Process Evaluation Report

PPL Electric

EE&C Plan, Program Year Four

November 15, 2013

Prepared for:
PPL Electric Utilities

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Introduction

Cadmus evaluated PPL Electric's portfolio of energy-efficiency programs, as outlined in its Phase 1 Energy Efficiency and Conservation (EE&C) Plan, in its fourth program year (PY4) under Pennsylvania Act 129. The findings from the impact evaluation, including savings by program, and the cost-effectiveness evaluation are publicly available in the document titled "Final Annual Report to the Pennsylvania Public Utilities Commission," dated November 15, 2013.

This report focuses on the process evaluation of PPL Electric's PY4 portfolio. It identifies opportunities and offers recommendations to improve the effectiveness of PPL Electric's energy-efficiency programs from the standpoints of design and implementation, enrollment processes, marketing and outreach, quality assurance, and other elements. Since PY4 is the final year of the Phase 1 EE&C programs, this process evaluation primarily focuses on identifying opportunities for improvement that can be applied prospectively to Phase 2 EE&C programs which run from June 2013 to May 2016.

Methodology

Process evaluation activities varied by program in PY4. The main activities that Cadmus conducted were:

- Participant and nonparticipant telephone surveys
- Net-to-gross benchmarking research
- Database and records review for quality assurance and quality control (QAQC)
- Stakeholder interviews
- Online trade ally survey

Table 1 illustrates the evaluation activities conducted for each program in PY4. A full description of the survey methodology is contained in Appendix A.

Table 1. Process Evaluation Activities by Program

Program	Process Evaluation Activity					
	Participant Survey	Nonpar-ticipant Survey	NTG Research	QA/QC Review	Stake-holder Interviews	Online Trade Ally Survey
Appliance Recycling	X	-	X	X	-	-
Custom Incentive	X	-	X	X	-	-
Direct Load Control	X	-	-	X	-	-
Efficient Equipment Incentive	X	-	X	X	-	X
Energy Efficiency Behavior & Education	X	X	-	X	-	-
E-Power Wise	-	-	-	X	-	-

Program	Process Evaluation Activity					
	Participant Survey	Nonpar-ticipant Survey	NTG Research	QA/QC Review	Stake-holder Interviews	Online Trade Ally Survey
Home Assessment & Weatherization	X	-	X	X	-	-
HVAC Tune-Up	-	-	-	X	X	-
Load Curtailment	X	-	-	X	-	-
Residential Lighting	X	X	X	X	-	-
Renewable Energy*	-	-	-	-	-	-
WRAP**	-	-	-	-	-	-

*Process evaluation activities were not conducted for the Renewable Energy Program in PY4 because no new projects were eligible.

** Process evaluation activities were not conducted for the WRAP program because the process evaluation is conducted for PPL Electric's USP WRAP.

Organization of this Report

The report includes findings, conclusions, and recommendations across all programs in the portfolio-wide section. This section examines the portfolio's overall achievement against compliance targets and planned savings for each program, and explores participant feedback, marketing and outreach, and participant decision-making across programs and across years.

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

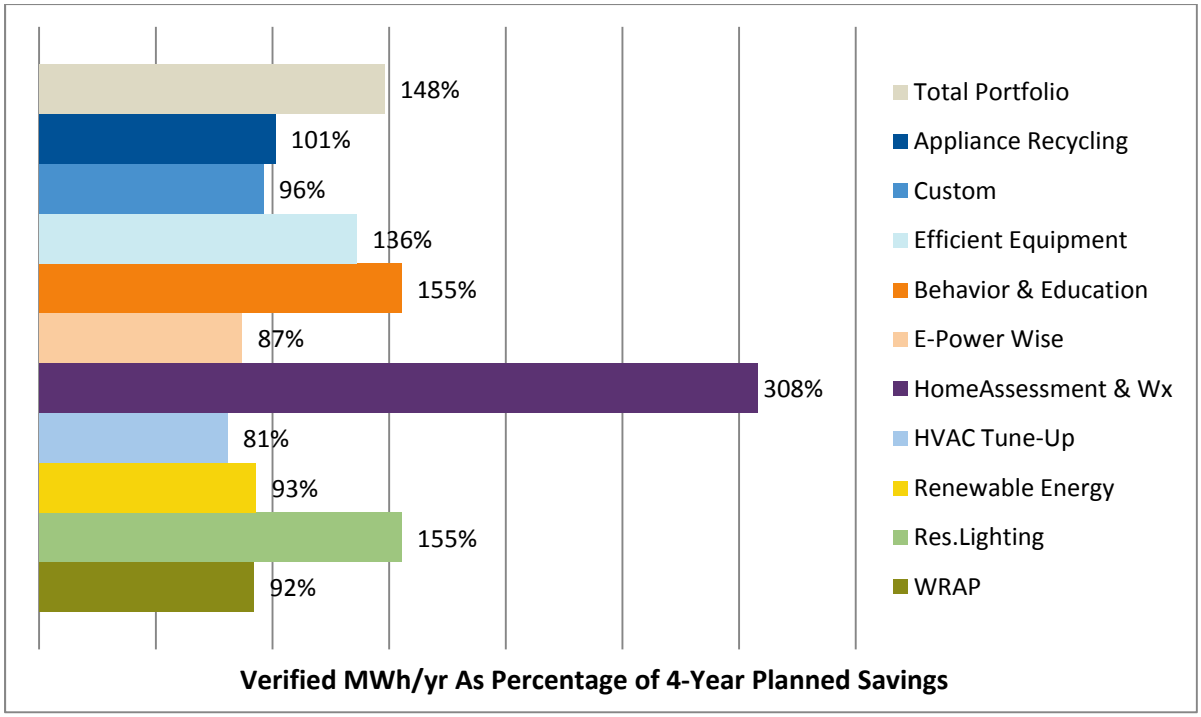
Portfolio-Wide Assessment

PPL Electric's portfolio of EE&C programs exceeded the 2013 compliance targets of 1,146,000 MWh/yr energy savings and 297 MW demand savings. PPL Electric achieved approximately 148% of the four-year energy savings compliance target and 115%[1] of the four-year top 100 hour demand savings target.

On the program level, all programs achieved at least 80% of their cumulative four-year planned energy savings, and several exceeded this goal.[2] PPL Electric is not required to meet regulatory targets by program; it is required to meet targets at the sector and portfolio level. However, examining programmatic achievements against stated goals is important for planning purposes. This comparison also provides context in evaluating the programs' design and delivery processes.

As illustrated in Figure 1, Appliance Recycling, Efficient Equipment, Behavior and Education, E-Power Wise, Home Energy Assessment and Weatherization, and Residential Lighting exceeded planned energy savings.

Figure 1. Achievements against Four-Year Planned Energy Savings by Program (MWh/yr)

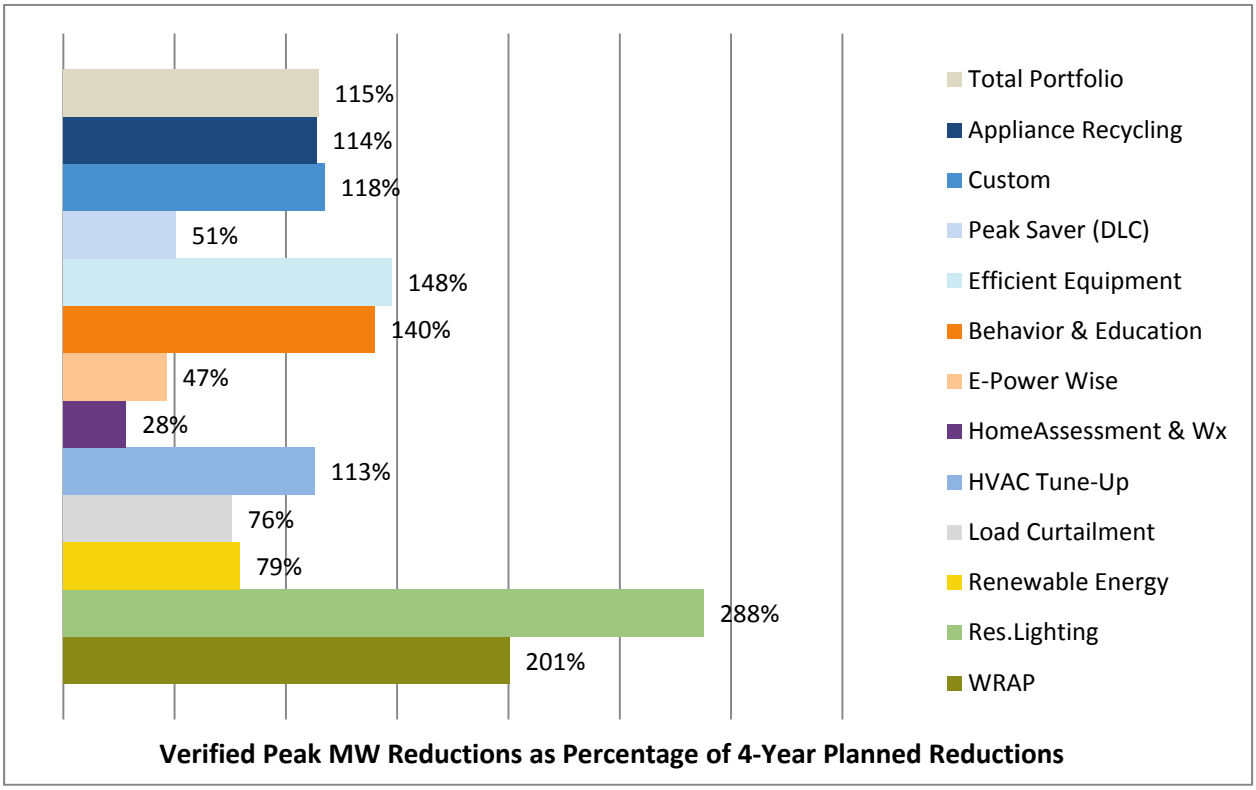


[1] Calculation based on the PUC/SWE's method for evaluating demand reduction from the Load Curtailment program. 120% based on PPL Electric's method.

[2] Planned savings are based on the PPL Electric Energy Efficiency and Conservation Plan, Docket No. M-2009-2093216, Compliance filing to Reflect the PA Public Utility Commission's Opinion and Order Entered May 25, 2012, Table 112.

Demand reduction was less consistent across programs. Many programs exceeded their four-year planned peak reduction (Figure 2). Three programs, Peak Saver, E-Power Wise, and Home Energy Assessment and Weatherization, fell short of their planned reduction by 49% or more, although the planned and verified demand reduction contribution from programs such as E-Power Wise, Home Energy Assessment, WRAP, HVAC Tune-Up is negligible.

Figure 2. Achievements Against Four-Year Planned Peak Demand Reduction by Program (MW)[3]



Portfolio-Wide Findings, Conclusions, and Recommendations

This section provides key results from Cadmus' process evaluation activities at a portfolio level. In this section, the conclusions drawn from the process evaluation are displayed in bold text, followed by the supporting findings. Our recommendations identify opportunities for improving processes and outcomes.

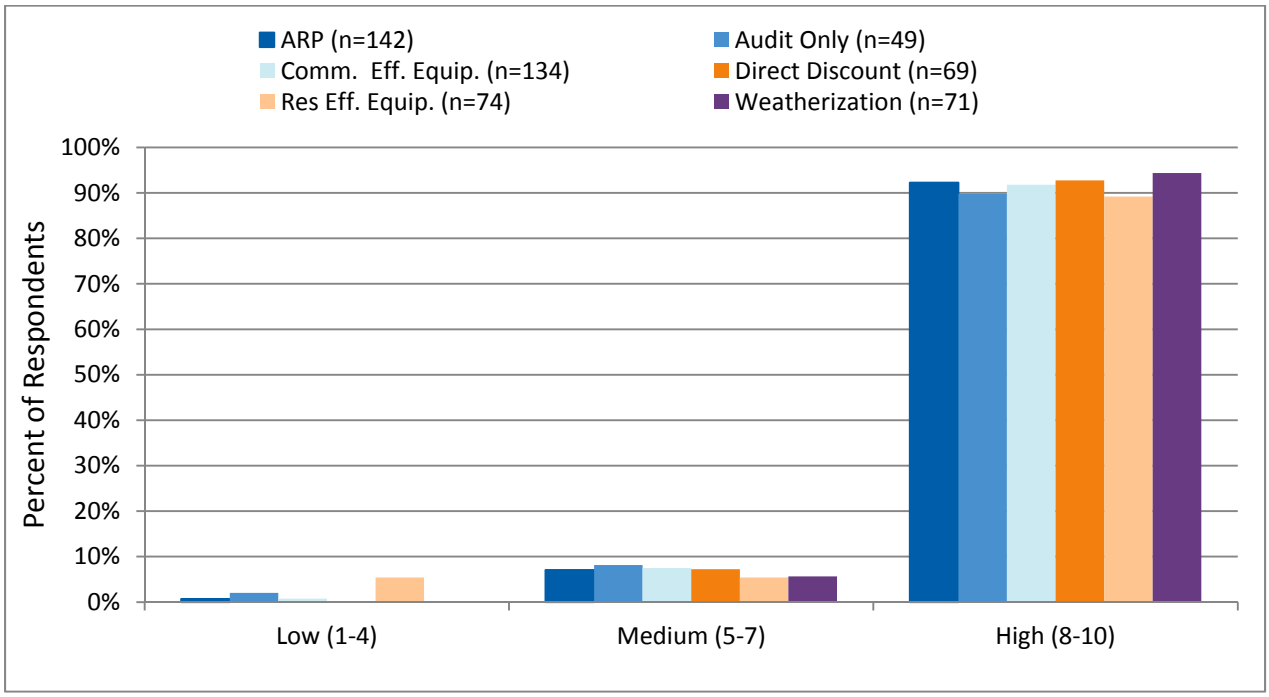
Participant Experience

Participants were highly satisfied with the PY4 programs.

[3] Achievements reflect top 100 hour reductions. Source: PPL Electric Energy Efficiency and Conservation Plan, Docket No. M-2009-2093216, Compliance filing to Reflect the PA Public Utility Commission's Opinion and Order Entered May 25, 2012, Table 5a.

For the majority of programs, more than 90% of survey respondents rated their satisfaction as an 8, 9, or 10 on a scale of 1 to 10 (Figure 3). This is an increase over PY3 satisfaction, where only two programs achieved high satisfaction levels among 90% of participants (these programs were Appliance Recycling and E-Power Wise).

Figure 3. Overall Satisfaction by Program in PY4



Surveys for two programs, the Behavior and Education Program and the Custom Incentive Program, asked about program satisfaction on a different scale. These findings are not included in Figure 3. For both of these programs, Cadmus asked respondents to rate their satisfaction as *very satisfied, somewhat satisfied, not too satisfied,* or *not satisfied at all.* For the Behavior and Education Program, respondents were asked specifically about satisfaction with the Home Energy Reports (HERs).

- **Behavior and Education.** Most participants were satisfied with the contents of the HERs, although moderately so. Half of the respondents (50%) indicated that they were *somewhat satisfied*, while 24% reported being *very satisfied* (n=141). These findings are relatively consistent with PY3 findings. Although not directly comparable, it is likely that Behavior and Education Program satisfaction is slightly lower than satisfaction with other PPL Electric energy-efficiency programs. Unlike other programs, participation in the Behavior and Education Program is not voluntary. This tends to lower satisfaction.
- **Custom.** Participant satisfaction was high. Seventy-three percent (73%) of PY4 respondents were *very satisfied* and 23% were *somewhat satisfied* with their overall experience with the Custom Incentive Program. The program-specific chapter on the Custom Incentive Program explores satisfaction with different components of the program in greater detail.

Reasons for Dissatisfaction

Cadmus asked survey respondents about experiences with several program components. Although the vast majority of respondents reported high satisfaction with their overall program experience, a small number of respondents indicated they were dissatisfied with some aspect of the program. These reasons are explored in greater detail in the program-specific sections of this report. In general, reasons that a small number of participants reported dissatisfaction were:

- **Program processes.** Program processes were slow, confusing, or cumbersome.
- **Rebates.** Rebates were too low, were not worth the investment, or took too long to receive.
- **Paperwork.** There was too much paperwork or paperwork took too long to complete.
- **Equipment.** The purchased or installed equipment was unsatisfactory.
- **Program partners and trade allies.** Poor experiences with implementers (for Appliance Recycling) or contractors (for Direct Discount) caused some dissatisfaction.

Participants have experienced consistently high levels of satisfaction throughout Phase 1.

Participants in several programs, including the Home Energy Assessment and Weatherization Program, Efficient Equipment Program (commercial measures), and the Direct Discount delivery channel of the Efficient Equipment program, increased satisfaction with the programs over time. These trends are highlighted in blue in Table 2.

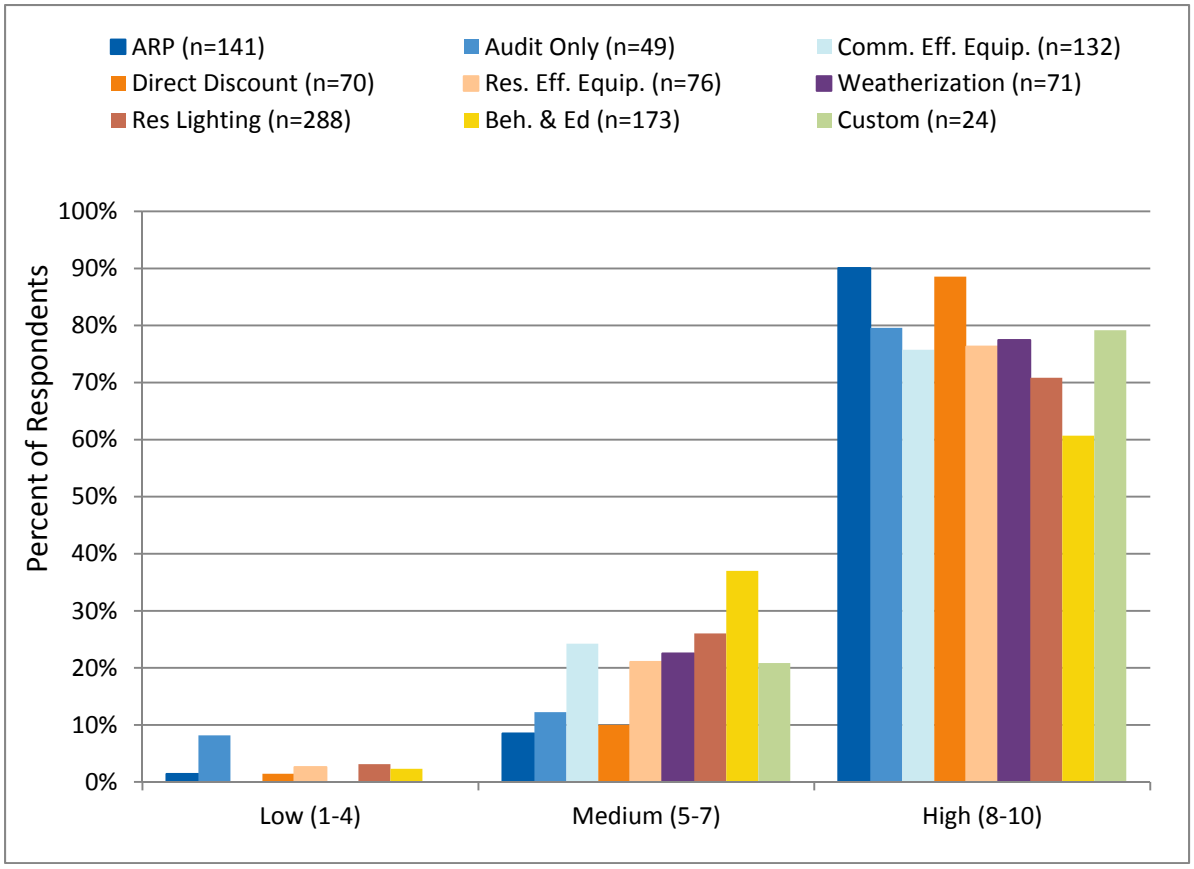
Table 2. Overall Program Satisfaction Across Program Years, by Program or Delivery Channel

Satisfaction Rating	Program Year	Appliance Recycling	Eff. Equipment Commercial participants	Eff. Equipment Direct Discount channel	Home Assessment & Weatheri-zation	Eff. Equipment Residential participants
1-4 (Low)	PY1	1%	7%	-	-	5%
	PY2	0	8%	-	6%	1%
	PY3	0	0	2%	0%	0%
	PY4	1%	1%	0%	1%	5%
5-7 (Medium)	PY1	6%	22%	-	-	11%
	PY2	4%	18%	-	13%	10%
	PY3	3%	19%	10%	20%	11%
	PY4	7%	7%	7%	7%	5%
8-10 (High)	PY1	92%	71%	-	-	84%
	PY2	96%	74%	-	78%	88%
	PY3	97%	81%	88%	78%	87%
	PY4	92%	92%	93%	93%	89%

Most program participants were very satisfied with PPL Electric. Although the majority of respondents reported their opinion of PPL Electric did not change as a result of the program, findings may indicate otherwise for some programs.

Cadmus asked survey respondents about their overall satisfaction with PPL Electric as an electric provider and whether their experiences with Act 129 programs changed their opinion of PPL Electric. As illustrated in Figure 4, the majority of respondents across programs rated their satisfaction with PPL Electric as an 8, 9, or 10 on a scale of 1-10.

Figure 4. Satisfaction with PPL Electric by Program



Respondents in two programs, Residential Lighting and Behavior and Education, reported being less satisfied with PPL Electric overall than respondents in other programs. This may be tied to program experience. However, unlike other participants, respondents in the Residential Lighting survey are not necessarily aware of the PPL Electric program.[4] Therefore, it is unclear if that program influenced customers' satisfaction with PPL Electric. Respondents in the Behavior and Education survey were only moderately satisfied with their Home Energy Reports, and these respondents were more likely to say that their opinion of PPL Electric decreased as a result of the participation in the program when

[4] This program provides an upstream discount for energy-efficient light bulbs.

compared to other participant groups (13% of Behavior and Education respondents said their opinion of PPL Electric decreased).

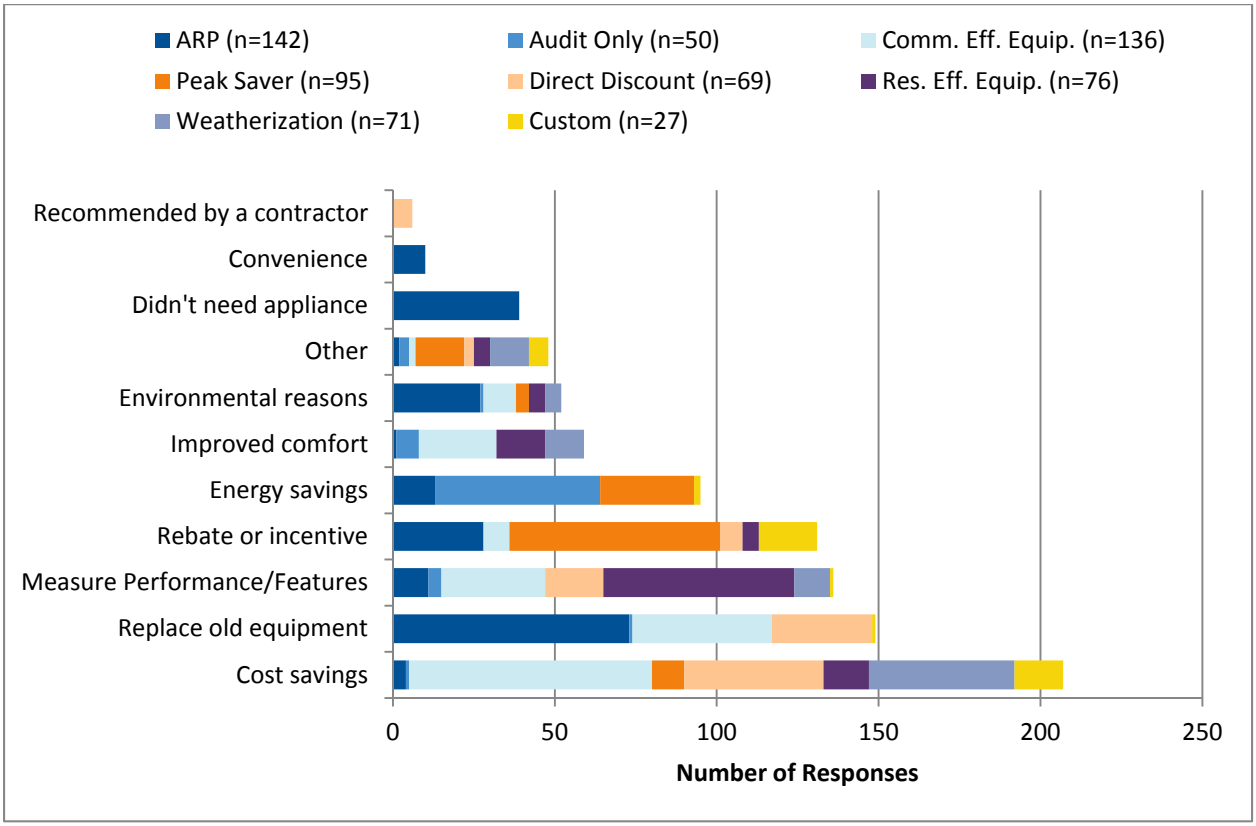
Across all programs, most respondents (61%) reported that their opinion of PPL Electric *had not changed* as a result of the program. Thirty four percent (34%) reported that their opinion either *improved significantly* or *improved somewhat*, and 5% reported that their opinion either *decreased significantly* or *decreased somewhat*.

