficult for low-income customers to learn about energy-efficiency opportunities for saving money on utility bills.

Solutions to Delivery Challenges and Market Barriers

To address the delivery challenge of access and the market barrier of awareness, Opower proposed these solutions:

- ***Opt-Out/Auto-Enroll program format.*** *To make it easier for low-income customers to enroll in* the program and access the home energy reports, Opower recommends the opt-out/auto-enroll program format. Opower found that low-income customers in an opt-out/auto-enroll program format generated higher participation than opt-in program formats, where customers had to initiate the enrollment. PPL Electric's Low-Income Behavior & Education Program will operate as an opt-out format in PY6.
- ***Targeted outreach activities.*** Demographic data from utilities in the East and West of the United States show that low-income customers range in age, nationality/language, housing type, and homeownership. Therefore, utility programs' outreach activities need to tailor marketing and education of energy-efficiency awareness to these various low-income segments.

---

[94] Opower. *Unlocking Energy Efficiency for Low-Income Utility Customers.* June 2014. Available online: http://www2.opower.com/unlocking-ee-for-low-income

Conclusions and Recommendations

The full list of conclusions and recommendations is included in **Appendix A, Table A-12** of the report titled *"PY5 Annual Report."*

Appendix A. Completed Telephone Surveys in PY5

Table A-1 contains the number of completed surveys conducted in PY5 by program and by strata, and the percent of the achieved target.

Table A-1. PY5 EM&V Surveys

Survey	Field Start Date	Field End Date	Target Completes	Achieved Completes	Percentage of Achieved Target
Appliance Recycling Participants			**140**	**140**	**100%**
Refrigerators	4/22/2014	5/3/2014	70	69	99%
Freezers			70	71	101%
Appliance Recycling Nonparticipants [1]			**70**	**11**	**16%**
Refrigerators	4/23/2014	5/1/2014	50	9	18%
Freezers			20	2	10%
Custom Incentive [2]			**Up to 20**	**13**	**65%**
Participants	5/22/2014	7/25/2014	15	11	73%
Partial participants			Up to 5	2	40%
Master Metered Low-Income Multifamily Housing			**N/A**	**55**	**N/A**
Landlord	4/1/2014 and 8/11/2014	4/16/2014 and 9/5/2014	11	8	73%
Tenant	2/24/2014 and 7/23/2014	2/28/2014 and 7/29/2014	N/A	47	N/A
Prescriptive Equipment			**236**	**150**	**64%**
Agriculture [3]	N/A	N/A	11	0	0%
Non-lighting [2]	7/24/2014	8/12/2014	75	0	0%
Direct Discount Lighting	7/28/2014	8/12/2014	75	75	100%
Lighting	7/24/2014	8/12/2014	75	75	100%
Residential Home Comfort			**222**	**158**	**71%**
Audit [2]	7/17/2014	7/30/2014	36	29	81%
Survey			36	43	119%
Weatherization measures [2]	7/14/2014	7/24/2014	75	11	15%
Air Source Heat Pumps	7/9/2014	7/25/2014	36	36	100%
Ductless Mini-Split Heat Pumps			28	28	100%
Pool Pump Rebates			11	11	100%

Survey	Field Start Date	Field End Date	Target Completes	Achieved Completes	Percentage of Achieved Target
Residential Retail			**450**	**451**	**100%**
Lighting	4/28/2014	5/15/2014	300	301	100%
Smart strip			18	18	100%
Refrigerator			45	45	100%
Heat Pump Water Heater			87	87	100%
Student and Parent EE Education			**335**	**561**	**167%**
Bright Kids Participants	3/13/2014	4/11/2014	70	74	106%
Take Action Participants			70	80	114%
Innovation Participants			70	40	57%
Teacher Workshop			10	10	100%
Parent Teacher Organization Workshop			45	45	100%
Participating Classroom Teacher			70	312	446%

[1] Cadmus halted the effort because it was apparent that completing the project was cost-prohibitive due to the low production rate.

[2] Survey target was not met due to insufficient unique contact records.

[3] There were no Agriculture participants in PY5.

Appendix B. Survey Sample Frame Attrition in PY5

Table B-1 through Table B-9 contain the sample attrition information for each program by strata for surveys conducted in PY5. Each table outlines the population, number of records selected for the survey frame, and the call outcome of each of these records.