Participant Decision-Making

Cost savings remained the most common reason for participation across programs, but individual program findings showed that motivations differ by program type.

Respondents' reasons for participating in PPL Electric programs varied. In general, the most frequently cited reason for participating across programs was to save money. Replacing old equipment, purchasing new equipment because of the measure performance or features, and participating because of the rebate were also all common factors reported by survey respondents (Figure 5). These patterns are very consistent with PY3 findings.

Figure 5. Motivations for Participating in the Program



While cost savings was the most common reason for participating across all programs, cost savings was not the leading factor for participation for each individual program. For example, Peak Saver survey respondents were most likely to say that the main reason they participated in the program was to receive the incentive from PPL Electric. Appliance recycling respondents were most likely to say that they participated because they needed to replace old equipment; financial reasons were less important in decision-making. Table 3 contains the most common and second-most common reason for participating for each program, according to survey responses.

Table 3. Most Common Reasons for Participating by Program

Program	#1 Reason for Participating	#2 Reason for Participating
Appliance Recycling (n=142)	Replace old equipment	Did not need appliance
Audit Only (n=50)	Energy savings	Improved comfort
Commercial Efficient Equip. (n=136)	Cost savings	Replace old equipment
Peak Saver (n=95)	Rebate or incentive	Energy savings
Direct Discount (n=69)	Cost savings	Replace old equipment
Residential Efficient Equip. (n=76)	Measure performance/features	Improved comfort
Weatherization (n=71)	Cost savings	Improved comfort
Custom (n=27)	Rebate or incentive	Cost savings

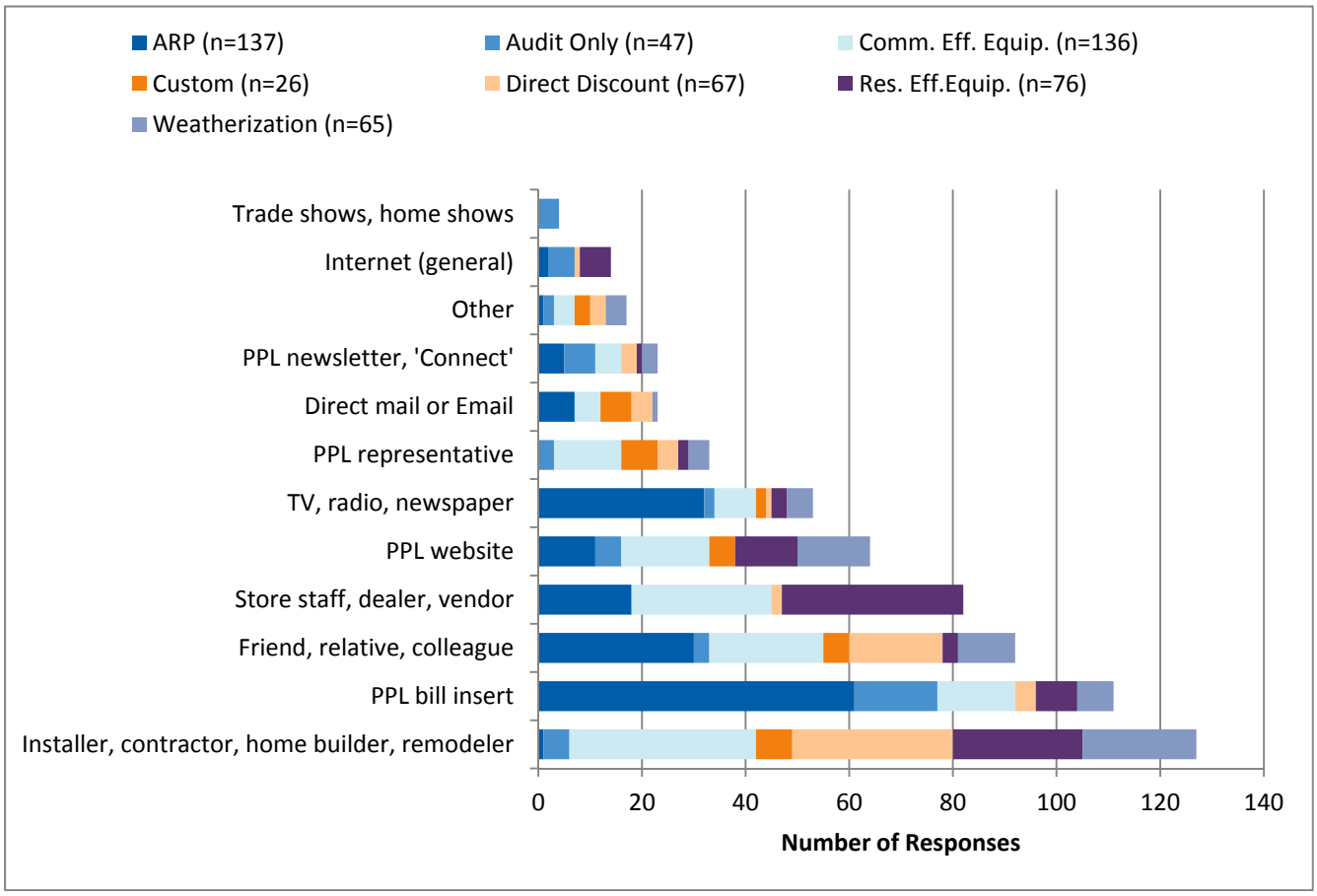
Recommendation: Consider how marketing messages can be tailored to each program. The general notion that people purchase energy-efficient equipment to save money may be true but is not necessarily the primary motivating factor for each program.

Marketing and Outreach

Trade allies were the most common way participants learned about PPL Electric's programs in PY4, but differences existed across segments, delivery channels, and even measure groups.

Trade allies and market actors were the primary method by which participants learned about PPL Electric's incentive programs (Figure 6). Like in PY3, however, differences existed among residential and commercial participant groups. For Efficient Equipment commercial customers and Direct Discount customers, installers and contractors were the most common outreach channel, but this was not the case for all residential programs. In the residential segment, only Weatherization participants were most likely to report hearing about the program from a contractor. Other residential participants heard about the program through other channels, such as bill inserts and retail stores.

Figure 6. How Participants Heard about the Program



Among commercial customers participating in the Efficient Equipment Program, the way participants heard about the program depended highly on measure type as well as delivery channel. These findings illustrate key differences in how different customer groups obtain their information.

Prescriptive Lighting participants were most likely to hear about the program from a contractor or installer, while customers receiving prescriptive rebates for non-lighting equipment were most likely to hear about the program through a store, dealer, or vendor. Meanwhile, almost no small business participants in the Direct Discount channel heard about the program from a store, dealer, or vendor (Table 4).

Table 4. Differences between Commercial Customers' Main Trade Ally Channels

Measure or Channel	Percent of Respondents Hearing from Trade Ally Group	
	Contractor or Installer	Retailer, Dealer, or Vendor
Direct Discount	46%	3%
Prescriptive Lighting Equipment	33%	16%
Prescriptive Non-Lighting Equipment	13%	31%

Measure or Channel	Percent of Respondents Hearing from Trade Ally Group	
	Contractor or Installer	Retailer, Dealer, or Vendor
Custom Incentive Program	27%	19%

PPL Electric collected data from customers on rebate or incentive forms. The Home Energy Assessment and Weatherization program and the Efficient Equipment Incentive program forms asked customers how they learned about the program. Findings from the survey were somewhat consistent with what customers reported on the forms, although there were some differences related to data collection methodology. For example, on the rebate form, customers were given specific answer options (check boxes). During the phone survey, the same question was asked as an open-ended question, without specific response options. In this way, the phone survey captured a variety of responses, while the rebate forms tended to have higher percentages of responses in the "Other" category.

One significant difference between Efficient Equipment participant surveys was that the rebate form did not capture whether the participants learned about the program through a trade ally, which was the highest or second highest response category from phone survey responses. The rebate form responses are compared with the survey responses in Table 5 through 8.

Table 5. Differences between Survey Responses and Rebate Form Responses – Residential Efficient Equipment Customers

Efficient Equipment - Residential		
How Participants Heard about the Program	Rebate Form Responses (n=21,509)	Phone Survey Responses (n=95)
Internet	9%	6%
Newspaper, TV, Radio	5%	3%
PPL Bill Insert	19%	9%
PPL Employee	0%	2%
Store	49%	37%
Other	17%	0%
Installer, contractor, home builder, remodeler	n/a	26%
Friend, relative, colleague	n/a	3%
PPL Website	n/a	13%

Table 6. Differences between Survey Responses and Rebate Form Responses – Commercial Efficient Equipment Customers

Efficient Equipment - Commercial		
How Participants Heard about the Program	Rebate Form Responses (n=513)	Phone Survey Responses (n=152)
Internet	2%	0%

Newspaper, TV, Radio	8%	5%
PPL Bill Insert	31%	13%
PPL Employee	4%	9%
Store	19%	18%
Other	36%	3%
Installer, contractor, home builder, remodeler	n/a	24%
Friend, relative, colleague	n/a	14%
PPL Website	n/a	11%
Direct Email from PPL	n/a	3%

Table 7. Differences between Survey Responses and Rebate Form Responses – Small Business Efficient Equipment Customers

Efficient Equipment - Small Business		
How Participants Heard about the Program	**Rebate Form Responses (n=610)**	**Phone Survey Responses (n=71)***
Internet	8%	1%
Newspaper, TV, Radio	3%	1%
PPL Bill Insert	12%	15%
PPL Employee	0%	6%
Store	22%	3%
Other	55%	4%
Installer, contractor, home builder, remodeler	n/a	44%
Friend, relative, colleague	n/a	25%

**Data from the phone survey with Direct Discount delivery channel participants*

Table 8. Differences between Survey Responses and Rebate Form Responses – Home Energy Assessment and Weatherization Customers

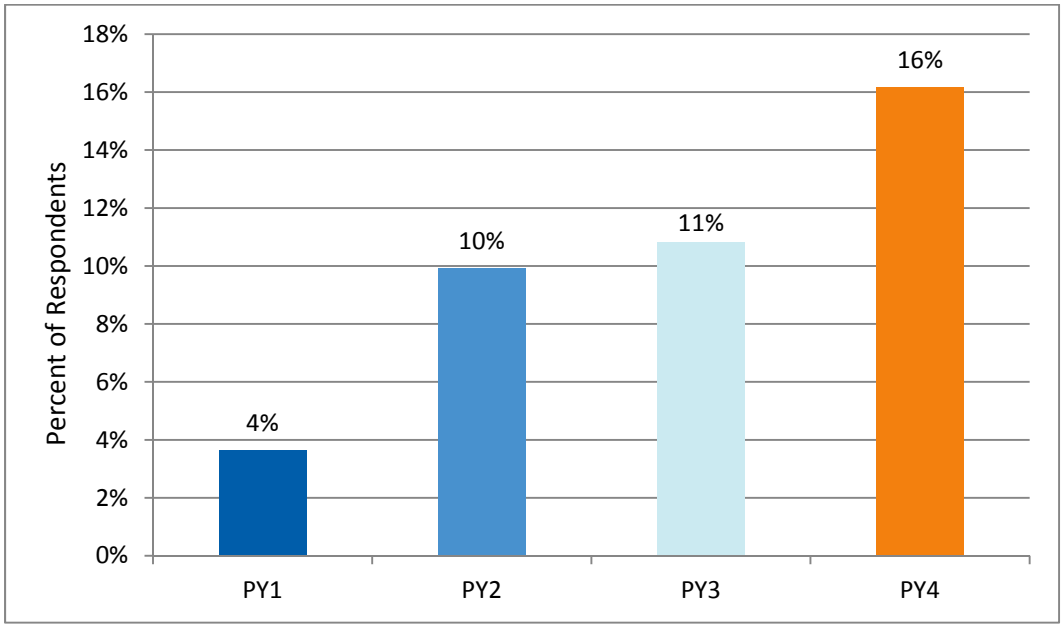
Home Energy Assessment and Weatherization		
How Participants Heard about the Program	**Rebate Form Responses (n=3,714)**	**Phone Survey Responses (n=122)**
Auditor or Contractor	10%	22%
Conference/Home Show/Trade Show	4%	3%
Word of Mouth	1%	11%
Internet	22%	4%
Retail Store	2%	0%
Newspaper, TV, or Radio	6%	6%
PPL Bill insert or Mailing	36%	27%
PPL Employee	2%	6%

PPL Website	2%	16%
Other	17%	5%

The number of commercial customers hearing about the program through word of mouth has grown over time.

The Custom, Efficient Equipment Program, and the Direct Discount delivery channel of the Efficient Equipment program all experienced increased awareness of PPL Electric's programs through a friend, family member, or colleague between PY3 and PY4. For the Efficient Equipment Program (commercial customers only), this trend can be seen across all four years (Figure 7).

Figure 7. Percent of Efficient Equipment Commercial Respondents Hearing through Word of Mouth



Increased awareness through word of mouth was also true for residential Weatherization participants, but not true for any of PPL Electric's other residential programs.

Other changes across program years included:

- Participants in the Custom Incentive Program heard about the program through the PPL Electric website 9% more often this year (PY4) than in PY3.
- The percentage of residential customers participating in the Efficient Equipment Program and the percentage of ARP participants who heard about the program from retailers or dealers declined in PY4. This is in contrast to the previous three year trend over PY1-PY3 in which awareness of the program through this channel had increased steadily for both programs.
- The percentage of weatherization participants hearing about the program through home contractors increased significantly (by 12%) between PY3 and PY4. At the same time,

weatherization participants heard about the program from a bill insert or other PPL Electric publication less often in PY4.

PPL Electric advertising campaigns gained industry recognition for creativity, yet were more effective for some programs than others.

In PY4, PPL Electric revamped its website and launched several advertising and integrated media campaigns for energy-efficiency programs. In March 2013, PPL Electric was recognized during the American Advertising Federation's 13th Annual ADDY Awards. AAF awarded PPL Electric with six gold and silver awards for the following initiatives:

- "Cool Customer" – Gold Award in the category of Television, Regional/National Campaign
- "Handwriting" – Gold Award in the category of Integrated Campaign, Regional/National, B-to-B
- PPL Electric Utilities Website – Silver Award in the category of Digital Advertising, Websites, Consumer Services
- "The Birds" – Silver Award in the category of Television, Regional/National, Single, Services
- "Start Saving" – Silver Award in the category of Television, Regional/National, Campaign, Services
- "Wise Teen" and "Control" – Silver Award in the category of Radio, Regional/National, Campaign.

The number of participants who reported hearing about the program through PPL Electric's advertising by program is reported in Table 9. On average, approximately 10% of survey respondents mentioned hearing about the program through some type of media effort, not including the PPL Electric website. The Appliance Recycling Program benefited the most from these initiatives, with 23% of participants reporting hearing about the program through an advertisement.

Table 9. Respondents Learning about PPL Electric Programs through Media Channels in PY4

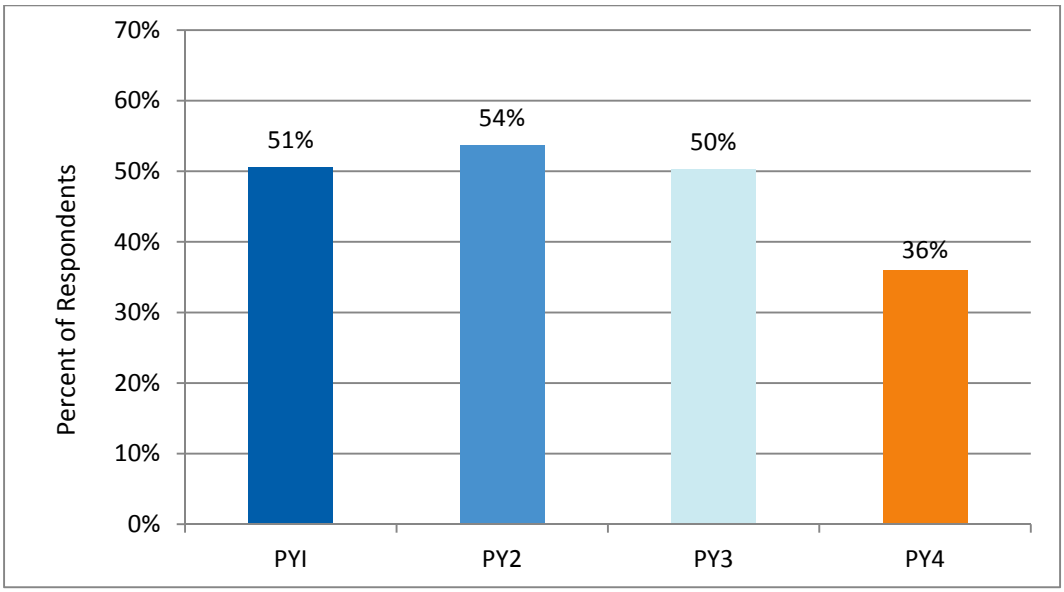
Program	Number of Responses					Sample Size	Percent of Respondents Reporting Media
	News-paper	TV	Radio	Other Respon-ses*	Total Respon-ses		
Appliance Recycling	15	10	4	3	**32**	137	23%
Residential Efficient Equip.	1		1	1	**3**	76	4%
Direct Discount	-	-	-	1	**1**	71	1%
Commercial Efficient Equip.	5	3	-	-	**8**	136	6%
Home Assessment and Weatherization	6	1	-	-	**7**	112	6%
Totals	**27**	**14**	**5**	**5**	**51**	**532**	**10%**

* Responses included "media," "advertising," or a combination of more than one media outlet

In PY4, the percentage of respondents reporting that they were aware of other PPL Electric programs decreased.

On average, just 36% of respondents across all programs reported that they were aware of other PPL Electric energy-efficiency rebates or incentives. This was a decrease from previous years, when between 50% and 54% of respondents reported being aware of other PPL Electric programs (Figure 8).

Figure 8. Awareness of Other PPL Electric Energy Efficiency Programs over Time



Note: PY1 and PY2 data includes survey results from ARP and Efficient Equipment (commercial and residential); PY3 and PY4 data includes these responses plus Home Energy Assessment and Weatherization, Direct Discount, and Behavior and Education.

While the percentage of respondents varied by program, the decrease between PY3 and PY4 was consistent across all programs except for the audit-only survey respondents of the Home Energy Assessment and Weatherization program. For this group, respondents who were aware of other programs stayed consistent (47% in PY3 and 48% in PY4).

Recommendation: In Phase 2, explore additional opportunities to improve cross-promotion of programs. This may be particularly helpful for generating awareness about new Phase 2 incentive opportunities.

PY4 Process Recommendations Status

Table 10 contains the status of each PY4 process recommendation made to PPL Electric on a portfolio-wide basis. A similar table is provided in each program-specific chapter of this report.

Table 10. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Consider how marketing messages can be tailored for individual each program.	**Implemented.** PPL generally provides 2 types of marketing--over-arching and program/sector specific. Over-arching marketing includes broad information about PPL's EE&C Programs and directs customers/trade allies to the Epower website for more information. Sometimes that over-arching marketing is targeted to a specific customer sector and/or type of measure (lighting, appliances, etc.). Program/specific marketing is tailored to a specific program (such appliance recycling), and/or a specific measure (such as lighting), and/or a specific customer segment (such as GNI or small commercial customers), and/or a sub-segment of a customer (such as a particular business type like a restaurant, customers who have/have not previously participated in a program. When PPL implements customer-specific marketing, it uses its customer segmentation data to improve the effectiveness of that marketing. For example, marketing the direct load control program to "green achievers" instead of to all 1.2 million residential customers.
Explore opportunities to improve cross-promotion of programs.	**Implemented.** Expansion being considered for Phase 2. PPL had several Phase 1 programs that cross-promoted other programs (for example: appliance recycling, low-income programs, home energy reports) and plans to implement this in Phase 2 where the cross-promotion makes sense and helps to achieve marketing (and savings) objectives at a lower program cost. "Too much" marketing or marketing that is "too effective" is not necessarily ideal. Marketing must be closely matched to the desired savings objectives (i.e. actual progress compared to goal). The budget for most programs (and the portfolio) was fully subscribed by the end of Phase 1 and PPL's Phase 1 savings were 50% greater than the compliance target. Therefore, additional marketing and outreach may not provide a benefit and may cause programs to go dark before the end of Phase 2 (i.e. exhaust their full funding too early).

Efficient Equipment Incentive Program

The Efficient Equipment Incentive Program is the largest in PPL Electric's energy-efficiency portfolio. It offers a diverse range of prescriptive efficiency measure incentives for all sectors. For this program, PY4 process evaluation activities were these:

- Participant surveys for:
  - Residential efficient equipment customers (n=76),
  - Commercial efficient equipment (lighting and non-lighting) customers (n=137),
  - The Direct Discount delivery channel (n=76),
- Online commercial trade ally survey,[5]
- Net-to-gross literature review and benchmarking, and
- Database Review and QA/QC.

Achievements against Plan

In PY4, the program achieved 212% of its planned MWh/yr savings, 179% of its planned gross kW savings, and 103% of its annual participation target.

Overall, the Efficient Equipment Program exceeded its four-year planned MWh/yr savings goal by 195,085 MWh/yr, exceeded its gross kW reduction goal by 45,065 kW, and its top 100 hour goal by 34,832 kW. At the end of Phase 1 (May 31, 2013), the program had achieved:

- 136% of its 539,933 MWh/yr four-year planned savings,
- 143% of its 105,186 kW four-year planned gross demand reduction, and
- 148% of its 73,000 kW four-year planned top 100 hour demand reduction.

Table 11. Efficient Equipment Program Achievements

Savings Category	PY4 Planned Savings	PY4 Verified Savings	Total Phase 1 Planned Savings	Total Phase 1 Verified Savings
MWh/yr[6]	143,800	305,173	539,933	735,018
kW[7]	31,992	57,360	105,185	150,250
Top 100 Hour kW[8]	n/a	n/a	73,000	107,830

[5] Findings, conclusions, and recommendations from this survey are presented in the separate report section, "Trade Ally Survey."

[6] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

[7] Ibid.

[8] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

The program did not have any significant structural changes in PY4. Some measures were discontinued during the first two quarters as PPL Electric began wrapping up Phase 1.

Introduction and Methodology

Because of the breadth of the Efficient Equipment Incentive program and the large number of process evaluation activities conducted in PY4, this chapter is organized by sector. Specifically, the chapter is organized as follows:

- Introduction and Methodology
  - Survey Methodology
  - Net-to-Gross Research Methodology
- Residential Sector
  - Residential Customer Survey Findings
  - Residential Retail Program Net-To-Gross Research
- Commercial and Industrial (C&I) Sector
  - C&I Customer Survey Findings (Lighting and Non-Lighting)
  - C&I Efficient Equipment Net-to-Gross Research
- QA/QC
- Conclusions and Recommendations
  - Residential Segment Conclusions and Recommendations
  - C&I Segment Conclusions and Recommendations

Survey Methodology

In PY4, Cadmus surveyed 289 participants in the Efficient Equipment Program. Results achieved 90% confidence and 10% precision at the program level. Table 12 shows the population, targets for completed surveys, and the achieved number of completed surveys.

Table 12. Targeted and Completed Surveys

Survey Group	Q1-Q3 Population	Target	Achieved
Residential Program Participants	13,355	70	76
White goods, office equipment, central air conditioners (small stratum)		10	5
ENERGY STAR refrigerators (medium stratum)		10	10
HVAC measures, heat-pump hot water heaters, RTS, commercial reach in refrigeration (large stratum)		50	61
Commercial & Industrial Program Participants	2,291	142	137
HVAC, appliances, office equipment (small stratum)		50*	40
VSDs, ASDs, refrigeration (medium stratum)		2*	2
Lighting (large stratum)		90*	95

Direct Discount Participants**	1,771	70	77
Total Completed Surveys			**289**

*Survey targets for Commercial & Industrial small, medium and large strata were modified from the original sample plan after analyzing the number of unique account holders in each stratum and removing accounts that had been contacted in the past year for EM&V efforts. These adjustments reduced the sample size of the medium stratum significantly. Sample points were reallocated to the small and large strata to achieve 90/10 for the non-lighting measure group and at the program level.
**Cadmus conducted 71 telephone surveys and six on-site surveys during EM&V site-visits.

Net-To-Gross Research Methodology

Cadmus researched other energy efficiency programs administered by utilities around the country to gather data on net-to-gross ratios and learn about the main factors impacting freeridership. For this research, we analyzed PPL Electric's net-to-gross ratios across years, sectors, and measure types, and made comparisons where possible to similarly structured programs. We provide conclusions and recommendations based on PPL Electric's own experience from the previous four years and experiences of other utilities.

Residential Sector

Residential Customer Survey Findings

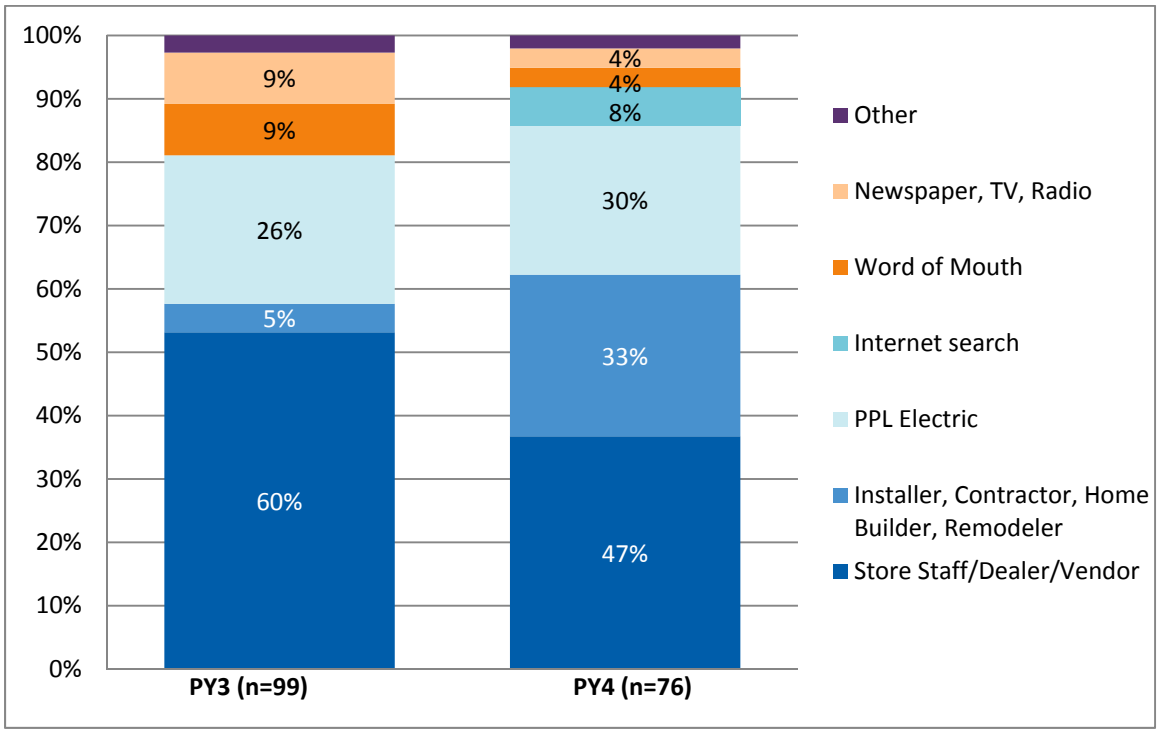
PPL Electric Marketing and Outreach

Trade ally organizations accounted for 80% of the ways residential participants heard about the program, which was more than in PY3 (65%). Within this group of trade ally organizations, the majority of PY4 respondents heard about the program through stores, dealers, or vendors (47%). This is consistent with the way the majority of participants heard about the program in PY3, although this year responses accounted for a smaller margin of the total (in PY3, 60% of respondents heard about the program through stores, dealers, or vendors) .

Installers, contractors, home builders, and remodelers accounted for 33% of the ways that residential participants learned about the program in PY4, up from just 5% in PY3. Figure 9 compares the ways residential participants learned about the Efficient Equipment Program in PY3 and PY4.

Other ways that respondents learned about the program were through PPL Electric (30%), internet search (8%), and word of mouth (4%). The proportion who mentioned hearing about the program through a newspaper, television, or radio advertisement declined from 9% in PY3 to 4% in PY4.

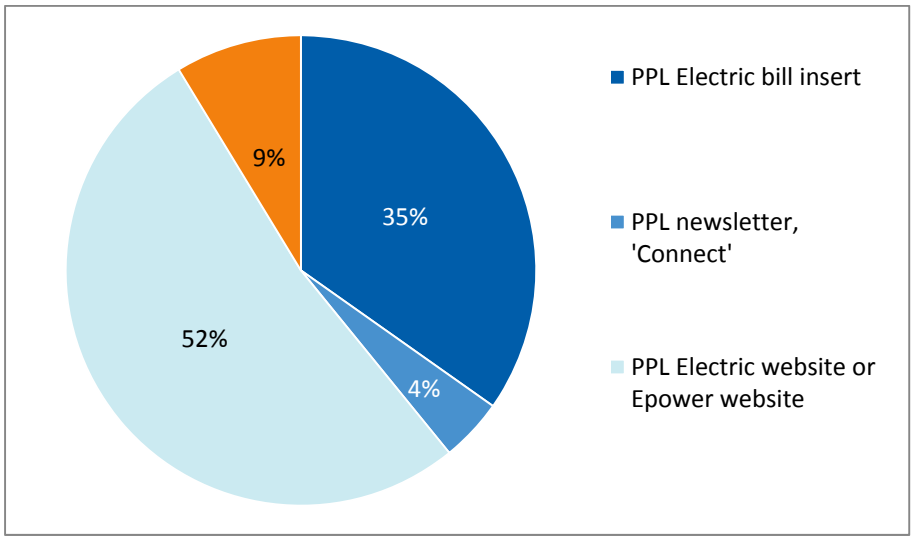
Figure 9. How Participants Learned about the Program



Source: M1. How did you learn about the rebate program? (n=76) Note: This question allowed for multiple responses; percentages may add up to over 100%.

Figure 10 looks more closely at the responses mentioning the PPL Electric marketing and outreach methods. Twenty three respondents (30%) said they had heard about the program through a bill insert, the PPL Electric *Connect* newsletter, the PPL Electric website, or a PPL Electric representative. Of these responses, most reported hearing about the program through the PPL Electric website (52%), followed by a bill insert (35%).

Figure 10. PPL Electric Marketing Materials Mentioned by Respondents

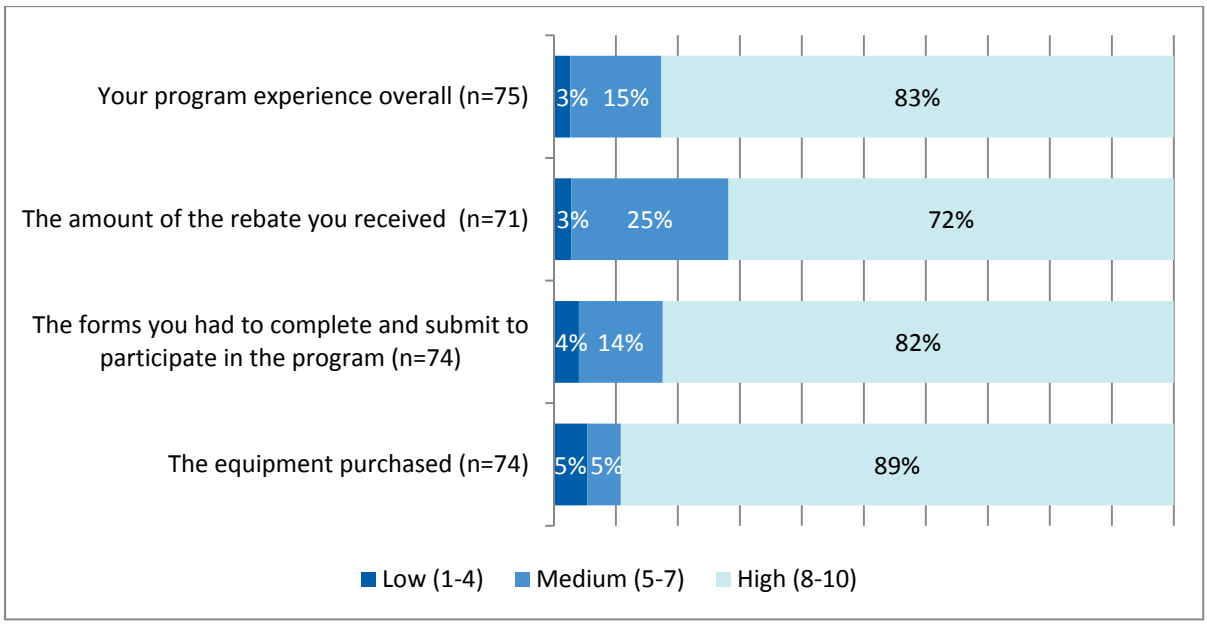


Source: M1. How did you learn about the rebate program? (n=76). Note: Graph summarizes the percentages of responses from 23 respondents who mentioned one of PPL Electric's outreach methods.

Satisfaction

Respondents were highly satisfied with the program (ranking satisfaction as an 8, 9, or 10 on a scale of 1 to 10, with 10 highly satisfied) across most program components in PY4. Participants were slightly less satisfied with the rebate amount than with other program components. Of the 83% who reported high satisfaction with their overall experience, 63% ranked their experience as a 10.

Figure 11. Residential Participants' Satisfaction with the Efficient Equipment Program



Source: PS1. Thinking about your experience with the PPL Electric rebate program, using a scale from 1 to 10, with 1 being extremely dissatisfied and 10 being extremely satisfied, how would you rate your satisfaction with… (n=76)

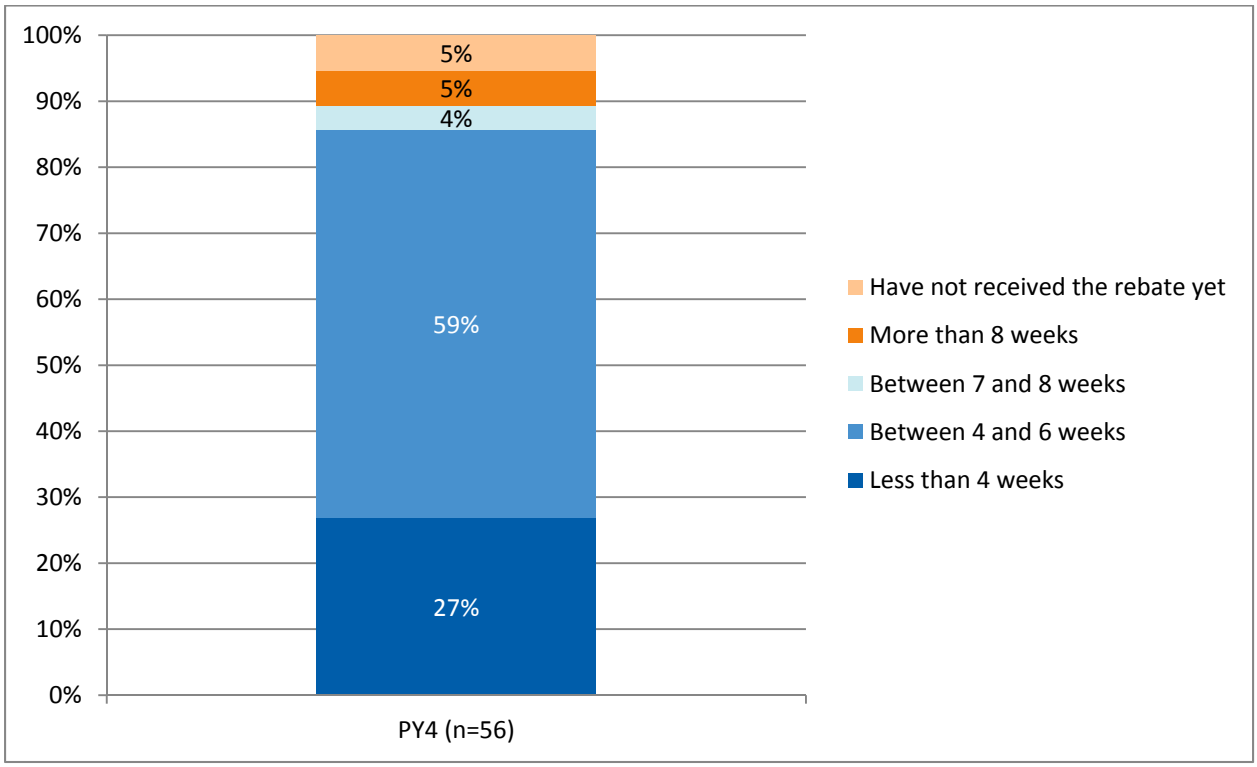
Although the large majority of respondents (83%) rated their satisfaction with the program overall as 8 or higher, this was a slight decline from 87% in PY3. Seven respondents (approximately 9%) indicated they were dissatisfied with some aspect of the program, though two of the seven could not provide a reason for their dissatisfaction. The other five respondents provided the following feedback:

- Two indicated they had not yet received their rebate check.
- One respondent noted that another utility in a neighboring county offered rebates for equipment not offered by PPL, but did not specify which equipment type.
- One of the respondents did not think the rebate amount was enough.
- Another respondent, who purchased a central AC unit, was dissatisfied with the equipment.

After participating in this program, 27% of respondents' opinions of PPL Electric improved at least somewhat, while only 1% of respondents' opinions decreased.

Most participants reported receiving their rebate check in a timely fashion (86% reported receiving the check in less than six weeks), while 9% reported it took seven weeks or longer. Figure 12 summarizes the reported time required to receive a rebate check.

Figure 12. Rebate Check Arrival



Source: QA5. After you submitted the rebate application for the [code_meas1], how long did it take to receive the rebate check from PPL Electric? (n=76)

Awareness of Other Programs

Only 28% of survey respondents (21 of 75) were familiar with other PPL Electric incentives or rebates. When asked, almost half (48%) of these respondents were familiar with other eligible measures rebated through the Efficient Equipment Program.

Participant Motivations and Decision-Making

Respondents reported they were primarily motivated to purchase new energy-efficient equipment to replace old, outdated equipment (46%). Other motivations to purchase rebated equipment included:

- Product performance (29%),
- Improved home comfort (12%),
- Reducing energy costs (12%).

These findings shifted slightly from participant motivations in last year's program. In PY3, the main motivating factor was product performance (41%), followed by replacing old equipment (33%).

Demographics

The survey collected customer demographic data. We found that respondents tended to be older, educated customers who earn more than $50,000 per year. Specifically, the survey found that:

- Sixty-nine percent of respondents reported a household income at or above $50,000.
- The average age of the survey respondents was 52 years.
- Seventy-two percent of respondents completed at least some college (52% had a four-year college degree or higher, 20% had completed some college), compared to only 26% who completed high school or equivalent.

Table 13 compares household income and age with ways participants learned about the program. While income brackets do not show large differences in how participants heard about the program, there are several notable differences between age groups. Specifically:

- Older participants (age 40 and above) used both retailers and home contractors for getting information about the program more than younger participants did. Only 10% of younger respondents reported hearing about the program from each trade ally group.
- Participants under 40 were more likely to learn about the program online compared to their older counterparts by a large margin; 40% of younger respondents reported hearing about the program through the internet (including but not limited to PPL Electric's website) compared to just 8% of older respondents.

Table 13. Demographics of Participants who Heard about the Program

Item	Below $50,000 (n=16)	Above $50,0000 (n=37)	40 or Younger (n=10)	40 or Older (n=52)
PPL Electric newsletter, *Connect*	6%	0%	0%	2%

PPL Electric bill insert	13%	5%	20%	4%
Store staff/dealer/vendor	44%	54%	10%	54%
Friend, relative, colleague	6%	0%	10%	0%
Installer, contractor, home builder, remodeler	19%	24%	10%	33%
Online (general internet search and PPL website)	13%	16%	40%	8%

Sources: D3. Which of the following categories best represents your annual household income before taxes in 2012? and M1. How did you learn about the rebate program?

Further Research

Overall, participants were generally satisfied with their program experience (83% reported an 8, 9, or 10), but less so with the rebate amounts (only 72% of respondents reported they were highly satisfied with the rebate amount).

Cadmus investigated the responses of respondents who ranked their satisfaction with the rebate lower than an 8. The majority purchased a heat pump hot water heater, air source heat pump (ASHP), or ductless heat pump. To determine rebate levels for the same type of equipment elsewhere, Cadmus reviewed rebate levels for similar residential energy-efficient equipment offered by PennPower and PECO through their Act129 residential prescriptive rebate programs.

Our comparison shows that PennPower and PECO rebated heat pump hot water heaters and ASHPs at notably higher levels than PPL Electric (although they did not rebate ductless heat pumps). See Table 14 for a comparison of measures and rebate levels.

Table 14. PY4 Efficient Equipment Rebate Levels Comparison

Measure	PennPower/First Energy		PECO		PPL Electric	
	Rebate Amount	Qualification	Rebate Amount	Qualification	Rebate Amount	Qualification
Heat Pump Hot Water Heater	$300	2.0 EF or higher	$300	2.0 EF or higher	$200	Energy Star
Air Source HP SEER >=15	$325	SEER >= 15	$325	SEER >=15	$100	SEER >=15
Air Source HP SEER >=16	$400	SEER >= 16	$400	SEER >= 16	$200	SEER >= 16
Central AC	$300	SEER >= 16	$300	SEER >=16	$100	SEER 16
Room AC	$25	Energy Star	$25	Energy Star	$25	Energy Star
Refrigerator	$50	Energy Star	$25	Energy Star	$25	Energy Star

Residential Retail Program Net-to-Gross Research

The Phase 2 Residential Retail Program offers rebates and downstream incentives for high-efficiency or ENERGY STAR-rated equipment including refrigerators and heat pump water heaters. The program also

offers midstream subsidies to retailers for energy-efficient televisions and free Smart Strips to end-use customers. As part of the PY4 process evaluation, Cadmus conducted research to benchmark PPL Electric's net savings impacts against those of similar programs and to offer recommendations to help reduce freeridership. We primarily structured the research around the Phase 2 Residential Retail program design to assist PPL Electric plan for Phase 2 implementation.

Net Savings in PPL Electric's Program Over Time

Over the four program years in Phase 1, the residential component of PPL Electric's Efficient Equipment Program showed a slight increasing trend in net-to-gross ratios (NTGR) (see Table 15). Cadmus determined these ratios by analyzing self-report surveys from a sample of program participants.

Table 15. Phase 1 Efficient Equipment (Residential) NTG Ratios

Program Name	PY1	PY2	PY3	PY4
Efficient Equipment Incentive – Residential	51%	54%	65%	66%

*Includes freeridership only

Benchmarking Against other Programs

Table 16 shows freeridership and NTG ratios for PPL Electric's residential retail program and programs offered by other utilities. PPL Electric's NTG ratio for PY4 is somewhat lower than the other downstream and midstream programs, although this appears to be mainly the result of higher spillover estimates for other programs. Freeridership appears to be similar to PacifiCorp and Rocky Mountain Power's programs.

Table 16. Residential Retail Benchmarking Findings

Utility	Program Name	Rebate Structure	Verified Gross MWh/yr	Program Start Year	Evaluation Year	Freeridership Score	Spillover	NTGR
PPL Electric	Prescriptive Efficient Equipment (Residential)	Downstream	9,025	2009	2012-2013	34%	0.56%	66%
PacifiCorp/Rocky Mountain Power[9]	Home Energy Savings CA	Downstream and Midstream	365	2008	2009-2010	43%	25%	82%
PacifiCorp/Rocky Mountain Power	Home Energy Savings ID	Downstream and Midstream	2,944	2006	2009-2010	20%	7%	87%
PacifiCorp/Rocky Mountain Power	WY Residential Home Energy Savings	Downstream and Midstream	1,411	2009	2009-2010	34.0%	9%	76%
PacifiCorp/Rocky Mountain Power	UT Residential Home Energy Savings	Downstream and Midstream	43,875	2006	2009-2010	35%	23%	88%
PacifiCorp/Rocky Mountain Power	Home Energy Savings WA	Downstream and Midstream	4,204	2006	2009-2010	44% (Appendix L 12)	4%	61%
CA Utilities (PG&E, SCE, SDG&E)	Statewide Business Consumer Electric Program[10]	Midstream	118,820 ex-post gross savings (p. 7-57)	2010	2010-2011	5.8%[11]	N/A	20.3%-43.7%
NV Energy[12]	Consumer Electronics and Plug Loads	Midstream	9,046 ex post annual savings (CEPLP p. 282)	Not available	2011	0.0% (p. 44)	22%	78% (Delphi approach)

9 http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/CA_Home_Energy_Savings_Program_Evaluation_2009-2010.pdf, pp. 9-10

10 http://www.energydataweb.com/cpucFiles/pdaDocs/941/WO34%20BCE%20Report%20-%20Phase%201_FINAL_2013-04-15.pdf

11 Comparing NPD sales data for California only against the rest of the US produces a NTG of 5.80 percent. In this case, the BCE program accounted for 5.8 percent more energy savings in California than would have happened without the BCE program in place.

12 https://www.nvenergy.com/company/rates/filings/IRP/NPC_IRP/images/vol_7.pdf

Factors Affecting Freeridership

Incentive Level

While PPL Electric data are not readily available to demonstrate a direct relationship between the proportions of incentive level to total measure cost and increased NTG ratios, analysis of other programs have suggested the incentive level is a significant factor. Specifically, PacifiCorp's California program found a "strong inverse relationship" between incentive level and freeridership.[13]

Measure Type

Cadmus designed the Efficient Equipment residential survey sample to meet levels of confidence and precision for the program as a whole. We did not design the sample to provide reliable data by measure or to calculate freeridership scores by measure. We present Table 17 for information only, to provide a sense for freeridership for specific measures. To determine reliable estimates of freeridership at the measure level, the sample size will need to be increased and target specific measures.

Table 17. PPL PY4 Freeridership by Measure

Measure	Number of Respondents*	Percentage of Total Respondents	Average Free Ridership Score
Computer	2	3%	75%
Room AC (1st unit)	20	26%	51%
All-In-One EnergySTAR	2	3%	50%
Ductless mini-split heat pumps primary rooms- Kitchen Dining Room	1	1%	50%
ASHP - SEER 16	8	10%	39%
CAC - SEER 16	11	14%	34%
Ductless mini-split heat pumps primary rooms- Living Family Room	3	4%	33%
Energy Star Refrigerator	11	14%	25%
ASHP - SEER 15	2	3%	25%
ES Printers	1	1%	25%
Heat Pump Hot Water Heater	15	19%	12%
Ductless mini-split heat pumps secondary rooms- Sun Seasonal Room	1	1%	0%
Grand Total	**77**	**100%**	**34%**

*The sample is not large enough to provide reliable data by measure nor to calculate freeridership scores by measure.

[13] http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/CA_Home_Energy_Savings_Program_Evaluation_2009-2010.pdf, pp. 50, Figure 5

Delivery Channel for TV Rebates

As detailed in the California statewide Business Consumer Electric Program,[14] both PG&E and SCE decided that the relatively low incentives for televisions would have a greater impact as a mid-stream incentive, where the incentive would be larger proportional to margins rather than total retail price. Under this approach, the NTG ratio is based on the influence of the program on the market, rather than directly on consumers' behavior.

Commercial and Industrial (C&I) Sector

C&I Customer Survey Findings: Non-Lighting Participants

PPL Electric Marketing and Outreach

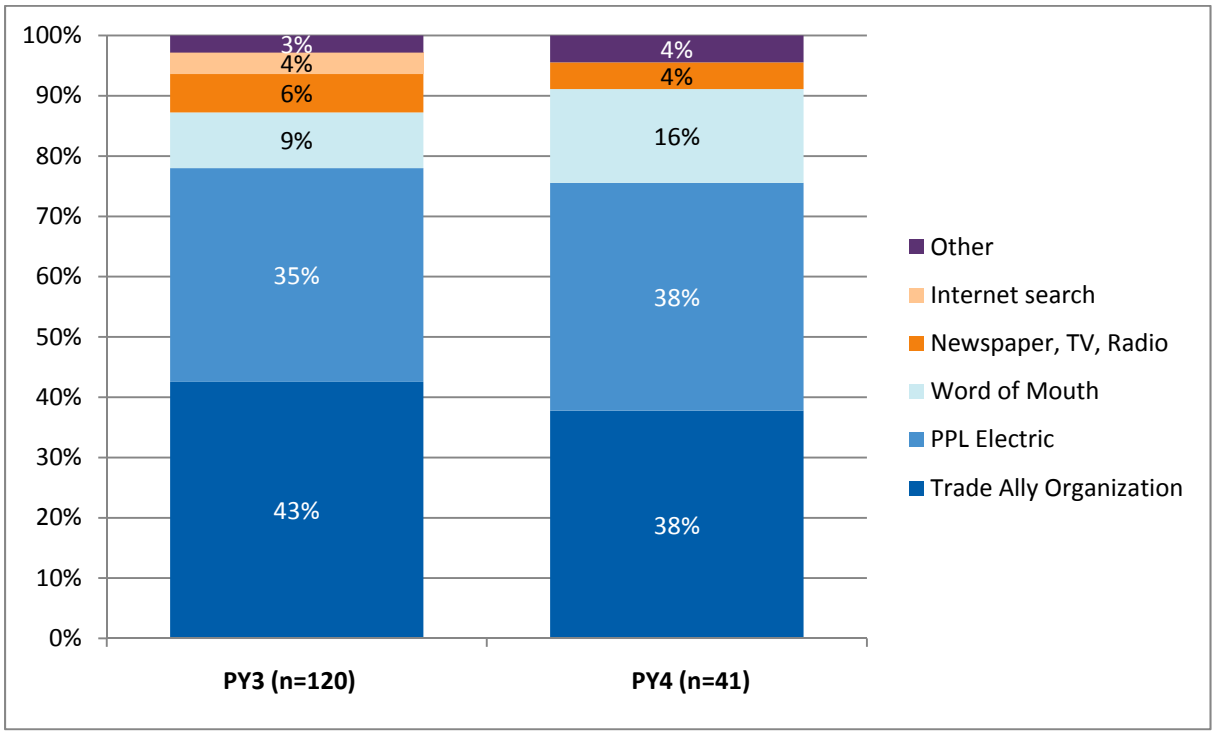
The top way respondents learned about the program were from trade allies (38%) and from PPL Electric outreach methods (38%). The ways that participants heard about the program in PY4 are very similar to PY3 results (Figure 13).[15] Of those who reported learning about the program through trade ally organizations in PY4, 71% heard from a store, dealer, or vendor, and 29% heard from contactors or installers.