Table B-1. Residential Retail Equipment

Description of Call Outcomes	Sample Frame Number of Records
Population (number of rebates Q1-Q3)	**5,489**
Survey Sample Frame (sent to survey subcontractor)	**1,142**
Not attempted	**70**
Records Attempted	**1,072**
Nonworking number	24
Wrong number, business	28
Call privacy	4
Language barrier	1
PPL Electric or market research employee	16
Do not know if measure was installed	6
Refusal	128
No answer/answering machine/phone busy	569
Non-specific or specific callback scheduled	103
Partial complete	43
Completed survey	**150**

Table B-2. Upstream Lighting

Description	Sample Frame Number of Records
Total Population (number of residential customers)	**1,215,560**
Survey Sample Frame (sent to survey subcontractor)	**5,459**
Adjusted Survey Sample Frame	**5,372**
Removed because they were businesses	87
Not Attempted	**372**
Records Attempted	**5,000**
Nonworking number	464
Wrong number, business	82
Language barrier	31
Call privacy	22
PPL Electric Utilities or market research employee	31
Refusal	1,206
No answer/answering machine/phone busy	2,262
Non-specific or specific callback scheduled	419
Partial complete	182
Completed survey	**301**

Table B-3. Prescriptive Equipment

Description	Sample Frame Number of Records		
	Direct Discount	Standard Lighting	Equipment
Total Population (number of rebates PY5)	**1,352**	**972**	**24**
Survey Sample Frame (sent to survey subcontractor)	**617**	**588**	**9**
Adjusted Sample Frame	**610**	**570**	**9**
Removed because phone number was missing or incomplete	3	6	0
Removed because duplicate phone number	4	12	0
Records Attempted	**610**	**570**	**9**
Nonworking number	21	19	0
Wrong number, residence	35	34	1
Language barrier	0	1	0
PPL Electric or market research employee	5	7	0
Did not participate in program	17	6	0
Refusal	177	178	5
Non-specific or specific callback scheduled	137	178	3
No answer/answering machine/phone busy	58	56	0
Partial complete	85	16	0
Completed survey	**75**	**75**	**0**

Table B-4. Appliance Recycling Program

Description	Sample Frame Number of Records	
	Participants	Nonparticipants
Total population (number of rebates Q1-Q3)	**11,148** [1]	**1,215,560**
Survey Sample Frame (Records sent to survey subcontractor)	**1,340**	**4,164**
Adjusted Survey Sample Frame	**1,337**	**4,133**
Invalid phone number	0	1
Business record	0	30
Duplicate record	3	0
Records Not Attempted	**337**	**632**
Records Attempted	**1,000**	**3,501**
Nonworking number	52	304
Wrong number, business	9	66
Call privacy	2	17
Language barrier	4	16
Did not discard a refrigerator or freezer or don't know what appliance they recycled	27	519
Did not discard a refrigerator or freezer since June 2013 or don't know date	0	29
Participated in Appliance Recycling Program or doesn't know if participated in program	N/A	5
PPL Electric or market research employee	7	1
Refusal	178	470
No answer/answering machine/phone busy	415	1761
Nonspecific or specific callback scheduled	118	292
Partial complete	48	10
Completed survey	**140**	**11**

[1] Number of rebates

Table B-5. Student and Parent Energy-Efficiency Education Program

Description	Sample Frame Number of Records			
	Teacher		Parent	
	Workshop	Participant	Workshop	Participant
Total population (number of participants)	**47**	**713**	**999**	**17,439**
Survey Sample Frame	**47**	**713**	**318**	**1,970**
Adjusted Survey Sample Frame (records sent to survey subcontractor)	**46**	**713**	**262**	**1,826**
Removed because no e-mail address and no phone number	0	0	41	116
Removed because no e-mail and incomplete phone number	0	0	7	28
Removed because incomplete or unreadable e-mail and no phone number	0	0	8	0
Removed because duplicate e-mail address	1	0	0	0
Records Attempted	**46**	**713**	**262**	**1,826**
Undeliverable e-mail	6	60	0	0
Undeliverable e-mail and no phone number	0	0	35	287
Did not qualify to take survey	0	1	3	6
Nonworking number	0	0	4	22
Business/wrong number	0	0	3	6
Refusal	0	0	4	26
Language barrier	0	0	0	4
Did not complete survey	0	0	0	8
No answer/answering machine/phone busy	0	0	16	135
Nonspecific or specific callback scheduled	0	0	9	33
Partially completed survey	3	79	6	35
Remaining non-final records[1]	*27*	*261*	*137*	*1,070*
Completed survey	**10**	**312**	**45**	**194**

[1] These records were included in the sample frame but participants did not respond.