Of those who reported learning from PPL Electric (n=17), the majority heard about the program through a PPL Electric bill insert (35%), followed closely by the E-power website (29%) (Figure 14).

[14] http://www.energydataweb.com/cpucFiles/pdaDocs/941/WO34%20BCE%20Report%20-%20Phase%201_FINAL_2013-04-15.pdf, Appendix D, pp. 7-54.

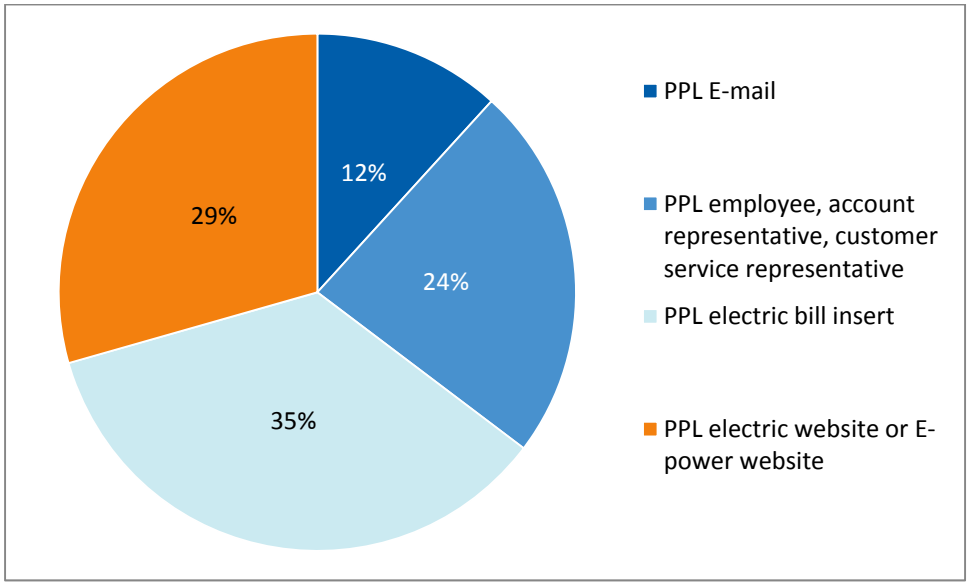
[15] All PY3 results referenced in this section include all efficient equipment measures. PY4 findings for this section reflect just non-lighting efficient equipment.

Figure 13. How Respondents Learned about the Program in PY3 and PY4



Source: M1. How did your organization learn about the rebate Program? (n=41)

Figure 14. PPL Electric Marketing Materials Mentioned by Respondents

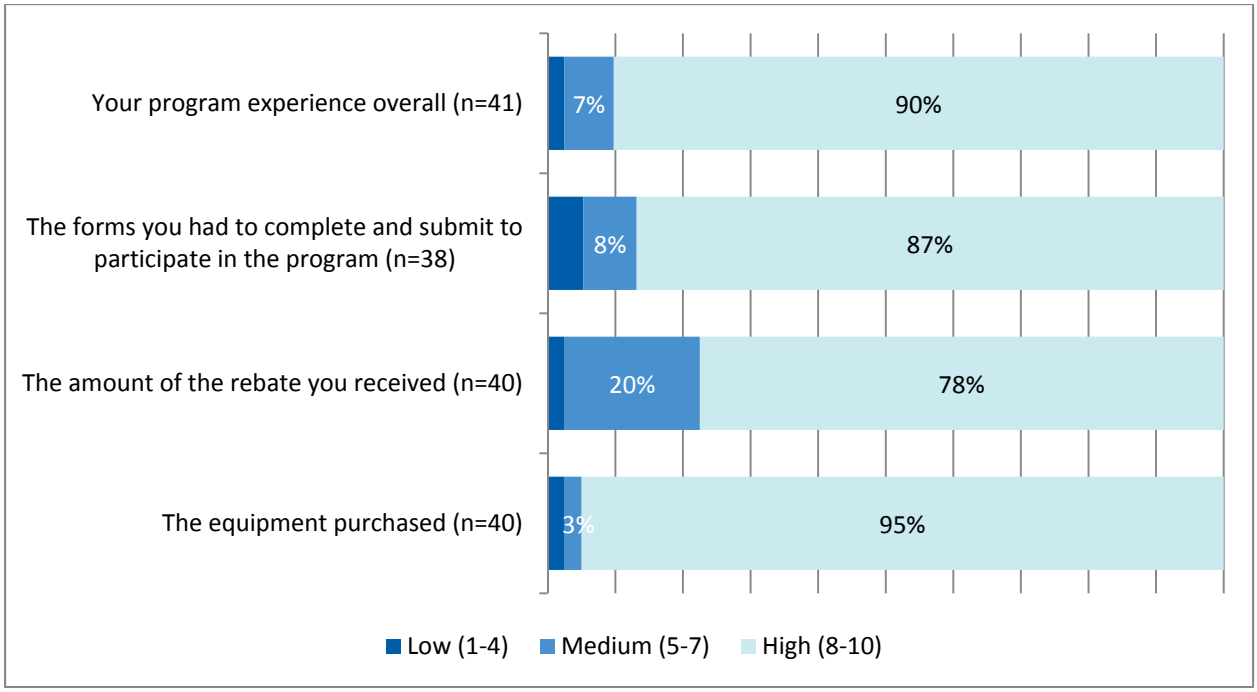


Source: M1. How did your organization learn about the rebate Program? (n=41). Note: Graph summarizes the percentages of responses from 17 respondents who mentioned one of PPL's outreach methods.

Satisfaction

Respondents were highly satisfied with the program (giving a ranking of either an 8, 9, or 10) across most program components in PY4; participants reported medium satisfaction with the rebate amount more often than other program components. Figure 15 shows respondents' satisfaction with the program overall and with different aspects of participant experiences.

Figure 15. Satisfaction with Commercial Efficiency Equipment Program



Source: PS1. Thinking about your overall experience with this rebate program, using a scale from 1 to 10, with 1 being extremely dissatisfied and 10 being extremely satisfied, how would you rate your satisfaction with… (n=41)

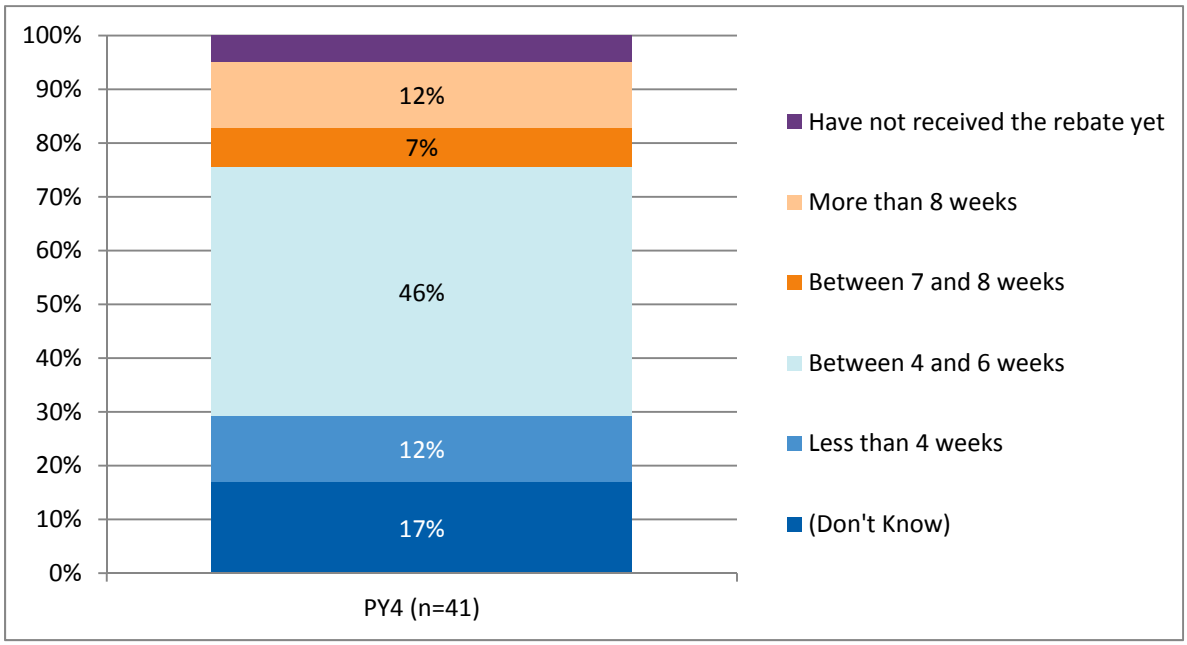
The large majority of respondents (90%) rated their satisfaction with the experience overall as 8 or higher. This was a slight increase from 81% in PY3. Of the 90% of participants who reported high satisfaction, more than half (51%) ranked their overall experience as a 10. Two respondents (approximately 5%) indicated they were dissatisfied with some aspect of the program. These two respondents provided the following reasons for their dissatisfaction:

- One of the respondents thought the rebate amount was not worth the investment
- One respondent reported there was a lot of paperwork.

Although these respondents noted dissatisfaction with part of the program, only one participant reported that their opinion of PPL Electric decreased slightly, while the other reported their opinion improved somewhat.

Most participants reported receiving their rebate check in a timely fashion (58% reported receiving the check in less than 6 weeks), while 19% reported that it took checks seven weeks or longer to arrive. Figure 16 summarizes the reported time it took to receive a rebate check.

Figure 16. Rebate Check Arrival



Source: QA4. After your organization submitted your rebate application for the [Measure], how long did it take to receive the rebate check from PPL Electric? (n=41)

Utility Satisfaction

We asked respondents for their opinion of PPL Electric as a provider of electric service and whether this opinion had changed since participating in the program.

Overall, most respondents (83%) are satisfied (defined by a ranking of 8, 9, or 10) with PPL Electric as a provider of electric service to their company. This is slightly higher than in PY3 when 77% ranked their satisfaction as an 8 or above.

As a result of participating in the program 44% of respondents' opinions of PPL Electric improved *somewhat* or *significantly*, while only 2% of respondents' opinions decreased, and 54% remained unchanged.

Participant Motivations and Decision-Making

We asked respondents to tell us the main reasons they decided to participate in the program. The leading motivation noted by participants to purchase new energy efficient equipment in PY4 was to replace old or outdated equipment (36%), followed by reducing energy costs (28%), and improving product performance (13%). These findings are consistent with participant decision-making in PY3.

We asked the commercial sector respondents who participated in the Efficient Equipment Program if they had specific reasons for purchasing the equipment they did, and the majority (37%) said there was not a specific reason. Twenty-four percent of respondents said they chose the model they did because of the price.

Corporate Policies

A small number of respondents (9 out of 41) had corporate policies related to energy efficiency standards that were considered when purchasing new equipment or making improvements to the facility.

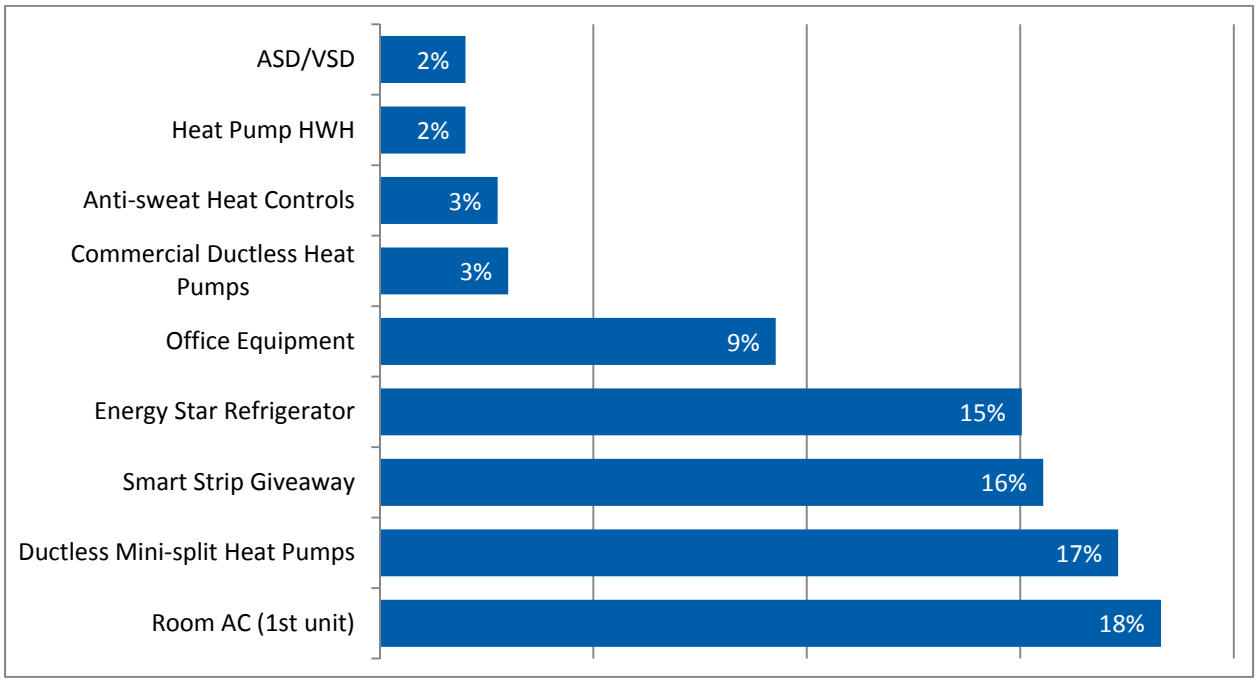
The majority of respondents with corporate energy policies stated that their company's policy is to purchase energy efficient equipment if it meets payback or return on investment criteria. One respondent reported always purchasing energy efficient equipment regardless of upfront cost.

Business Size

Cadmus asked all participants questions about their business, including the size (number of employees). Approximately 79% of participants reported employing 10 or fewer people. Cadmus investigated this finding further to understand how many small businesses would qualify for PPL's Direct Discount channel, if they had installed eligible measures (lighting or refrigeration). We found that 45% (362 out of 809) of the non-lighting participants were small businesses that used less than 400,000 kWh per year, which would have qualified them to participate in the Direct Discount delivery channel).

The four most common energy efficiency measures installed by small businesses that received rebates represented more than half (66%) of the total measures installed by this group. These four measures were room ACs (18%), ductless mini-split heat pumps (17%), smart strips (16%), and Energy Star refrigerators (15%) (Figure 17). These measures are not offered through the Direct Discount delivery channel.

Figure 17. Most Common Energy Efficiency Measures Selected by Small Businesses (Non-Lighting)



Source: EEMIS Participant Data and Customer Annual kWh Consumption Data. Note: Graph only reflects measures that were greater than 1% of the total installations or more.

Commercial Customer Findings – Lighting and Direct Discount Participants

Cadmus spoke with 95 participants who received prescriptive lighting incentives through the Efficient Equipment Incentive Program and 76 participants who participated in the program's Direct Discount delivery channel. The Direct Discount channel reduces the upfront costs of lighting upgrades for eligible small businesses by providing a free lighting energy assessment of the facility to identify opportunities to save energy, and then passing the rebate to the contractor directly for upgrades. This section summarizes the survey findings from both prescriptive lighting participants and Direct Discount participants. Some questions, such as those pertaining to the free energy assessment, were only asked of Direct Discount participants.

Direct Discount Energy Assessment

Cadmus asked participants a variety of questions pertaining to the energy assessment to understand the participant's experience and to explore the value and effectiveness of the assessment. In general, participants rated their satisfaction with the assessment very high, and most described the assessment as *very important* in their decision-making.

Satisfaction with the Energy Assessment and Satisfaction with Contractor

Over 90% of respondents rated their experience with the assessment as an 8, 9, or 10. This included the quality of the assessment, the recommendations from the assessment, and the clarity of information

they received about the Direct Discount services and equipment that qualified. We also asked them to rate their satisfaction with the contractor, including their contractor's knowledge of their business and equipment needs, the convenience of scheduling the installation, and the ease with which they were able to find a Direct Discount contractor.

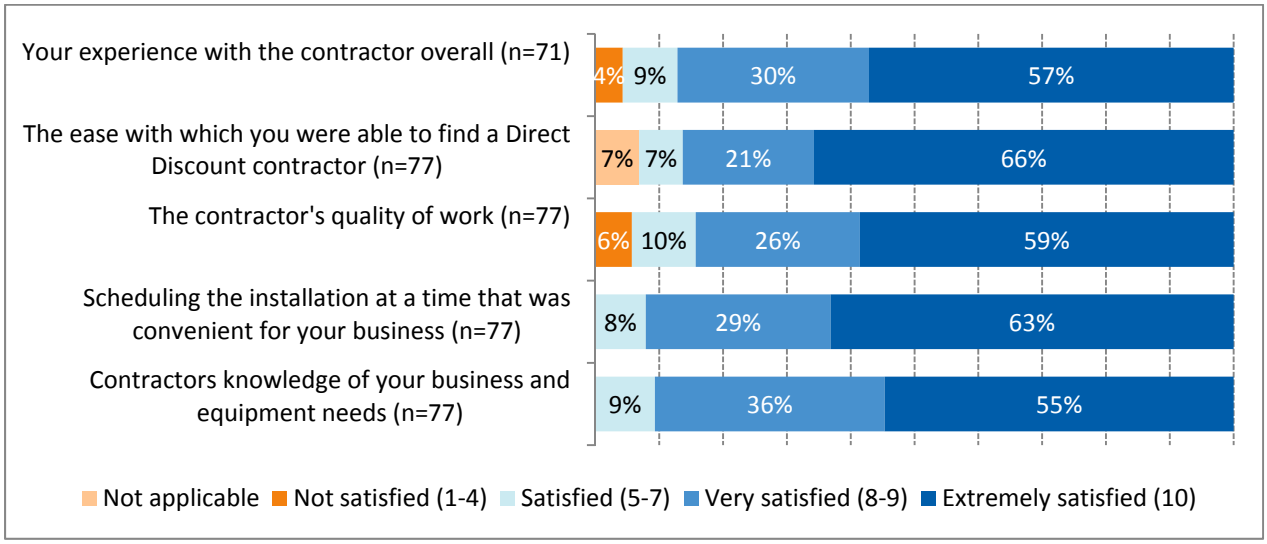
Over half of respondents (57%) ranked their overall experience with the contractor as a 10. However, there were differences between on-site survey respondents and telephone survey respondents on this topic; three of six on-site respondents reported being dissatisfied with the contractor, while only three of 71 phone respondents reported dissatisfaction.

Reasons for dissatisfaction with the contractor were:

- One respondent reported having problems dating back to the installation of their new equipment, and had not received a response from the contractor after attempting to contact them.
- One respondent said that some of the lighting fixtures that were replaced during the project originally had dimmers, but were replaced with fixtures without dimmers.
- One respondent was dissatisfied with the contractor because their company reportedly lost all light and power after the equipment was installed, and the contractor did not help find a solution.
- Two respondents who completed the survey with an on-site interviewer said the workers were sloppy and unprofessional.
- One on-site respondent wasn't happy with the fixture placement.

Figure 18 compares satisfaction across different aspects of the contractors' service.

Figure 18. Satisfaction with Contractor



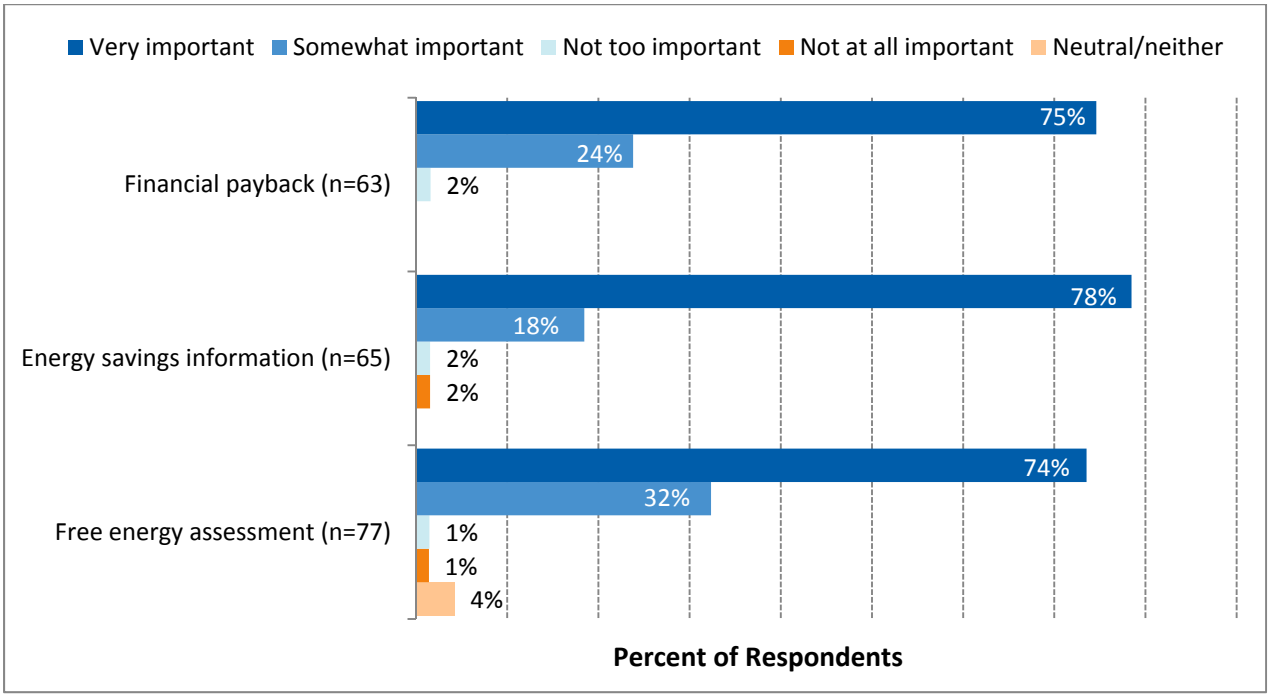
Source: Question PS5. Now thinking about your experience with the contractor who installed the new equipment, using the same 1-10 scale, how would you rate your satisfaction with …?

Importance of Free Energy Assessment

The vast majority of Direct Discount participants indicated that the free lighting energy assessment was important in their decision to implement the recommendations, with over 98% of respondents reporting it was *very important* or *somewhat important* (Figure 19). Only two people said it was *not too important* or *not important at all.*

Further, responses indicate that contractors are consistently communicating critical information on the opportunities to save money as well as the payback period, both of which prove to be important in customers' decisions. For example, 96% of Direct Discount participants said the contractor told them how much energy installing the recommended measures might save, and 78% said this information was *very important* in their decision to implement the recommendations. Just under three-quarters (74%) said information on payback periods was *very important* in their decision.

Figure 19. Importance of Free Energy Assessment on Installation of Recommendations



Source: Question EA4. How important was the free energy assessment in your decision to implement the recommendations? Question EA5b. How important was the information about the energy savings in your decisions to implement the recommendations? and Question EA6b. Using the same scale, how important was the information about the financial payback in your decision to implement the recommendations?

Fourteen percent of respondents (14%) asked auditors about installing equipment that they did not initially recommend. The additional equipment they asked about included reflectors, general lighting, outdoor lighting, and refrigeration. Some of the auditors did not think the payback was enough to warrant the changes. One provided a proposal for the upgrades. Several thought the changes might save

money but because they do not provide that service they could not help with the additional projects. One auditor helped the business make the change.

Implementation of Recommended Measures

We asked if Direct Discount participants implemented all the recommendations made by the contractor. Most respondents (82%) implemented all the recommendations, 6% did not implement everything, and 12% did not know if everything was implemented.

Suggestions for Improving the Direct Discount Service

Cadmus asked telephone respondents if they had any suggestions for changes to the service. The majority of those who answered the question (71%) said they wouldn't change anything. Some respondents (6 out of 71) said they would like higher incentives, lower costs, or free upgrades and improvements. A few respondents (4 out of 71) said they had contractor issues and would like these fixed. One person contacted four contractors and didn't receive a reply from any of them. One person would like the option to use a different contractor. Four respondents wanted the service to cover more products such as LEDs, outdoor lighting, and induction lights.

PPL Marketing and Outreach

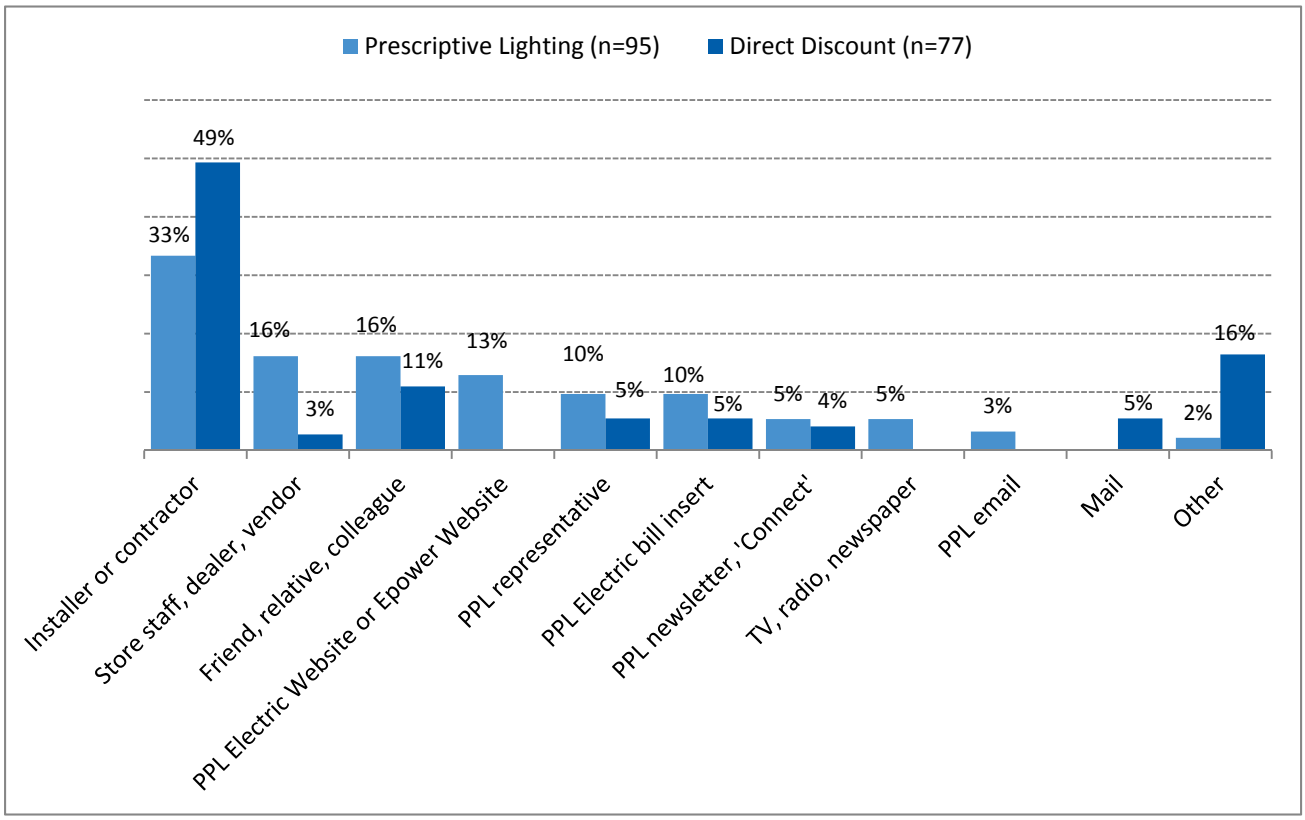
The primary way respondents learned about the program was from an installer or contractor. This was the same for both delivery channels (the Direct Discount and prescriptive lighting incentive path), but a larger percentage of Direct Discount participants (49%) learned about that service through an installer or contractor than other participants did (33%). Figure 20 provides a summary of marketing and outreach channels reported by survey respondents.

There were a few differences between incentive paths:

- A higher percentage of prescriptive lighting participants found out about the program from store staff, dealers, or equipment vendors (16%) than participants using the Direct Discount delivery channel (3%).
- While 13% of respondents who participated through the prescriptive path said they heard about the program from the PPL Electric Website or E-power Website, no Direct Discount participants learned about the service through the Website.
- A fair portion of Direct Discount participants (16%) also mentioned learning about PPL's program through professional networking or community-based events, such as corporate meetings, Lions Club meetings, Lenade Solar, and town meetings or the Chamber of Commerce (represented as "Other" in Figure 20).

Direct Discount participants heard about the service through a larger variety of channels this year than in PY3. In PY3, 55% of respondents heard about the program from PPL and this year just 14% heard from some PPL source (bill inserts; PPL employee, account representative, or customer service representative; or PPL newsletter). In PY3, 37% of respondents learned of the program from a trade ally compared to 49% in PY4.

Figure 20. How Participants Heard about the Program in PY4



Source: Question M1. "How did your organization learn about the program?"

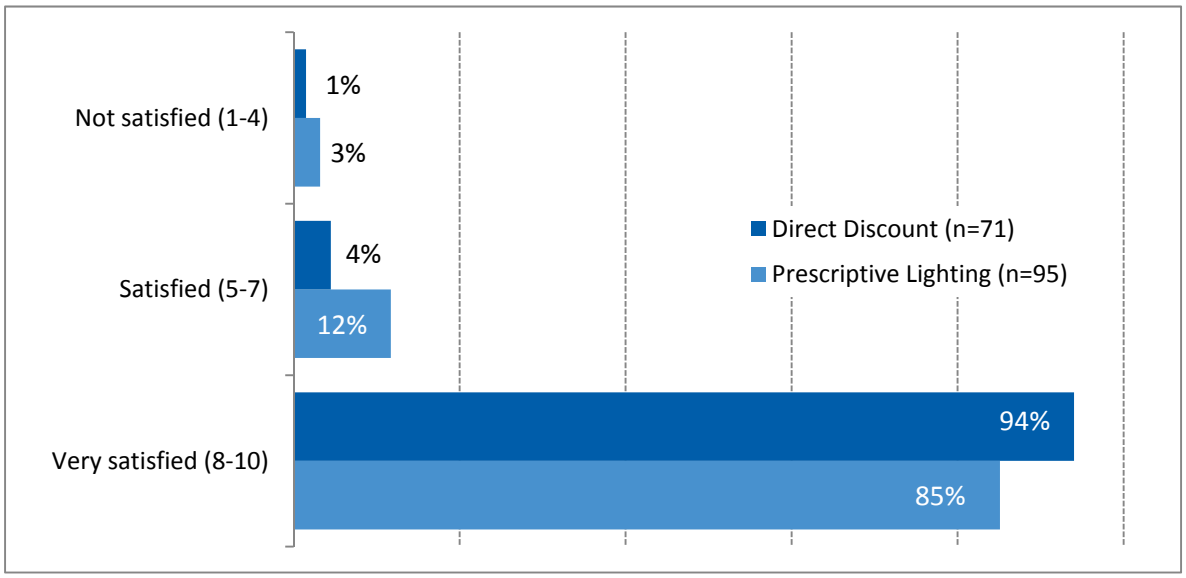
Awareness of Other Programs

Commercial sector participants installing lighting measures in the Efficient Equipment Program were more familiar (34%) with other PPL Electric incentives or rebates than the participants in the Direct Discount delivery channel (18%). When asked, the majority of respondents were familiar with other eligible measures under the Efficient Equipment program.

Participant Satisfaction

Telephone respondents who participated in the program's Direct Discount delivery channel rated their satisfaction with the overall program higher than those installing lighting equipment through the prescriptive path of the Efficient Equipment Program. Sixty-one percent of respondents (61%) in Direct Discount ranked their satisfaction as a 10 (on a scale of 1 to 10 where 10 was *extremely satisfied*), while 44% did so in the prescriptive. Overall, almost all respondents were satisfied with all aspects of both programs and gave satisfaction ratings of 8 or higher (see Figure 21).

Figure 21. Overall Satisfaction

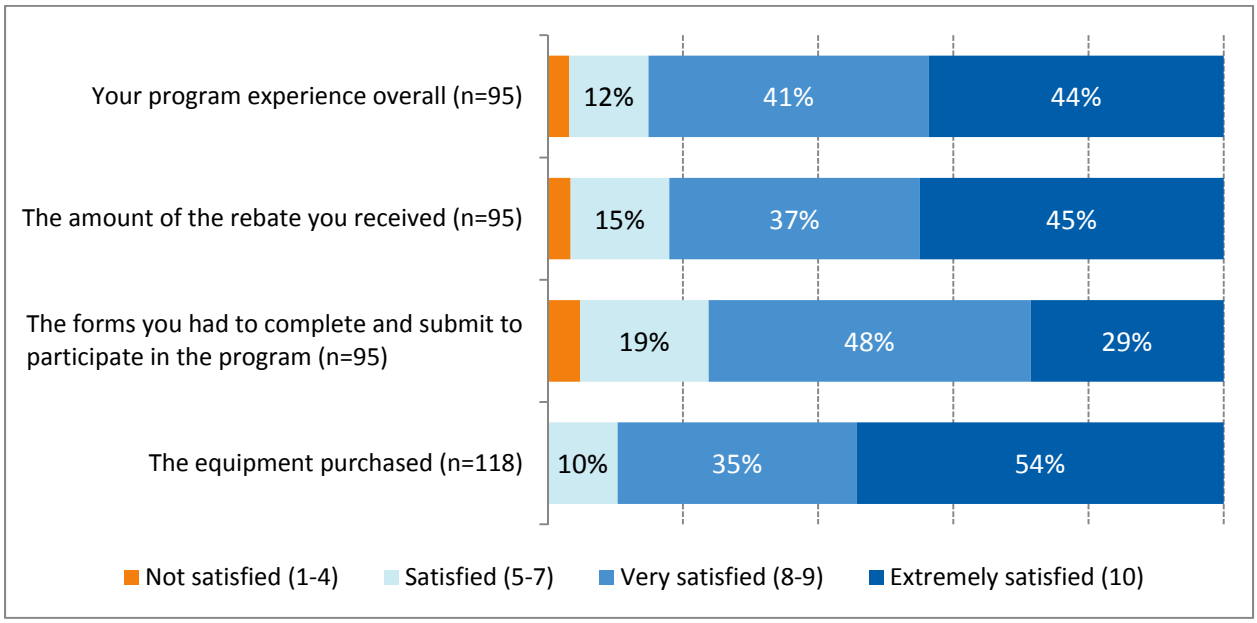


Source: Question PS1. "Thinking about your overall experience with this rebate program, using a scale from 1 to 10, with 1 being extremely dissatisfied and 10 being extremely satisfied, how would you rate your satisfaction with your experience with…?"

Prescriptive Lighting Path Components

Respondents who installed lighting through the prescriptive path were generally very satisfied with all program components. Figure 22 highlights the differences in participant experiences across different aspects of the program. Participants were most satisfied with the lighting equipment they purchased—more than half of them (54%) rated this aspect a 10—and less satisfied with the forms they had to complete to participate. This aspect of the program had the largest number of respondents (5%) who said they were dissatisfied.

Figure 22. Satisfaction with the Commercial Efficient Equipment Program (Prescriptive Lighting)



Source: Question PS1. "Thinking about your overall experience with this rebate program, using a scale from 1 to 10, with 1 being extremely dissatisfied and 10 being extremely satisfied, how would you rate your satisfaction with…"

Respondents who said they were dissatisfied with some aspect of the program (providing a rating of 4 or lower) were asked why they were dissatisfied. The top reasons for dissatisfaction were:

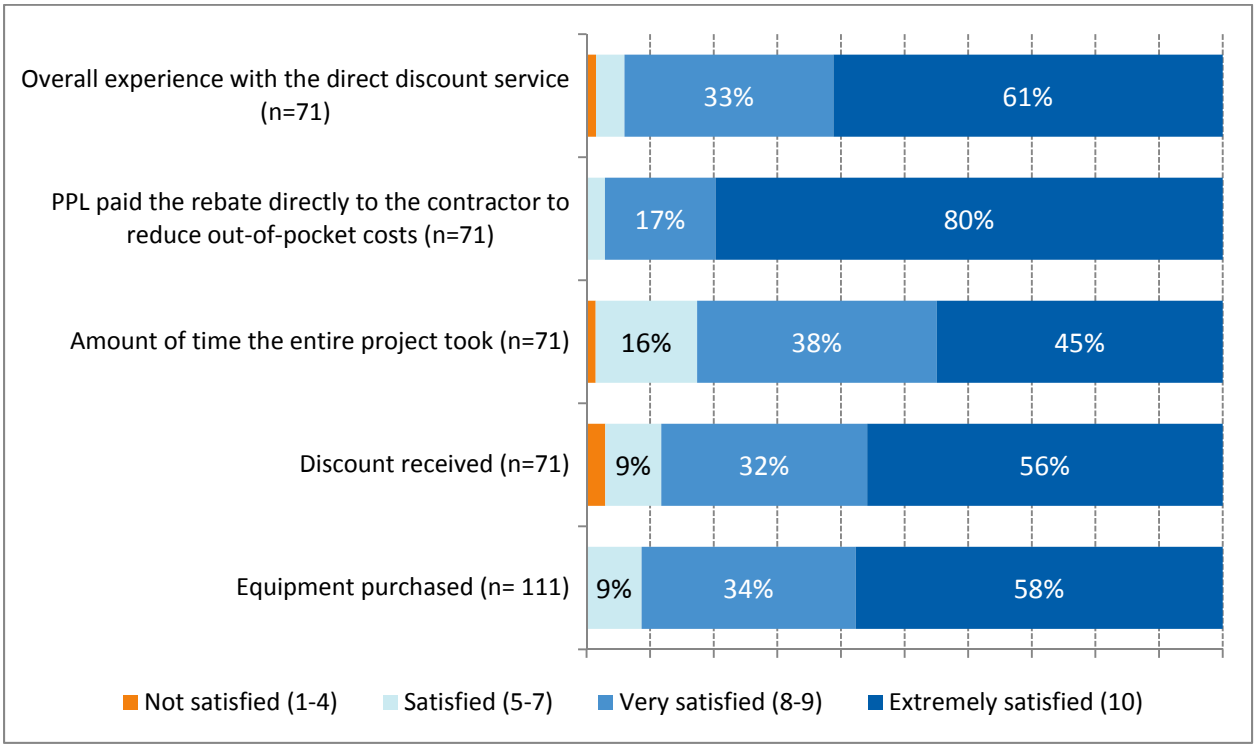
- Program and paperwork were difficult, confusing, and cumbersome (prescriptive lighting participants must complete the TRM Appendix A lighting worksheet)
- Timeliness; the program and paperwork took a long time to complete
- Size of the rebate; the money wasn't worth it

Direct Discount Components

Almost two-thirds of telephone respondents (61%) ranked their overall experience with the Direct Discount service as a 10, and 33% ranked it between 8 and 9. Satisfaction with the service increased since the last program year; in PY3, overall satisfaction (rating of 8 -10) was 88% and this year it was 94%.

Every respondent was satisfied (rated 5 or higher) with the fact that PPL paid the rebate directly to the contractor to reduce out-of-pocket costs. A large majority of respondents (80%) ranked their satisfaction with this aspect as a 10. This was the highest rated aspect of the service. In addition, participants were positive about the overall length of time the project took, the discount they received, and the equipment they purchased. Figure 23 highlights the differences in participant experiences across these components.

Figure 23. Satisfaction with the Direct Discount Channel



Source: Question PS1. Thinking about your overall experience with this rebate program, using a scale from 1 to 10, with 1 being extremely dissatisfied and 10 being extremely satisfied, how would you rate your satisfaction with…

There were three respondents who expressed dissatisfaction by rating one or more aspect of the program as 4 or lower. One respondent said the equipment was flimsy, one respondent said their electricity bill didn't decrease as expected, and one was dissatisfied with their contractor.

Participant Motivations and Decision-making

We asked respondents to tell us the main reasons they decided to participate in the program. Both types of program participants said the top reason for purchasing energy efficient equipment was to reduce energy costs and save money on energy bills (54% for the prescriptive lighting path and 79% for the Direct Discount service). The second most common reason for participating in the program was to replace old or outdated lighting. These findings are consistent with participant decision-making in PY3.[16]

Corporate Policies

A small number of respondents from both incentive paths (16 out of 95 prescriptive lighting respondents and 8 out of 77 Direct Discount respondents) have corporate policies related to energy efficiency standards that are considered when purchasing new equipment or making improvements to the facility.

[16] PY3 survey findings for the standard incentive included all efficient equipment measures. PY4 findings reflect just lighting.

The majority of respondents with corporate energy policies stated that their company purchases energy efficient equipment if it meets payback or return on investment criteria; this was true for both delivery channels. Three respondents reported always purchasing energy efficient equipment regardless of upfront cost, and one respondent reported that their company looks for the best price of equipment regardless of the equipment vendor.

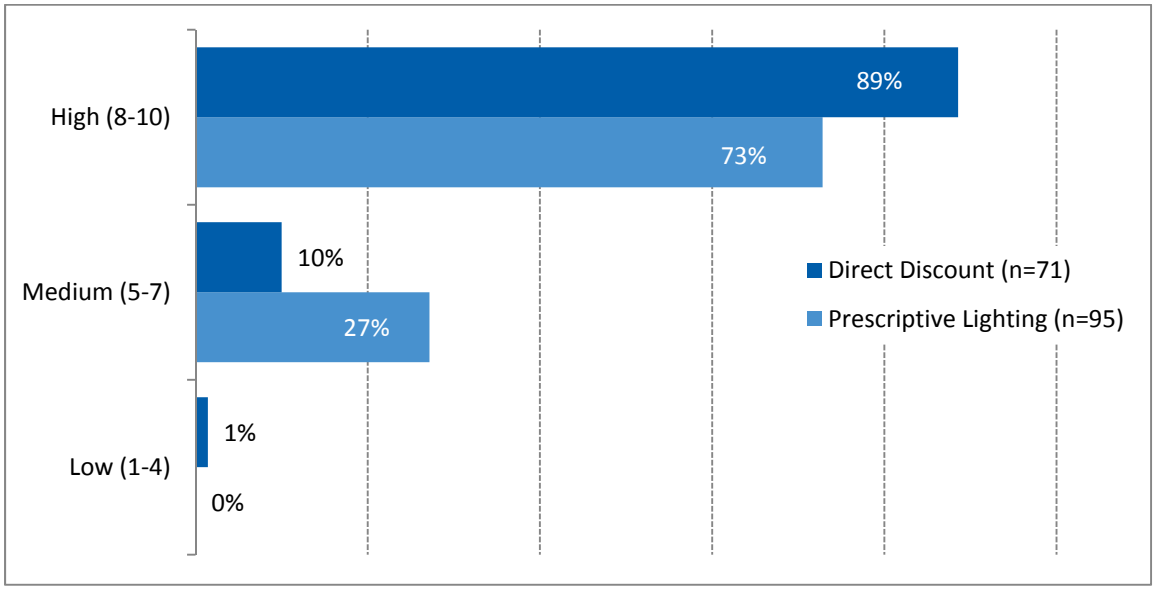
Utility Satisfaction

We asked telephone respondents for their opinion regarding PPL Electric as a provider of electric service and whether this opinion had changed since participating in the program.

Overall, most respondents were satisfied (as defined by a ranking of 8, 9, or 10 on a scale of 1 to 10) with PPL Electric as a provider of electric service to their company. This included 89% using the Direct Discount service versus 73% installing lighting through the prescriptive path of the Efficient Equipment Program. Figure 24 shows the rankings by program delivery channel.

Direct Discount service participants ranked PPL Electric slightly higher in PY4 than they did in PY3; 82% ranked their satisfaction as an 8 or above in PY3, up to 89% in PY4.

Figure 24. Rating of PPL Electric



Source: PP1. 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? (n=166)

Respondents' opinions of PPL Electric improved *somewhat* or *significantly* as a result of the program, with the opinions of Direct Discount service participants improving slightly more than those of the prescriptive lighting path participants (see Table 18).

Two prescriptive lighting respondents said their opinion of PPL Electric *decreased somewhat* since participating in the program. One respondent was not satisfied with the amount of paperwork. The other respondent did not indicate their reason for the change in opinion.

Four Direct Discount participants said their opinion of PPL Electric *decreased somewhat* since participating in the service. One was dissatisfied because a lens was broken and it took two months to repair, one was dissatisfied because their radio reception was interrupted and was still not working, and one respondent was dissatisfied because they had issues with their lights and the contractor had not taken care of the problem. The last respondent did not express dissatisfaction in any of the previous questions. They rated PPL Electric as an 8 as a provider of electricity and they gave a 10 as their overall satisfaction with the program.

Table 18. Changes in Opinion of PPL Electric as a Result of the Program

Survey Group	Improved Significantly	Improved Somewhat	Has not Changed	Decreased
Commercial Efficient Equipment lighting standard path (n=95)	22%	26%	50%	2%
Direct Discount delivery service (n=71)	28%	30%	36%	6%

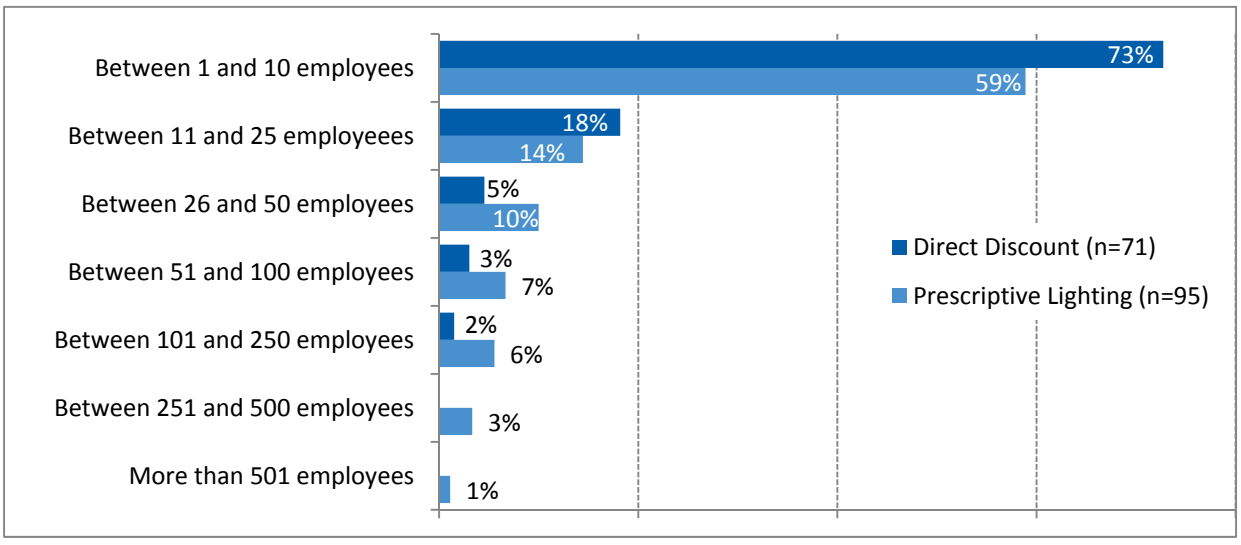
Source: Question PP2. After having participated in this service, has your opinion of PPL Electric Utilities…?"

Market Segments

Overall, survey responses indicated that the Efficient Equipment program as a whole reached a wide variety of market segments and business types.

Most companies surveyed were small businesses and had between 1 and 10 employees. Figure 25 shows employee size by delivery channel.

Figure 25. Employee Size of Survey Participants Installing Lighting Equipment



Source: Question F5. Approximately, how many full-time employees work at your current location?

According to the program tracking database (EEMIS), the most common participating business type for both the prescriptive lighting participants and Direct Discount channel participants was retail (19% and 41%, respectively) (Table 19). Other business types, such as manufacturing and office buildings, accounted for a greater share of participation among prescriptive lighting participants; the Direct Discount delivery channel reached a less diverse market. Fifteen percent of the participant records in EEMIS for the standard incentive did not have a business type associated with them.

Table 19. Business Type by Program Channel for Participants Installing Lighting Equipment

Business Type	Direct Discount Population (n=1,771)	Efficient Equipment Prescriptive Lighting Population (n=1,482)
24/7 Facilities and spaces	0%	1%
Hospitals, medical clinics, and nursing homes	1%	3%
Auto related	6%	2%
Dusk to dawn Lighting	6%	3%
Education and daycare	0%	9%
Grocery and convenience store	4%	7%
Manufacturing	9%	13%
Lodging	6%	2%
Office	6%	10%
Police, fire, and public order and safety	5%	3%
Religious worship	1%	2%
Restaurant	9%	2%
Retail	41%	19%
Storage and warehouse	6%	9%
Null	0%	15%

Source: EEMIS

C&I Efficient Equipment Net-to-Gross Research

Over the last three program years, PPL's non-residential Efficient Equipment net-to-gross ratios (NTGR) decreased each year for each program component (see Table 20). NTG ratios for the lighting and Direct Discount delivery channel of the Efficient Equipment program were higher than for the non-lighting measures in the program.

Table 20. Phase 1 Efficient Equipment NTG Ratios

Program Name	PY1	PY2	PY3	PY4
Efficient Equipment Incentive - Commercial, Non-Lighting	51%[1]	57%[2]	33%[2]	39%
Efficient Equipment Incentive - Commercial, Lighting		85%[2]	81%[2]	78%
Efficient Equipment Incentive – Direct Discount		N/A[1]	90%	80%

[1]The Direct Discount delivery channel was not implemented until PY3
[2]NTG Result weighted by savings

Table 21 shows the freeridership and spillover scores for the Phase 1 Efficient Equipment program.