Table B-6. Custom Incentive Program

Description	Sample Frame Number of Records	
	Participants	Cancelled Projects
Total Population (number of projects Q1-Q3)	**98**	**22**
Survey Sample Frame (unique contacts)	***20***	***9***
Records Attempted	**20**	**9**
Refusal	3	2
No answer/answering machine/phone busy	6	5
Completed survey	**11**	**2**

Table B-7. Residential Home Comfort Audit and Weatherization

Description	Sample Frame Number of Records	
	Audit	Weatherization
Total Population (number of rebates Q1-Q4)	**555**	**88**
Survey Sample Frame (sent to survey subcontractor)	**507**	**84**
Records Attempted	**507**	**84**
Nonworking number	5	4
Wrong number, business	7	1
Refusal	63	13
PPL Electric or market research employee	6	2
Did not participate in program	1	0
Nonspecific or specific callback scheduled	41	12
No answer/answering machine/phone busy	298	34
Partial complete	14	1
Completed survey	**72**	**17**

Table B-8. Residential Home Comfort Equipment

Description	Sample Frame Number of Records		
	Air Source Heat Pumps	Ductless Mini Splits	Pool Pumps
Total Population (number of rebates Q1-Q4)	**1206**	**532**	**68**
Survey Sample Frame (sent to subcontractor)	**276**	**234**	**62**
Adjusted Survey Sample Frame	**275**	**233**	**62**
Removed because they were businesses	1	0	0
Removed because duplicate	0	1	0
Records Not Attempted	**50**	**58**	**0**
Records Attempted	**225**	**175**	**62**
Nonworking	4	4	1
Wrong number, business	2	4	2
Language barrier	0	1	0
Refusal	56	38	16
PPL Electric or market research employee	4	7	0
Did not participate in program	0	4	0
No answer/answering machine/phone busy	103	68	24
Non-specific or specific callback scheduled	17	13	5
Partial complete	3	8	3
Complete	**36**	**28**	**11**

Table B-9. Master Metered Low-Income Multifamily Housing

Description	Sample Frame Number of Records Landlords
Total Population (number of projects Q1-Q3)	**36**
Survey Sample Frame (unique records[1])	**18**
Adjusted Survey Sample Frame	**10**
Removed; not included in site visits	8
Records Attempted	**11[2]**
Refused	1
No answer/answering machine/phone busy	2
Complete	**8**

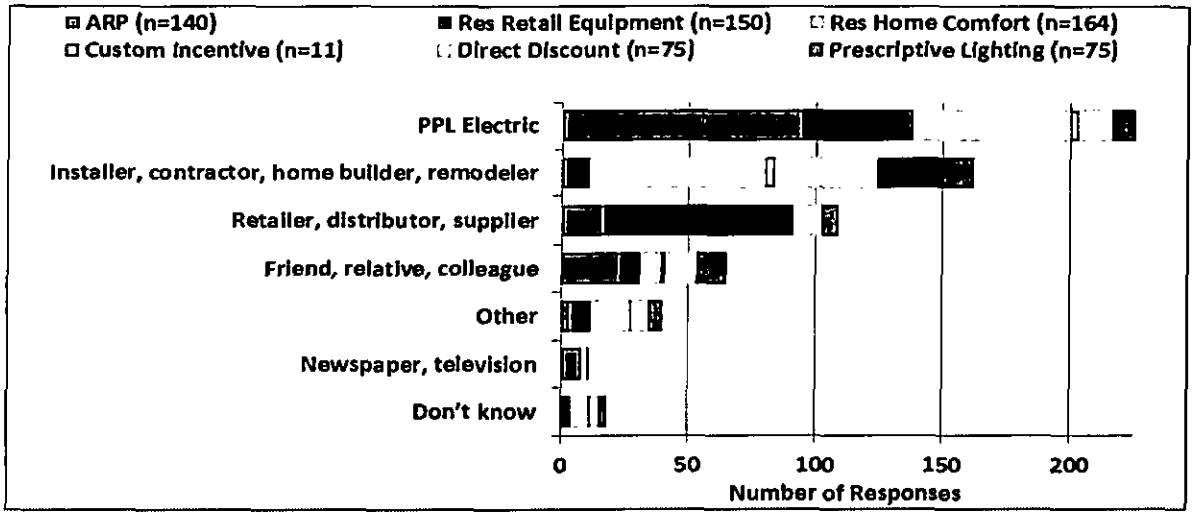
[1] The decision maker was the same for multiple projects so we selected on project to include in the sample frame.