Table 21. Phase 1 Efficient Equipment FR & SO

Program Name	PY1 FR	PY2 FR	PY2 SO	PY3 FR	PY3 SO	PY4 FR	PY4 SO
Efficient Equipment Incentive - Commercial, Non-Lighting	49%[2]	47%	4%	72%	0%	61%	0%
Efficient Equipment Incentive - Commercial, Lighting		15%	0%	19%	0%	22%	.02%
Efficient Equipment Incentive – Direct Discount	N/A[1]	N/A	N/A	10%	0%	20%	0%

[1] Direct Discount delivery channel did not exist in PY1, PY2

[2]NTG Result weighted by savings

Table 22 compares PPL's NTGR with other programs. The NTG components are reported separately as freeridership and spillover. PPL Electric's PY3 lighting and Direct Discount freeridership scores (19% and 10% respectively) are low compared to other benchmarked utilities. In contrast, PPL Electric's freeridership score for non-lighting measures (72%), was the highest of any program reviewed (see Table 22). In PY3 a key driver of the high freeridership for the non-residential non-lighting group was the four respondents who installed variable speed drives (VSDs): two were 100% free-riders and two were 50% freeriders. The freeridership score is weighted by savings, and savings for VSDs represented 92.3% of the total non-lighting survey respondent program savings.

Table 22 also indicates that, where utilities report freeridership separately by measure, freeridership scores for non-lighting measures were generally higher than lighting, which is consistent with PPL's results.

Table 22. Commercial Efficient Equipment Benchmarking Findings

Utility	Rebate Structure	Program Name	Verified Gross MWh/yr	Program Start Year	Evaluation Year	Freeridership Score	SO	NTGR
PPL (PY4	No pre-approval	Energy Efficient Equipment	216,620	2009	2012-2013	61% (non-lighting) 22% (lighting) 20% (Direct discount)	0%	39% (non-lighting) 78% (lighting) 80% (Direct discount)
Xcel CO	No pre-approval	Cooling Efficiency (only)	5,750	2006	2007-2009	51%	21%	70%
Xcel CO	No pre-approval	Air Conditioning	1,748	2006	2011	42.80%	10.80%	67.60%
Xcel CO	No pre-approval	Heating Efficiency	n/a[2]	2006	2011	26%	11%	85%
Xcel CO	No pre-approval	Lighting	n/a[2]	2006	2007-2009	16%	N/A	84%
ETO	No pre-approval	Existing Buildings – non-lighting measures	13,858	2003	2007	37%	N/A	63%
ETO	No pre-approval	Existing Buildings - Lighting only	11,101	2003	2007	29%	N/A	71%
PECO	Pre-approval	Smart Equipment Incentives: Commercial & Industrial Program	68,409	2009	2011-2012	Not reported	Not reported	57%-70%[1]
SW Utility	Pre-approval	Standard Business Solutions	85,777	2004	FY2012	34%	0%	66%
CT Utilities[3]	Pre-approval	Non-lighting Measures[4]	22,094	2005	2011	14.30%	4.80%	93.80%
Pacificorp/ Rocky Mountain	Hybrid[5]	Finanswer Express UT	48,000	2000	2005-2008	21%	0%	79%
Pacificorp/ Rocky Mountain	Hybrid[5]	Finanswer Express WA	18,000	2000	2005-2008	12%	0%	88%
CT Utilities[3]	Hybrid[5]	Lighting Measures	68,903	2005	2011	8.40%	4.50%	96.20%
CT Utilities[3]	Direct Install	Small Business Energy Advantage	32,080	2005	2011	3.70%	2.20%	98.50%

[1]NTG calculations for the Smart Equipment Incentives program were not yet finalized when the Annual Report was submitted. The range shows the possible final value.
[2]Programs did not claim electric savings; peak demand or natural gas savings only
[3]Study conducted for the Connecticut Energy Efficiency Board for Connecticut Light & Power's and United Illuminating's Commercial and Industrial electric and natural gas programs
[4]Measures are implemented through the Energy Opportunities program; eligible projects are restricted to replacements of functioning equipment
[5]A hybrid program requires pre-approval for certain measures in the program.

Factors Affecting Freeridership

There are several program design factors that can impact freeridership. These include the measures in the program, the number of repeat customers, the length of time after installation that projects are eligible for a rebate, and rebate structure.

Measure Type

In Phase 1 PPL Electric rebated ENERGY STAR office equipment and these measures are no longer offered during Phase 2. This could reduce freeridership in Phase 2 for the non-lighting measures. Customers may base their office equipment purchase decision on other features instead of an appliance's energy efficiency. Additionally, the rebates offered for these measures were relatively small in proportion to the cost of the measures, and it is unlikely customers decided to purchase these higher efficiency measures because of the small incentive.

Repeat Customers

Cadmus reviewed the top ten customer contact names by number of jobs in PY4 to see if these customers were installing one measure type at all their locations, which could be an indication of freeridership. For example, a customer may plan to install equipment at multiple locations, and prioritize activities to take advantage of rebates. We also looked for opportunities to market other measures to these customers.

Table 23 shows the number of accounts and number of jobs represented by the top ten customer contacts in PY4. The table shows that 9 of the top 10 customers applied for lighting rebates. Five of the 10 customers applied for rebates for more than one measure type. Since the number of accounts generally equals the number of jobs, it is likely that these customers are applying for rebates for similar equipment at each location. The table also shows that account executives are successful in identifying measure opportunities for large customers and should continue to identify and promote opportunities for other types of measures. For example, Customer Contact #4 installed lighting measures at 35 different grocery stores. PPL Electric could recommend this customer also look at opportunities to install efficient refrigeration equipment.[17] We recommend that PPL Electric begin tracking customer contacts with a large number of jobs and working with these customers to recommend other measures (if this is not being done already). This could increase participation if customers install equipment recommended by PPL Electric. This may not reduce freeridership for the measure the customer was already installing at their locations, but it could help in reducing freeridership for the program as a whole if the customer installs additional measures recommended by PPL Electric.

[17] Note that our analysis only looked at PY4. It's possible these customers installed other measures in previous program years.

Table 23. Number of Accounts and Jobs for the Top Ten Customers in PY4

Customer Contact	Business Types Represented	Measure Types	Number of Accounts	Number of Jobs
#1	Retail	Lighting	75	75
		Other	75	75
#2	Multifamily	Appliances	65	65
#3	Retail	Lighting	36	37
		HVAC	1	1
		Refrigeration	10	10
		Motors	4	6
#4	Grocery	Lighting	35	35
#5	Office	Lighting	28	28
#6	Retail	Lighting	19	19
		Refrigeration	14	15
#7	Retail	Lighting	21	21
#8	Big Box Store	Lighting	19	19
#9	Fast Food	Lighting	13	22
		Refrigeration	15	23
#10	Office	Lighting	14	18
		Motors	1	1

Installation Date, Rebate Paid Date, and Upload into EEMIS Date

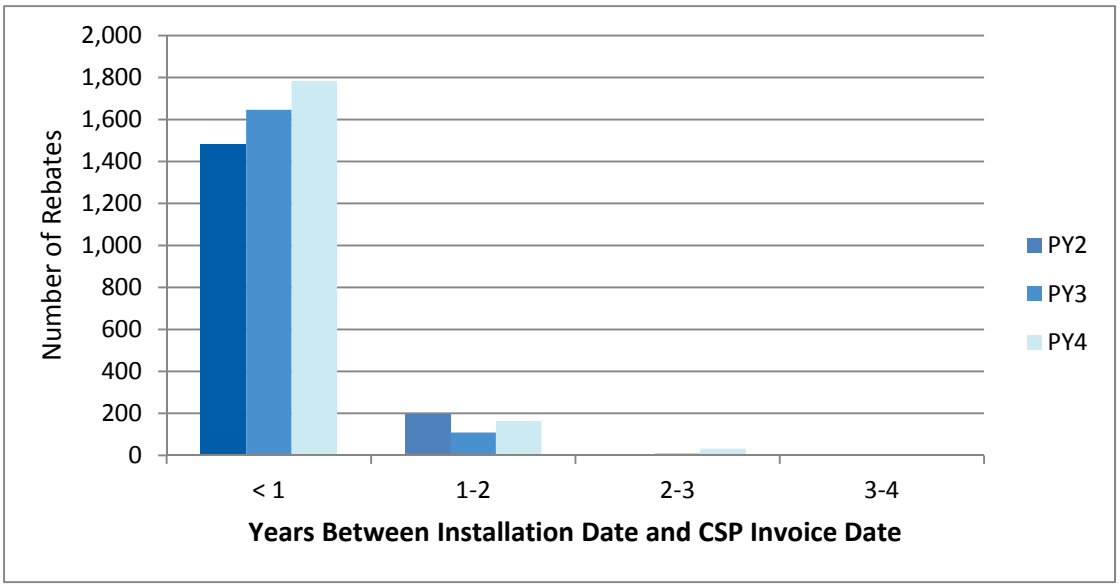
The Efficient Equipment program began accepting rebate applications in December 2009. Throughout all Phase 1 program years, customers were permitted to apply for a rebate for projects that were installed after July 1, 2009.[18] A customer could install energy efficient equipment in July 2009, before the rebate program began. These customers may be freeriders or may have been aware of the rebate program through public meetings, the filed EE&C Plan, or stakeholder meetings to brief customer and trade ally groupsbefore programs launched. Figure 26 shows the length of time between the installation date and the CSP invoice date by program year. The CSP invoice date provides the closest approximation of the date the customer submitted their rebate application.

The CSP invoice date is typically within one year after the equipment is installed, but between 100 and 200 rebates have a CSP invoice date more than one year after the equipment was installed, regardless of program year. This may be an indication that customers learned about the rebate program after installing their equipment are therefore freeriders, or it may be an indication that customers were aware of the program but were slow to submit rebate applications. For Phase 2, only measures installed

[18] There were some program-specific restrictions such as rebate submittal date deadlines, or restrictions for rebate submittal for programs that were fully subscribed.

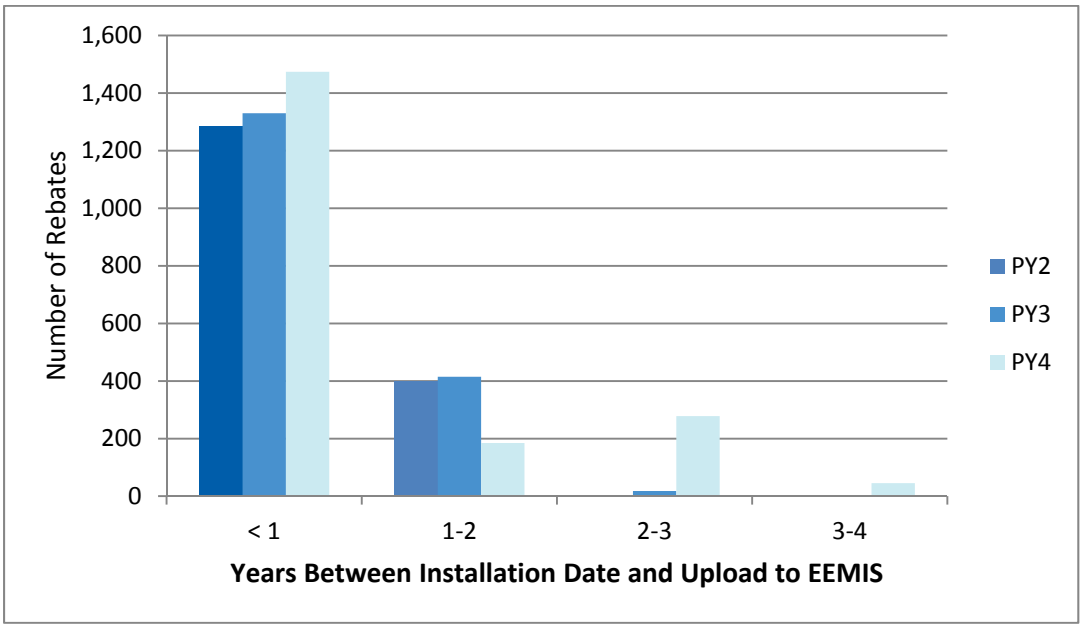
after June 1, 2013 where the customer submits the rebate application within 180 days of installation are eligible for a rebate. This will limit the number of applications from customers who learn of the rebate after purchasing the equipment.

Figure 26. Years Between the Install Date and CSP Invoice Date by Program Year



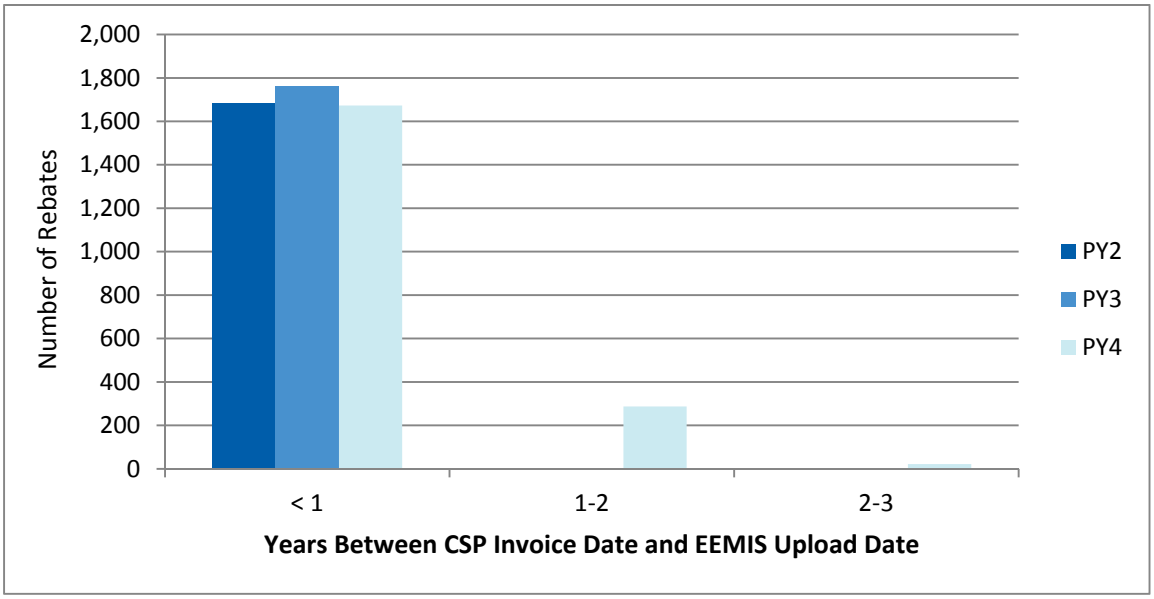
Additionally, survey bias could be introduced if customers were interviewed more than one year after they applied for their rebate. Figure 27 shows the number of years between the installation date and the date the measure is uploaded into EEMIS. More than 400 records were uploaded to EEMIS over one year after the equipment was installed. If selected for the survey sample, these customers may not remember their motivation for purchasing the measure, and could respond with very different answers than they would have if the survey had been completed within a year of their installation date. In PY4, Cadmus was not able to screen for customers with installation dates more than one year before the beginning of PY4 because the available sample was small. However, we can screen for this in the future if necessary. We also recommend that PPL Electric try to upload all of the records to EEMIS during the same program year that the incentive is paid. In Phase 2, implementation CSPs are responsible for processing rebates for their respective programs. We expect this will reduce or eliminate delayed rebate processing.

Figure 27. Years between the Installation Date and Reporting the Measure in EEMIS



Lastly, Figure 28 shows the number of years between the CSP invoice date and when the record was uploaded to EEMIS. The figure shows that in PY4, measures were uploaded to EEMIS that received rebates more than one year before the upload. This can also cause survey bias with the NTGR results, as discussed earlier. Cadmus recommends that PPL Electric upload records during the same program year that the rebate is provided. Cadmus will screen records for the survey calls to include only those installing measures within the prior year (and within the same program year as the phone survey).

Figure 28. Years between CSP Invoice Date and Upload to EEMIS



QA/QC Review

This section summarizes factors affecting the Efficient Equipment Incentive Program's realization rates during PY4.

The records review and site visits for Q1 through Q3 measures showed some differences between the *ex ante* adjusted savings and the *ex post* savings for commercial lighting, ASD/VSDs, residential air source heat pumps, central air conditioners, display cases, direct expansion (DX) packaged air conditioners, ductless heat pumps, copiers, printers, scanners, faucet aerators, HVAC motors, and evaporator fans. The main reasons for differences between *ex ante* and *ex post* savings are summarized below and Appendix A. Efficient Equipment Program: Differences is Ex Ante and Ex Post Savings by Measure Type, Non-lighting Measures" contains a detailed explanation by measure type.

- **Errors on PPL Lighting Incentive Forms.** Using data collected during site-visits, Cadmus corrected the PPL lighting forms (TRM Appendix C) for a majority of projects in the PY4 review sample and updated the *ex post* savings accordingly. Errors on the TRM Appendix C forms included entries relating to space cooling type, fixture code variables, and building type identification, which impact *ex ante* savings calculations.
- **Differences in EER values and Air-Conditioning, Heating, & Refrigeration Institute (AHRI) database values.** For several measures, the EER values used to calculate savings in EEMIS (which are derived from the customer-reported SEER value by assuming 13 SEER is equivalent to 11 EER) were higher than values in the AHRI database, which are used to calculate *ex post* savings. This led to a reduction in energy and demand savings.
- **Ineligible equipment.** In the case of some office equipment, the measures could be not be verified as ENERGY STAR. In the case of faucet aerators, a records review found that one record showed the measure rebated did not qualify for the program. In both cases, zero energy savings were assigned.
- **Data collection during site visits**. For many refrigeration measures, *ex ante* savings are based on assumptions. The inputs needed to calculate savings per the TRM were not collected on the rebate forms. Cadmus collects data on the relevant inputs during site-visits and updates the *ex post* savings accordingly.

Conclusions and Recommendations

Residential Segment Conclusions and Recommendations

Based on the findings, we recommend PPL consider the following recommendations in Phase 2 for residential customers. Note that in Phase 2, the Residential Retail and Home Comfort programs will rebate residential measures that were offered through the Efficient Equipment Program in Phase 1.

Conclusion: Only 28% of program participants were aware of other PPL energy conservation rebates or incentives.

Recommendation: Consider ways to leverage existing PPL marketing and outreach to promote the rebates and incentives, such as through materials disseminated in the Appliance Recycling Program, Residential Retail, and Home Comfort.

Conclusion: In Phase 2, PPL Electric will use a mid-stream delivery channel for television rebates. Maintaining a high NTG ratio will depend on the ability to influence retailers to carry more high-efficiency models (possibly multiple tiers above the standard) than they would have without the incentive. Maintaining an understanding of the rapidly changing market for this measure has proven difficult for other utilities.

Recommendation: Because the specifications for TVs change so rapidly, PPL Electric should ensure that the models for which incentives are being offered are a step ahead of standard specifications. This will help to control or reduce freeridership.

Conclusion: Expensive products, such as high efficiency refrigerators and heat pump water heaters, require higher incentives to have a meaningful impact on participants' decision-making.

Recommendation: In Phase 2, PPL Electric should ensure incentive levels remain high enough for these measures to maintain low levels of freeridership. Incentives should be offered for equipment a step ahead of standard specifications, codes, and standards.

C&I Segment Conclusions and Recommendations

Based on the findings, we suggest PPL consider the following recommendations in Phase 2 for commercial and industrial customers who receive rebates through the Efficient Equipment Incentive Program.

Conclusion: Almost half (45%) of commercial customers who received a rebate for non-lighting equipment are small businesses that would qualify for PPL's Direct Discount delivery channel.

Recommendation: Consider expanding the Direct Discount program to include certain measures that are commonly installed by this group of customers, where the measure is a good fit with the delivery channel's structure. For example, common measures such as room air conditioners, smart strips, refrigerators, and office equipment do not typically require specialty expertise to install, and therefore may not require recruiting and training new contractors for the Direct Discount channel. Consider methods to train current program trade allies, who are primarily lighting contractors, to recommend and implement these easy-to-install measures as part of the program to increase uptake.

Conclusion: While overall satisfaction among prescriptive lighting and Direct Discount delivery participants is high, some participants indicated challenges with their contractor such as responsiveness to problems after installation and installing incorrect equipment.

Recommendation: PPL could consider some opportunities to improve participant experience with the program, particularly with Direct Discount contractors. These could include conducting a random sample of QA/QC site-visits or phone calls to ensure that in-progress projects or recently completely projects are going smoothly; allowing PPL to identify any issues or problems up-front and resolve them quickly.

Conclusion: Understanding financial payback periods and potential energy savings of lighting upgrades proved to be important to participants' decisions to move forward with Direct Discount projects; other participants receiving prescriptive lighting incentives may also benefit from this information.

Recommendation: Although PPL already provides a series of savings calculation worksheets for prescriptive lighting projects on the PPL website, consider opportunities to bring general financial savings information for eligible prescriptive lighting measures more front-and-center on the website. This could be achieved by cross-linking to lighting case-studies and the Business Incentives brochure currently posted on the trade ally microsite. Making the "business case" will likely prove valuable for larger commercial customers in choosing their equipment upgrades, just as it does for small Direct Discount customers.

Conclusion: Participants installing lighting equipment said they would like to see rebates or discounts for other lighting equipment including LEDs, parking lot lights, and induction lights, which are eligible measures in Phase 2.

Recommendation: Consider opportunities to highlight these and other new measure offerings when working with Phase 2 trade allies and on website and program brochures.

Conclusion: Freeridership scores vary by measure and end use. When freeridership data are available at the measure level, it is useful for investigating market maturity. Typically, freeridership is the highest when the public is aware and accepting of the measure, it is commonly accepted in the market, and/or offered as standard practice. Cadmus can assist PPL Electric with investigating market maturity by focusing on specific measures during the participant surveys and tracking the NTG ratios for these measures. We can also review trade ally marketing materials and interview trade allies about their standard of practice recommending and installing measures included in the Prescriptive Equipment program. In PY5, we are conducting market effects studies, highlighting specific measures.

Conclusion: Repeat customers often install the same measure types in multiple locations.

Recommendation: Continue to recommend additional measures to repeat customers. Often, repeat customers are large franchises that have high energy usage, making them a key account customer. If the customer is a key account, PPL key account managers should continue to look for opportunities for their customers to install other measures and apply for rebates. If the customer is not a key account, the implementation CSP should identify repeat customers and work with them to make upgrades across multiple locations.

Conclusion: Freeridership scores may be higher due to applications from customers who learn of the rebate after purchasing the equipment.

Recommendation: Limit the time between equipment installation and rebate application by requiring that customers submit their applications within six months after they install (or purchase) their equipment. This will limit the number of applications from customers who learn of the rebate after purchasing the equipment. Note that in Phase 2, PPL has already implemented rules requiring an in-service date of 6/1/13 or later (installed and operable), and also requires customers to submit the rebate application within 180 days of installing the equipment.[19]

Conclusion: Freeridership scores may be higher because of survey responses from customers who received their rebates more than a year before the survey was conducted.

Recommendation: Limit the time between processing the rebate and uploading the record into EEMIS. If records are uploaded into EEMIS during the same program year that the rebate was processed, this will provide more accurate survey responses used in determining freeridership.

Conclusion: Adjustments to nonresidential lighting *ex ante* savings were necessary due to errors on the PPL lighting forms regarding space cooling type, fixture code variables, and building type identification. These errors are likely avoidable and can be minimized to reduce the savings adjustments needed and improve the realization rate.

Recommendation: PPL Electric should consider establishing a review procedure to check the accuracy of the site specific data collected and recorded in the PA Lighting worksheet (TRM Appendix C). These are data used to calculate *ex ante* savings estimates for nonresidential lighting projects. One possible procedure could be to review a sample of projects before incentives are paid, make any needed corrections, and inform team about the corrections and why they were needed. This procedure will be instructive to the individuals and the team as a whole.

PY4 Process Recommendations Status: Efficient Equipment Incentive Program

Table 24 contains the status of each PY4 process recommendation made to PPL Electric.

Table 24. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Residential Efficient Equipment	
Leverage existing PPL marketing and outreach to promote the additional rebates and incentives	**Implemented.** Expansion being considered for Phase 2.

[19] At the time this report was prepared, PPL Electric was considering a change that requires non-residential customers to obtain pre-approval of their project before purchasing their equipment. That should further reduce freeridership.

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
through this channel	PPL provided information/marketing materials about other programs to participants in the Phase 1 appliance recycling program. For Phase 2, PPL has expanded the role of its E-Power Team to provide more face-to-face marketing, including information about PPL's Ph 2 programs. PPL will consider expanding this recommendation for Phase 2 if it helps to achieve marketing (and savings) objectives at a lower program cost. This recommendation is specific to the following conclusion from PPL's evaluator: "Only 28% of [residential] program participants were aware of other PPL energy conservation rebates or incentives." That conclusion may be true but the type and extent of marketing must be closely matched to the desired savings objectives (i.e. actual progress compared to goal). The budget for most programs (and the portfolio) was fully subscribed by the end of Phase 1 and PPL's Phase 1 savings were 50% greater than the compliance target. Therefore, additional marketing and outreach would not have provided a benefit and may have caused programs to go dark before the end of Phase 1 (would have reached full funding too early).
Because the specifications for TVs change so rapidly, PPL Electric should ensure that the models for which incentives are being offered in Phase 2 are a step ahead of standard specifications to reduce freeridership	**Implemented.** PPL's approved Ph 2 EE&C Plan includes a mid-stream delivery channel for television rebates. PPL agrees with its evaluator's conclusion that "Maintaining a high NTG ratio will depend on the ability to influence retailers to carry more high-efficiency models (possibly multiple tiers above the standard) than they would have without the incentive. Maintaining an understanding of the rapidly changing market for this measure has proven difficult for other utilities." Therefore, PPL is planning to delete this as an eligible measure because it likely is not practical to ensure the TV models are a step ahead of standard specifications and, therefore, the program would likely have unacceptably high freeridership.
Commercial Efficient Equipment	
Consider expanding the Direct Discount program to include measures that are commonly installed by small businesses receiving non-lighting rebates, where the measure is a good fit with the delivery channel's structure.	**Rejected.** Adding these measures to the Direct Discount delivery mechanism would merely "displace" other measures (such as lighting) and, therefore, would not increase total savings (program or portfolio) within the existing funding. In addition, since those additional measures are not more cost-effective than the measures currently in DD (primarily lighting), the benefit-cost ratio would likely decline.
Consider opportunities to improve Direct Discount participant experience, such as conducting a random	**Implemented.** PPL has reviewed this recommendation

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
sample of QA/QC site-visits or phone calls to ensure projects are going smoothly	with the C&I CSP and corrective actions have been implemented to include QA/QC questions in post inspections. The C&I CSP will address the customers' satisfaction and quality concerns with the specific contractor.
Bring general financial savings information for eligible measures more front-and-center on the PPL Electric website	**Implemented.** Expansion being considered for Phase 2. In phase 1, PPL used case studies on specific projects by C&I customers (with the customer's permission) in advertising (print, direct mail, digital, broadcast). PPL recently won 1st place for its print ad showing savings for a small business customer. PPL will evaluate this recommendation further for Phase 2 and expand it if necessary to achieve savings objectives within budget. Providing "too much" information to customers is not necessarily ideal and the level of information/program promotion must be closely matched to the desired savings objectives (i.e. actual progress compared to goal). Otherwise, programs will go dark (exhaust their funding) too early.
Highlight new Phase 2 measure offerings when working with trade allies and on website and program brochures	**Implemented.**
Repeat customers with multiple facilities have the opportunity to install the same measure types across multiple locations. PPL key account managers should continue to look for opportunities for their customers to install other measures and apply for rebates.	**Implemented.**
Limit the time between equipment installation and rebate application by requiring that customers submit their applications within six months after they install (or purchase) their equipment. In Phase 2, PPL has already implemented rules requiring an in-service date of 6/1/13 or later (installed and operable).	**Implemented.** PPL's approved Ph 2 EE&C Plan and rebate forms require customers to submit the rebate form within 180 days of installing the measure. In addition, PPL is proposing to change its EE&C Plan by requiring non-residential customers to get pre-approval of their application before purchasing the measure.
Establish an internal QC procedure to check variables such as space cooling type, fixture code variables, and building type identification in the PA Lighting worksheet (TRM Appendix C) used to calculate ex-ante savings to improve lighting project realization rates.	**Implemented.** PPL has recommended this additional QA/QC to its C&I CSP who is responsible for non-residential lighting. A realization rate as close as possible to 100% will help PPL ensure its reported savings (monitored in near real-time) are reasonably representative of the verified savings (determined in November each year) that will count toward compliance.

Residential Lighting Program

For the Residential Lighting Program, the PY4 process evaluation activities were these:

- Residential customer telephone survey (n=301),
- Net-to-Gross Literature Review and Benchmarking,
- Database Review and QA/QC, and
- Small commercial customer survey to estimate cross-sector sales (n=920).[20]

Achievements against Plan

In PY4, the program achieved 123% of its planned bulb sales, 263% of planned MWh/yr savings, and 831% of its planned gross kW savings target.

Overall, the Residential Lighting Program exceeded its four-year planned quantity of bulbs by 962,889 bulbs, exceeded its MWh/yr savings goal by 216,774 MWh/yr (including 157,367 MWh/yr for the cross-sector sales adjustment), and exceeded its four-year gross kW reduction goal by 46,250 kW (including 46,600 kW for the cross sector sales adjustment). The program also exceeded its four-year top 100 hour kW reduction goal by 38,410 kW (including 37,610 kW for the cross sector sales adjustment). At the end of Phase 1 (May 31, 2013), the Residential Lighting Program had achieved:

- 111% of its 8,744,034 four-year planned bulb sales (9,706,923 of 8,743,034 bulbs),
- 155% of its 392,137 MWh/yr four-year planned savings (608,911 of 392,137 MWh/yr),
- 286% of its 24.9 MW four-year planned demand reduction (71.14 of 24.9 MW), and
- 302% of its 19 MW four-year planned top 100 hour demand reduction (57.41 of 19 MW)

Table 25. Residential Lighting Program Achievements

Savings Category	PY4 Planned Impacts	PY4 Verified Impacts	Total Phase 1 Planned Impacts	Total Phase 1 Verified Impacts
Quantity of Bulbs	2,152,707	2,647,830	8,743,034	9,706,923
MWh/yr[21]	90,065	237,271	392,137	608,911
kW[22]	6,300	52,340	24,900	71,140
Top 100 Hour kW[23]	n/a	n/a	19,000	57,410

[20] Includes partial completes

[21] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

[22] Ibid.

[23] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

The program had no significant structural changes in PY4. Program promotions at participating retailers began to ramp down during PY4. While the program offered a limited number of incentives for light-emitting diodes (LEDs) in PY3, none were offered in PY4. The program CSP began working with retailers to educate them on Phase 2 offerings, which will include more LEDs.

Survey Findings

Cadmus conducted two general population surveys in PY4: a residential survey and a small business survey.

For the residential survey, we stratified the survey population to reach a minimum number of 100 customers who were aware of the PPL Electric discounted bulbs and another 75 who had purchased bulbs recently (in the past three months) but were not aware of the PPL Electric discounted bulbs. As in previous years, this minimum target was necessary to conduct the net-to-gross analysis. As such, we selected a random sample of residential customers to fill each stratum. Findings are representative of each particular stratum and may be compared to previous years' results.

For the small business survey, Cadmus selected a random sample of customers in PPL Electric's small business segment to determine cross-sector sales of program-discounted bulbs. We contacted 920 customers in total, with a target of reaching 300 customers who had purchased compact fluorescent lamps (CFLs) for their business in the past six months. Results achieved 90% confidence with +/- 4.74% precision.

Table 26 contains the number of targeted and achieved surveys for each group.

Table 26. Targeted and Completed Surveys

Survey Group	Group	Target	Achieved
Residential Customers		325	301
Aware of Program, Recent CFL Purchasers	1	100	100
Not Aware of Program, Recent CFL Purchasers	2	75	75
Non- Recent Purchasers	3	75	93
Not Aware of CFLs	4	75	33
Small Business Customers		300	920
Recent CFL Purchasers	1	300	301
Non-Recent CFL Purchasers	2	N/A	619

This section provides key findings from the Residential Lighting Program's PY4 general population survey. Findings from the small business survey are contained in the separate report section, Small Business Lighting Survey.

Residential Findings

To achieve the stratification planned for the general population residential survey, Cadmus asked survey respondents whether they had heard of CFLs. Those who did not answer affirmatively were given a brief description of CFLs and asked again. We then asked respondents who indicated awareness of CFLs whether anyone in their household had purchased or received free CFLs in the previous three months. We asked separate questions regarding awareness of PPL Electric's program and observation of promotional or educational materials, to inform the quota for Group 1 (as defined in Table 26). Answers to these questions and the status of the quotas determined whether the survey proceeded or terminated. The following findings should be considered in this light.

Awareness of CFLs

Of the respondents completing the survey, 89% were aware of CFLs (268 of 301; or Groups 1, 2, and 3). This proportion is similar to those found in PY3 and PY2. Regarding PPL Electric's educational and promotional materials about the energy saving benefits of CFLs, 43% of survey respondents reported having seen such materials, roughly the same as PY3 but a decrease from 56% in PY2.

Bulbs Purchased and Used

Cadmus asked each respondent how many bulbs they either purchased or received for free during the previous three months. Responses were aggregated and then divided by the total number of respondents who purchased or received free bulbs, to derive an average of 7.80 bulbs per participant. Of recently-acquired bulbs, 93% were purchased at a retail store, down 3% from PY3, and 4% were received free.[24] Of bulbs purchased at a retail store, 5% were known to be part of a PPL Electric program. Only one respondent reported they purchased bulbs from PPL Electric's E-Power website.

A total of 81% of respondents (217 of 268)[25] reported they installed CFLs inside or outside their homes, compared to 86% in PY3. Of those who reported having ever used CFLs, the vast majority (95%) reported that they still use CFLs.

Awareness and Use of Specialty Bulbs

Respondents who were aware of CFLs in general were asked about their awareness of different types of specialty CFLs (Figure 29). Those who were aware of specific types were asked about their usage of that type. The numbers of respondents in each category and percentages of those reporting awareness and usage are shown in the charts below. Both awareness and usage have been relatively consistent over the past three program years.

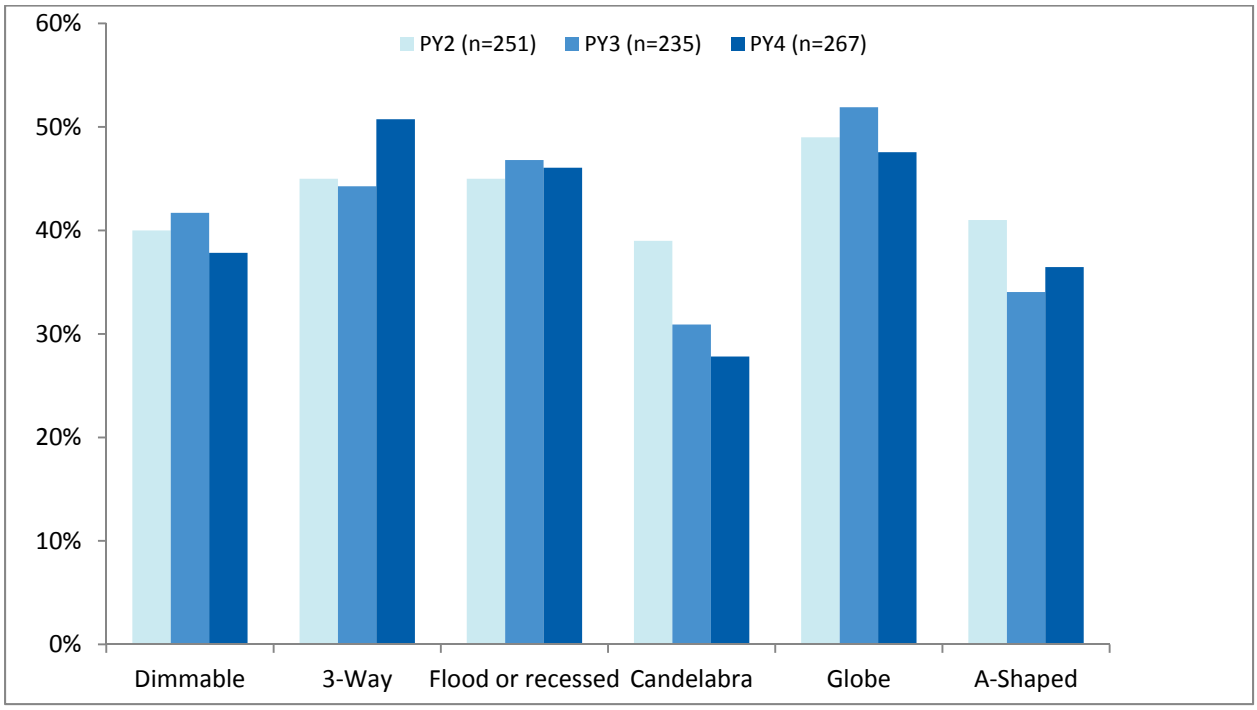
Only about half of respondents were aware of specialty bulbs. Although this survey did not collect data on LED awareness or use, surveys conducted in 2013 by PPL Electric indicate that awareness of LEDs is

[24] The survey did not ask about all locations where the respondent may have purchased bulbs. Customers who indicated they purchased bulbs at a retail store were asked how many of those bulbs were part of a PPL Electric promotion or sponsored sale.

[25] This question was only asked of those respondents who were aware of CFLs, or, Groups 1, 2, and 3 (n=268).

also low among PPL Electric customers.[26] PPL Electric's survey results found that in a hypothetical shopping scenario, just 13% of respondents reported that they would likely purchase an LED over a CFL or incandescent bulb at typical current market prices. Of those who did not select the LED, 53% said price was the main reason. Other top reasons were that the respondent was unfamiliar with them (37%) and that they "*didn't like them*" (27%). In the hypothetical situation presented, the LED was priced at $15.

Figure 29. Awareness of Specialty CFLs by Type



Source: QA7. While most CFLs are spiral shaped, CFLs also come in other shapes and some have special features. I'm going to read you a list of different types of CFLs. Please tell me whether you are aware of each of the following types of CFLs.

The number of respondents aware of each bulb type is outlined in Table 27. In PY4, only half of respondents aware of specialty bulbs reported having *used* specialty bulbs, as shown in Figure 30.

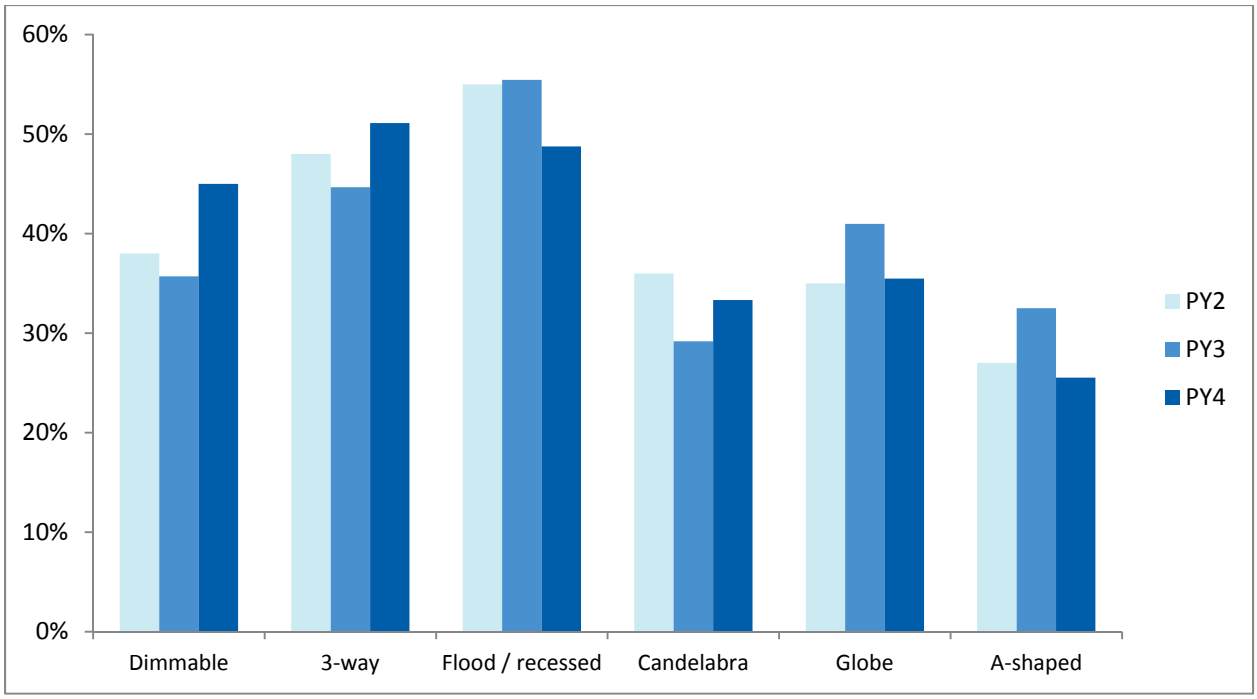
Table 27. Number of Respondents Aware of Specialty Bulbs

Specialty Bulb Type	Number of Respondents Aware (n)		
	PY2	PY3	PY4
Dimmable	66	97	100
3-way	77	103	135
Flood / recessed	71	110	121
Candelabra	67	72	72

[26] PPL Electric Lighting/CFL Survey Results (PPL Power Panel), July 2013. (Report not publically available).

Globe	81	122	124
A-shaped	63	80	94

Figure 30. Usage of Specialty CFLs by Respondents Aware of Specialty Bulbs



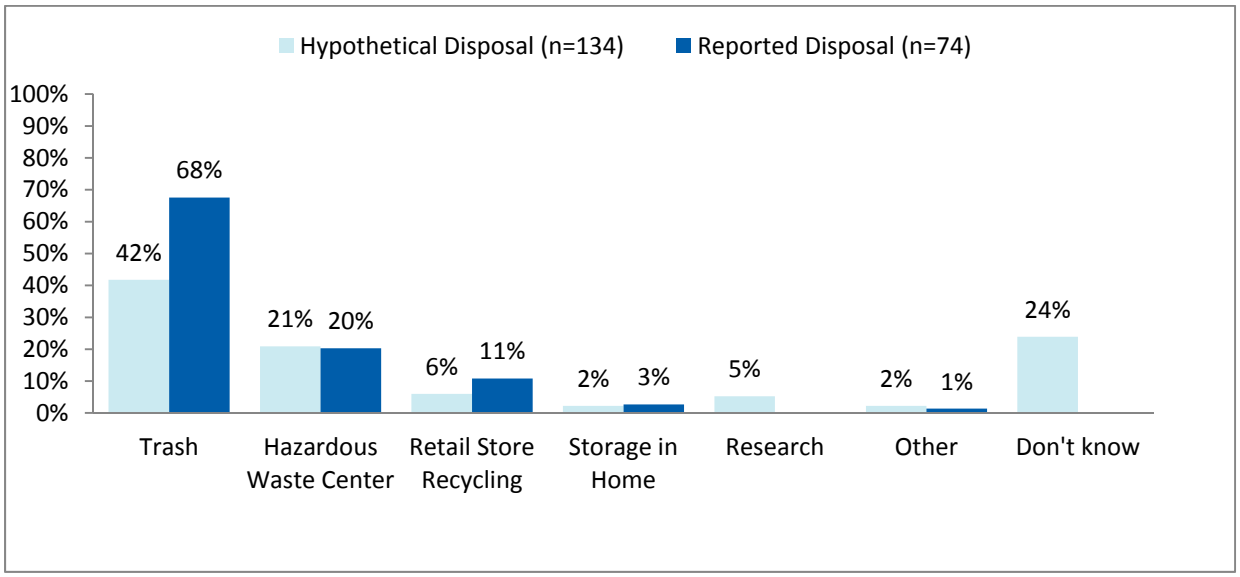
Source: QA7a-f. Have you ever used a [ ]CFL? Note: Number of respondents vary depending on question. Question was asked only of respondents who indicated they were aware of a specific specialty bulb.

Disposal of CFLs

The respondents who had used CFLs (n=217) were asked whether they disposed of any CFLs in the previous 12 months. Those who had (77 out of 217) were asked how they disposed of CFLs and those who had not disposed of any yet were asked, hypothetically, how they would dispose of a CFL.

The reported disposal methods of those who disposed of CFLs and hypothetical methods of those who had not are shown below in Figure 31. Notably, a higher proportion of those who actually disposed of a CFL reported throwing them in the trash than those who answered hypothetically. This could be a reflection of the fact that 24% of respondents who had not disposed of CFLs expressed uncertainty about how they would do so, or it could indicate a divergence between idealized and actual behavior.

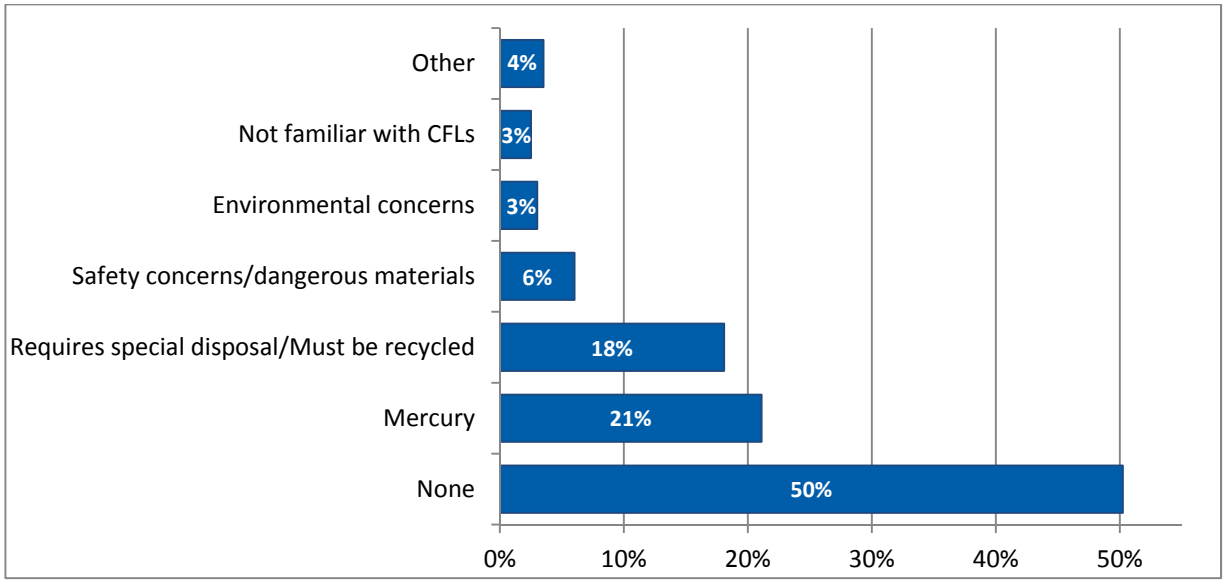
Figure 31. Disposal Behavior: Reported and Hypothetical



Source: Qs DIS3/DIS4. How did you dispose of the CFL(s)? / If you were to dispose of a CFL, how would you do so?

Figure 32 shows that half of respondents had no concerns about CFL disposal. About half expressed concerns about the disposal of CFLs, with the largest number concerned about mercury and/or special disposal.

Figure 32. Disposal Concerns



Source: QDIS5. What concerns, if any, do you have with the disposal of CFLs?

Energy Independence and Security Act Awareness

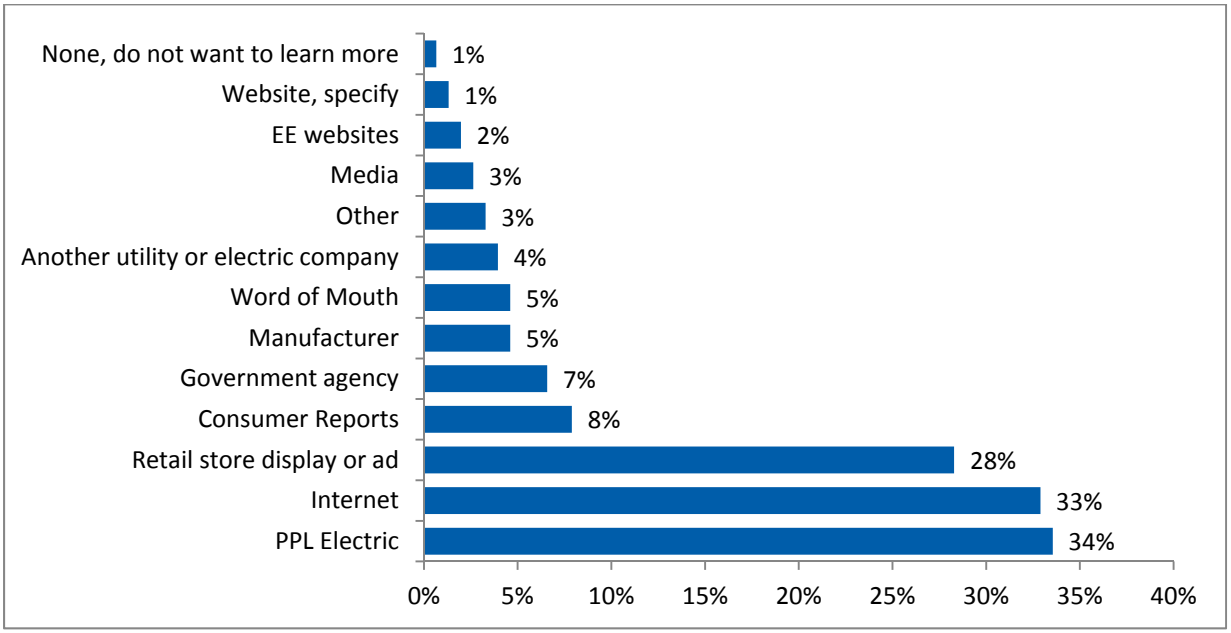
When asked whether they had heard about the Energy Independence and Security Act of 2007, or EISA requiring light bulbs that use less energy,[27] approximately half of respondents (156 out of 301) indicated awareness of this legislation. Of those, more than two-thirds knew that the law will be phased in over a period of two years.

All respondents were informed that the law will be phased in over the next two years and that many standard incandescent light bulbs will not be available by January 2014. Given this information and asked whether they thought they would be satisfied with the new light bulb choices, 65% indicated they would be satisfied. Most respondents (79%) reported they will know how to choose replacements for incandescent bulbs, as well as where to shop for energy-efficient bulbs (89% of respondents reported they will know where to shop). About half reported being concerned about an increase in cost.

Rates of awareness of EISA, level of satisfaction with choices, and degree of confidence in shopping are similar to PY3 survey results.

Of the 152 customers who indicated they knew where to get reliable information about efficient light bulbs, just over one-third reported they would go to PPL Electric for this information (Figure 33). All respondents were asked which organizations should be responsible for education about EISA and approximately one third reported that PPL Electric should fill this role (Figure 34).