[2] *We included one additional contact in our survey sample. This contact was the* decision-maker for a large project that was not included in other verification activities.

Appendix C. How Participants Heard about the Program

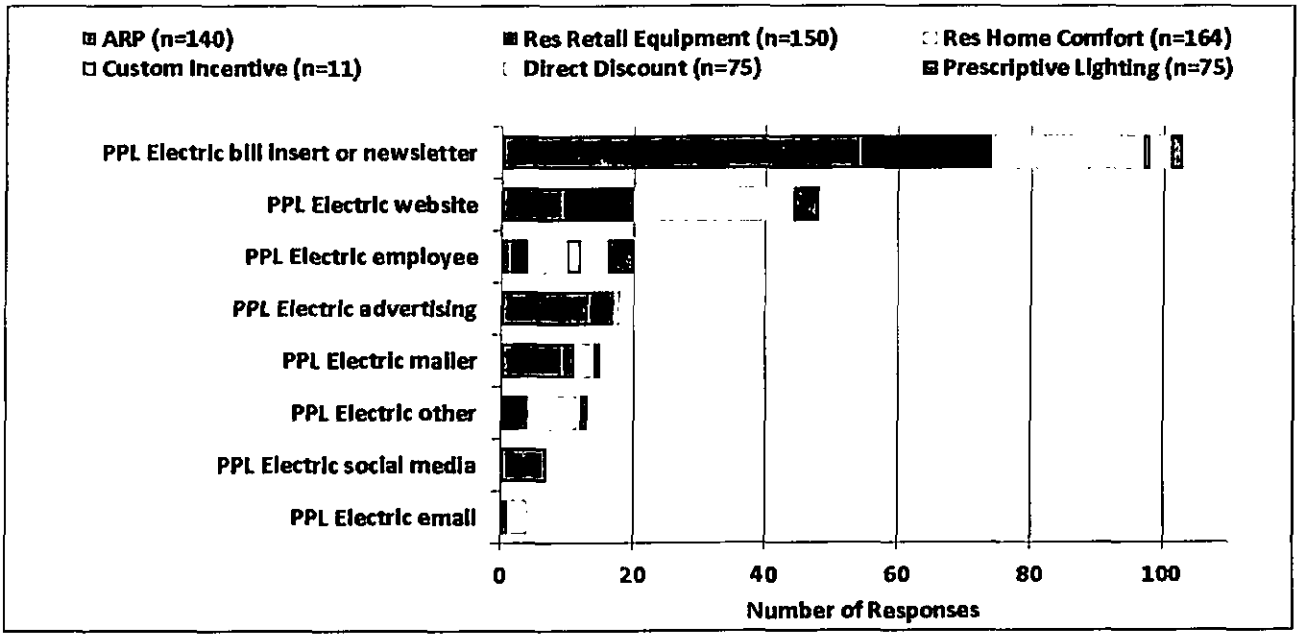
Figure C-1 shows how survey respondents learned about the program. For those who heard from PPL Electric, **Figure C-2** shows the specific method of PPL Electric outreach that survey respondents reported.

Figure C-1. How Participants Heard about the Program in PY5



Source: Survey Question, "How did you learn about the program? Was it from PPL Electric, from a contractor or retailer, from a friend or family member or some other way?"

Figure C-2. PPL Electric Outreach Methods



Source: Survey Question, "How did you learn about the program? Was it from PPL Electric, from a contractor or retailer, from a friend or family member or some other way?"