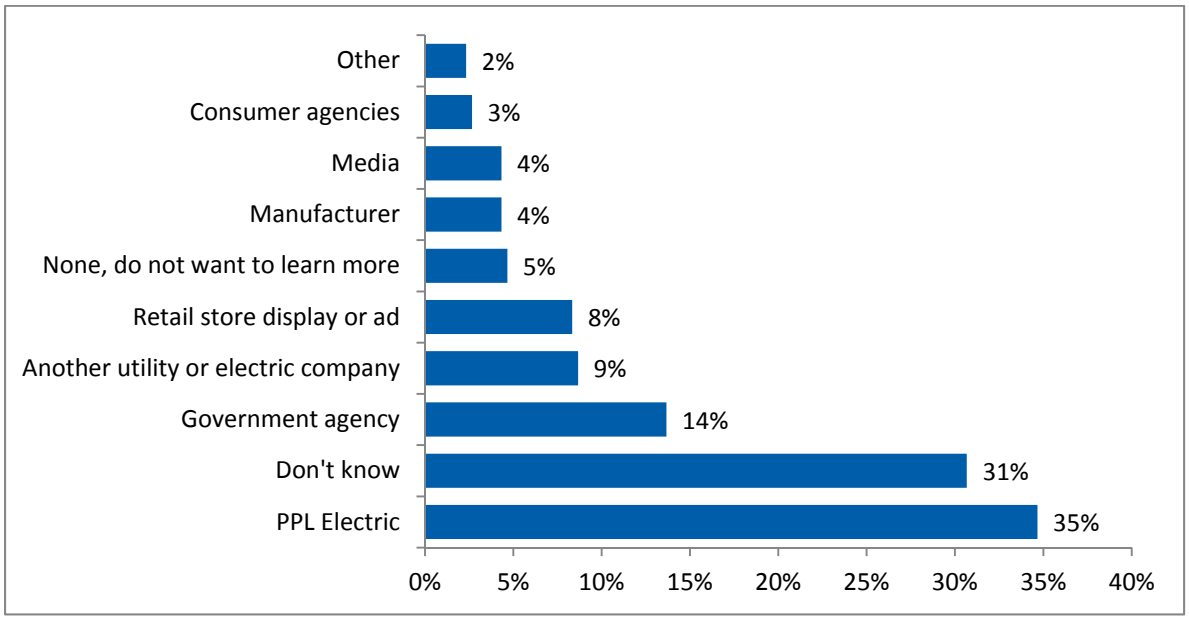
Figure 33. Reported Sources of Information about Efficient Bulbs



Source: QE14. What organizations or sources would you go to for reliable, objective information about energy efficient light bulbs? (n=152)

[27] QEI1: "Have you heard or read about the bipartisan legislation that became law January 1, 2012 requiring light bulbs to use less energy? This national legislation was signed into law by George Bush in 2007."

Figure 34. Opinions on Who Should be Responsible for Light Bulb Education



Source: QE15. What organizations do you think should be responsible for helping you understand the new light bulb law? (n=301)

Awareness of Other Programs

Approximately one-third of respondents said they were aware of other PPL Electric energy conservation rebates or incentives. Of these, one-quarter of respondents (26%) were aware of the Appliance Recycling Program, and nearly half (42%) were aware of the Efficient Equipment Program.

Satisfaction with PPL Electric

The majority of respondents (68%) ranked their overall satisfaction with PPL Electric as a provider of electric service as an 8, 9, or 10 on a scale of 1 to 10, with 10 being highly satisfied. These results are a slight improvement over PY3, in which 65% of respondents ranked satisfaction with PPL Electric as an 8, 9, or 10.

Net-to-Gross Research

Cadmus conducted research to understand how the PPL Electric Residential Lighting Program's net savings compared to other similar utility programs, and to explore factors affecting freedership for this type of program design. The upstream retail lighting component of PPL Electric's program provides incentives to CFL and LED manufacturers. The upstream incentives buy down the retail price of ENERGY STAR CFL and LED bulbs. The majority of program-discounted CFLs and LEDs are then sold in retail brick-and-mortar stores, although PPL Electric also offers program-discounted CFLs through an online retail store accessed through its website.

Comparison with Other Residential Lighting Programs

Table 28 compares PPL Electric's PY3 and PY4 freeridership scores with those of other, similar programs. This table also shows scores for different bulb types, where evaluated separately.

Comparing net-to-gross (NTG) values between programs can be difficult due to differences in evaluation techniques (for example, self-reported survey data vs. econometric studies), as well as differences in how and whether spillover is taken into account. PPL Electric's freeridership score is determined via analysis of self-reported survey data, specifically, responses from customers who indicated awareness of PPL Electric's discounted CFL program. The freeridership score is computed as a range of values, targeting a 90% confidence interval. Participant spillover, i.e., bulb purchases by customers unaware of the program yet influenced by it, is calculated by weighting the assumed proportion of customers influenced by the program (1 minus freeridership) by the number of bulbs reported purchased by respondents who were not aware of the program. Including participant spillover increases the NTG ratio.

The studies that use econometric models automatically include participant spillover in their NTG ratio calculations because they capture all program purchases and determine the proportion of purchases attributable to the program, regardless of awareness.

Market-effect spillover (downward price pressure on non-program bulbs) is not estimated for PPL Electric's upstream CFL program.

The programs chosen for comparison in Table 28 used econometric models to compute NTG ratios, the planned approach for PPL Electric's Phase 2 evaluation. Any program-induced market-effects spillover was not included in the NTG calculations. Also, the table shows the breakdown of the NTG calculations by standard vs. specialty bulb types, showing a clear difference in the NTG ratios by bulb type.

Table 28. Benchmarking Findings for Residential Lighting Upstream CFL Programs

Utility	Program Structure	Bulb Type	Verified Gross MWh/yr	Program Start Date	Year	Freeridership	Freeridership – Participant Spillover	NTGR	Method
PPL Electric	Upstream and giveaway	All	127,802	2009	2011-2012	44%-61%	22%-39%	70%	Residential customer survey
PPL Electric	Upstream and giveaway	All	156,298	2009	2012-2013	31%-47%	5%-21%	84%	Residential customer survey
Focus on Energy[28]	Upstream program, including retail appli-	Standard	143,087	2001	2012	Not reported separately	39%	61%	Econometric model using sales data
		Specialty				Not reported	59%	41%	

[28] http://www.focusonenergy.com/sites/default/files/FOC_XC_CY%2012%20Report%20Volume%20II%20Final_05-3-2013.pdf

Utility	Program Structure	Bulb Type	Verified Gross MWh/yr	Program Start Date	Year	Freeridership	Freeridership – Participant Spillover	NTGR	Method
	ances; NTG calculated specifically for CFLs					separately			
Efficiency Maine[29]	Upstream and coupons, giveaways to appli-ance rebate participants	Standard	71,617	2002	2010-2011	Not reported separately	32%	68%	Econometric model using sales data, weighted by wattage
		Specialty				Not reported separately	92%	8%	

Focus on Energy and Efficiency Maine

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 seen for specialty and LED bulbs. Additional tables in the Focus on Energy report show incentives levels by retail channel and by additional utility programs used in benchmarking. These are reproduced here as

Table 29 and Table 30.

Note that the Focus on Energy tables refer to net-to-gross as "net of freeridership," which is explicitly defined as:

$$1 - FR = \frac{Sales\ with\ Program - Sales\ without\ Program}{Sales\ with\ Program}$$

Table 29. Results by Retail Channel from Focus on Energy 2012 Evaluation Report[30]

Retail Channel	Bulb Type	Average Original Retail Cost per Bulb	Average Incentive per Bulb	Incentive as Percentage of Original Retail Price	Net of Freeridership (NTG)
Do-it-yourself	Standard	$2.57	$1.27	50%	69%
	Specialty	$6.61	$1.50	23%	41%
Dollar	Standard	$4.14	$1.25	30%	34%

[29] http://www.efficiencymaine.com/docs/Efficiency-Maine-Residential-Lighting-Program-Final-Report_FINAL.pdf

[30] http://www.focusonenergy.com/sites/default/files/FOC_XC_CY%2012%20Report%20Volume%20II%20Final_05-3-2013.pdf, pgs. 83 & 84

	Specialty	$5.00	$1.50	30%	44%
Local Chain	Standard	$2.67	$1.20	51%	64%
	Specialty	$6.46	$1.50	24%	34%
Residential Retailer	Standard	$2.00	$1.22	62%	61%
	Specialty	$5.23	$1.50	32%	37%

Table 30. Other Benchmarking Results from Focus on Energy 2012 Evaluation Report

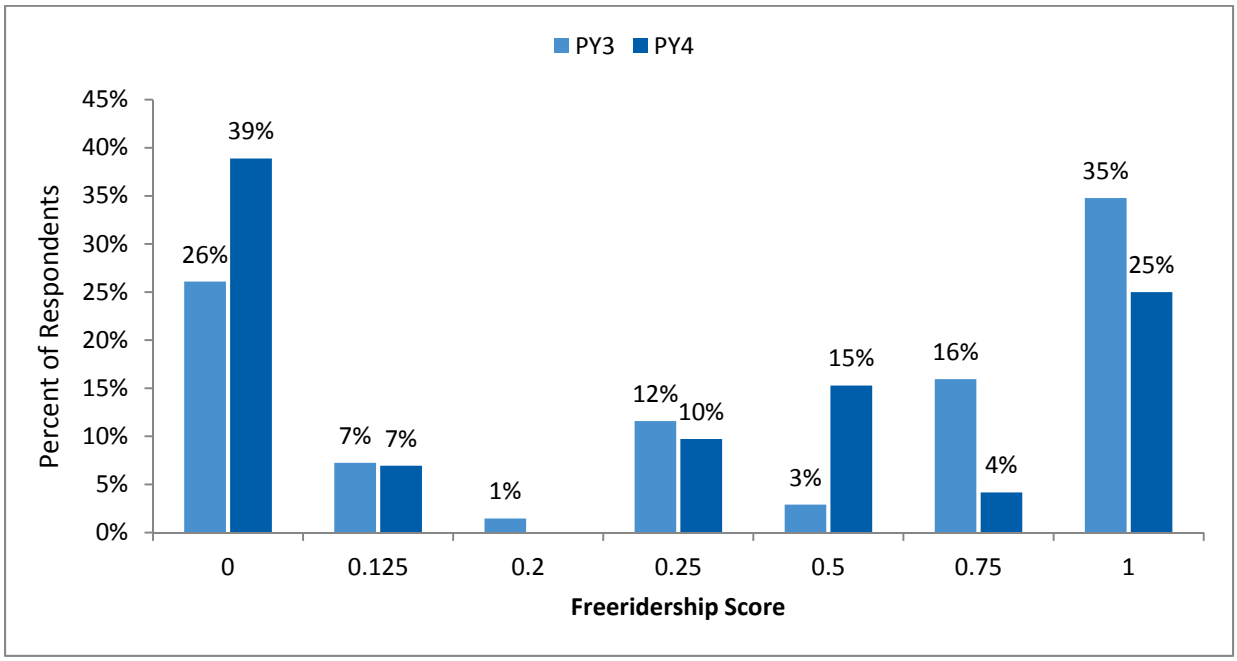
Upstream Lighting Program	Bulb Type	Average Original Retail Cost per Bulb	Average Incentive per Bulb	Incentive as Percentage of Original Retail Price	Net of Freeridership (NTG)
Focus on Energy	Standard	$2.31	$1.24	54%	61%
	Specialty	$5.63	$1.51	27%	41%
East Coast Consortium	Standard	$2.03	$1.23	61%	59%
	LEDs	$34.30	$9.69	28%	22%
	Specialty	$5.23	$1.73	33%	33%
	Reflector	$4.70	$1.82	39%	39%
Efficiency Maine 2010-2011	Standard	$3.65	$1.02	28%	68%
	Specialty	$6.77	$1.33	20%	8%
Midwest Utility 1	LED	$36.99	$13.94	38%	83%
	Specialty	$5.20	$1.90	37%	65%
Midwest Utility 2	Standard	$2.11	$1.00	47%	51%
	Specialty	$5.01	$1.56	31%	24%

Comparison of PPL Electric's PY3 and PY4 Results

The self-report survey conducted in PY4 produced an estimated freeridership range[31] of 31% to 47%, which is lower than the range of 44% to 61% produced by the PY3 survey results. Figure 35 shows the breakdown of scores by respondent. For example, in PY3, only 26% of respondents answered the freeridership questions in a manner that resulted in a score of zero for freeridership (indicating the respondent was not a freerider), whereas 39% of respondents scored zero for freeridership in PY4. Similarly, 35% of respondents in PY3 were deemed 100% freeriders, and only 25% were 100% freeriders in PY4. See Figure 35 comparing PY3 and PY4 freeridership scores.

[31] Detailed in Appendix D of the PY4 Annual Report.

Figure 35. Freeridership Scores by Year



Cadmus suggests a possibility for the reduction in freeridership from PY3 to PY4.

EISA standards are now in effect for 100-watt and 75-watt equivalent bulbs. The halogen bulbs that meet EISA requirements for incandescent lamps are more expensive than traditional incandescents, reducing the incremental cost of CFLs in these lumen ranges. This results in the incentive representing a higher proportion of the incremental cost. The Focus on Energy and Efficiency Maine evaluations suggest that this is likely to reduce freeridership. However, Cadmus believes that an incentive level that largely eliminates the incremental cost would have a greater effect on a consumer's choice. If a price-conscious consumer is presented with options that are comparably priced due to the incentive for CFLs, it would seem more likely that the consumer would choose the bulb known to use less energy, whereas this same consumer might continue to default to the lower-priced option without the incentive. While 60-watt equivalent bulbs still comprise the majority of program sales, 75-watt equivalents make up about one-quarter of program sales. Early adopters of energy-efficient bulbs were more likely to be freeriders and, now that PPL Electric's program is in its fourth year, more price-sensitive consumers are beginning to purchase CFLs.

Planning For Future Analysis

As PPL Electric begins to include more specialty bulbs and LEDs in the lighting component of its Phase 2 Residential Retail program, understanding any observed variations in freeridership by bulb type or retail channel will be important so that incentives and promotions can be structured to minimize freeridership. The proposed econometric model will allow for a more nuanced analysis of these potential drivers.

Assuming sales data are captured in a consistent fashion (i.e., bulb sales can be tracked by date and any reporting lags are known and consistent), and data regarding promotional and educational events are available, the econometric model may be able to capture program influence due to these activities. The current methodology, using survey responses, cannot adequately capture this influence.

Quarterly Variation in Bulbs Sold by Retailer

Data from the previous four quarters are shown in Table 31 and indicate variation in the number of bulbs sold quarter-to-quarter. Seasonal fluctuations in the total number of bulbs sold are to be expected, and need to be taken into account in any analysis, but the observed quarterly variation by retailer is greater than the variation in total, and the potential causes behind this need to be understood. For example, Sam's Club sold just 21,817 bulbs in PY4 Q1 and 312,371 bulbs in PY4 Q3. Assuming this is not the result of the timing of reported sales but actually reflects changes in participation by retailer, if combined with participating retailer sales data, these fluctuations could illuminate the effectiveness of promotional campaigns and/or incentives.

Table 31. Quarterly Bulb Sales by Retailer

Retailer	PY4Q1	PY4Q2	PY4Q3	PY4Q4
Ace Hardware	1,612	15,378	8,668	24,739
Batteries Plus	4,252	9,245	3,192	4,489
BJ's Wholesale Club	17,314	7,001	14,005	7,699
Costco	20,634	97,702	41,122	58,216
Dollar General		2,176	2,526	7,810
Giant Food Stores	1,383	12,682	11,194	17,357
Lowe's	71,267	79,224	152,477	93,108
Rite Aid			129	1,314
Sam's Club	21,817	149,268	312,371	63,152
The Home Depot	165,762	140,980	52,484	122,960
True Value	33,535	1,947	5,051	4,120
Walmart	181,470	256,888	88,778	114,715
Online/Etailer		110	30	24
Total	**519,046**	**772,601**	**692,027**	**519,703**

QA/QC Review

The Residential Lighting program CSP works directly with CFL and LED manufacturers, as well as retailers, to implement lighting promotions in retail stores. The program Implementation CSP (Ecova) does not have access to participating retailers' sales data for energy-efficient lighting. Thus, on a monthly basis, participating manufacturers collect CFL/LED sales data on the approved program-discounted energy-efficient bulbs from participating retailers. The manufacturers then send their sales data to the Implementation CSP, and the program CSP reformats these disparate data sets and uploads them to their own internal program database. Finally, the Implementation CSP uploads the monthly

(participation) sales data from its database to EEMIS. Only data from the Residential Lighting program Implementation CSP's database and from EEMIS are available for Cadmus to review.

Cadmus compared the energy and demand savings for each record in EEMIS to our own energy and demand savings calculations. The Cadmus calculations apply the bulb-specific inputs associated with each record (which originated from the CSP's database) to the current TRM savings equations.

For each record (unique SKU, retailer, and sales date combination), Cadmus checked that:

- Savings (kWh/yr and kW) recorded in EEMIS were calculated correctly (per TRM) based on delta watts and the installation rate and hours of use specified in the TRM.
- If the record was for a three-way bulb, the delta watts were calculated based on the highest incandescent and CFL wattages.

If Cadmus found discrepancies between the savings calculated using the bulb-specific inputs and the EEMIS-reported savings that were not the result of either a baseline change or an incorrect assumption across all bulbs for a particular SKU, we made an adjustment to *ex post* savings and the realization rate was affected.

Prior to PY4 Q2, record-level savings were computed by the CSP and delivered to PPL Electric via spreadsheets, for import into EEMIS. Over time, it became apparent that this approach was prone to error. If fact, in PY3 Q4 and PY4 Q1, the errors in the MW calculations provided by the CSP were significant. In PY4 Q1 the realization rate for MW savings was only 22%[32] as a result of these errors. The realization rate for MWh/yr savings was 98% in PY4 Q1. Therefore, beginning in PY4 Q2, EEMIS savings values have been computed using the same approach Cadmus uses. EEMIS now applies bulb-specific inputs (from the CSP's database) to the current TRM savings equations. Because Cadmus and EEMIS are using the same inputs and methods to calculate Residential Lighting savings, Cadmus did not find any discrepancies between reported and Cadmus-calculated savings other than TRM *Ex Ante* Adjustments. Cadmus continued to perform a quarterly records review to ensure this was the case and that changes to the TRM savings equations were accurately implemented.

Cadmus did not find any discrepancies between reported and Cadmus-calculated savings other than TRM *Ex Ante* Adjustments in Q2 - Q4. PY4 quarterly results and the year-to-date totals and realization rate are shown in Table 32.

[32] The realization rate for Q1 was previously reported to be 43%, due to a computational error. This amounts to an additional decrease of 1.04 reported MW. However, the records contributing to the bulk of the *ex post* adjustment had "installation" dates prior to August 1 2012, so do not contribute much to the compliance demand target.

Table 32. PY4 Realization Rate Summaries

Quarter	MWh/yr Gross	MW Gross	MWh/yr Ex Ante	MW Ex Ante	MWh/yr Ex Post	MW Ex Post	MWh/yr Realiza-tion Rate	MW Realiza-tion Rate
PY4Q1	23,183	4.8	23,130	4.8	22,676	1.04	98%	22%
PY4Q2	33,397	1.52	33,304	1.52	33,304	1.52	100%	100%
PY4Q3	37,054	1.69	36,976	1.69	36,976	1.69	100%	100%
PY4Q4	23,151	1.06	22,948	1.05	22,948	1.05	100%	100%
PY4 Total	**116,784**	**9.08**	**116,358**	**9.06**	**115,904**	**5.3**	**100%**	**58%**

Conclusions and Recommendations

Based on our findings, we suggest PPL Electric consider the following recommendations in Phase 2.

Conclusion: The majority of respondents who disposed of CFLs reported they disposed of them in the trash. Of those who had used but not disposed CFLs, when asked hypothetically, a smaller proportion said they would choose this method, with almost a quarter of these respondents expressing uncertainty about what they would choose to do. Half of respondents who used CFLs expressed concern regarding disposal.

Recommendation: Consider opportunities to increase education regarding bulb disposal.

Conclusion: Only half of all residential survey respondents were aware of the Energy Independence and Security Act (EISA) and about one third indicated they would go to PPL Electric for information about this Act.

Recommendation: Consider methods to increase education regarding EISA phase-in.

Conclusion: Residential survey findings indicate that awareness and use of specialty bulbs in PY4 are low compared to standard CFLs; PPL Electric's survey findings found that consumer awareness of LEDs is also low.

Recommendation: Explore working with the Implementation CSP (Ecova) to improve retailer stocking and promotion of specialty CFLs and LEDs. Consider marketing specialty CFLs and LEDs to small commercial customers. An increase in the number of specialty CFLs sold may also help increase program savings as baseline standards for traditional incandescent bulbs increase.

Conclusion: The net-to-gross benchmarking analyses indicates that lower incentives relative to original retail prices as seen with specialty bulbs, is a predictor of higher freeridership.

Recommendation: Increase incentive levels for specialty CFLs and LEDs.

Conclusion: The econometric model proposed as the NTG evaluation tool for Phase 2 will allow PPL Electric to examine possible differences among retail channels, as well as track the effectiveness of efforts to reduce the high freeridership seen in other programs that sell specialty bulbs and LEDs. While the econometric model itself will not necessarily reduce the freeridership score calculated, it can provide a more comprehensive understanding of the program's influence on customer purchases. PPL Electric and Cadmus are currently planning to conduct an econometric study in PY5.

PY4 Process Recommendations Status: Residential Lighting Program

Table 33 contains the status of each PY4 process recommendation made to PPL Electric.

Table 33. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Residential Lighting Program	
Increase education regarding bulb disposal.	**Implemented.** PPL is proposing a change to its Ph 2 EE&C Plan that will eliminate incentives for CFLs by PY6, provide incentives for LEDs instead, and will provide additional CFL recycling sites for consumers.
Increase education regarding the Energy Independence and Security Act.	**Implemented**. PPL is proposing a change to its Ph 2 EE&C Plan that will eliminate incentives for CFLs by PY6 and provide incentives for LEDs instead. That change will include consumer education and awareness about the benefits of LEDs (compared to CFLs and incandescents) and, directly or indirectly, information about EISA. PPL thinks it is more important for consumers to understand the relative differences in performance and savings between lighting technologies, not necessarily the details about EISA per se.
Work with program CSP to improve retailer stocking and promotion of specialty CFLs and LEDs.	**Implemented.** PPL is proposing a change to its Ph 2 EE&C Plan that will eliminate incentives for CFLs by PY6 and provide incentives for LEDs instead.
Increase incentive levels for specialty CFLs and LEDs.	**Implemented.** PPL is proposing a change to its Ph 2 EE&C Plan that will eliminate incentives for CFLs by PY6 and provide incentives for LEDs instead.

Commercial and Industrial Custom Incentive Program

For the Commercial and Industrial Custom Incentive Program, the PY4 process evaluation activities were these:

- Participant surveys (n=27),
- Net-to-Gross Literature Review and Benchmarking, and
- Database Review and QA/QC .

Achievements against Plan

In PY4 (program year ending May 31, 2013), the program achieved 199% of its planned MWh/yr savings, and 205% of its planned gross kW savings.

Overall, the Commercial and Industrial Customer Incentive Program did not reach its four-year planned MWh/yr savings goal but exceeded its planned gross kW reduction goal by 5,152 kW. The program also exceeded its top 100 demand reduction goal by 2,276 kW. At the end of Phase 1 (May 31, 2013), the program had achieved:

- 96% of its 196,708 MWh/yr four-year planned savings,
- 130% of its 17,328 kW four-year planned gross reduction, and
- 118% of its 13,000 kW four-year planned top 100 hour demand reduction.

Table 34. Commercial and Industrial Custom Incentive Program Achievements

Savings Category	PY4 Planned Savings	PY4 Verified Savings	Total Phase 1 Planned Savings	Total Phase 1 Verified Savings
MWh/yr[33]	36,495	72,565	196,708	188,924
kW[34]	4,062	8,310	17,328	22,480
Top 100 Hour kW[35]	n/a	n/a	13,000	15,276

There were no major changes to the Program in PY4. The Phase 1 program ended May 31, 2013, but PPL Electric instituted earlier deadlines for submission of applications. The applications were due March 31 for projects that required collection of pre-participation data and April 30 for those that did not. A waitlist was started in PY3 for Large C&I customers. Throughout PY4, PPL Electric added new projects to the waitlist and removed projects from the waitlist. At the end of PY4, all of the projects on the waitlist that were constructed in time to be eligible for Phase 1 were paid by PPL Electric.

[33] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

[34] Ibid.

[35] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

Survey Findings

Cadmus surveyed 70 PY3 and PY4 participants representing 81 projects in the Commercial and Industrial Custom Incentive Program. Because surveys were not conducted in PY3 and the results have not yet been reported, this report provides key findings from the PY3 and PY4 surveys. Table 35 shows the population, targets for completed surveys, the achieved number of completed surveys, and the projects represented.

Table 35. Targeted and Completed Surveys

Stratum	Population	Target	Achieved	Projects Represented
PY4				
Completed Projects	45 unique decision-makers*	21	21	23
Technical Study and Project		3	3	3
Cancelled Projects		3 (1 technical study)	3	4
PY3				
Completed Projects	84 unique decision-makers	34	33	41
Technical Study and Project		5	4	5
Cancelled Projects		4	6	5
Program Total	**129 unique decision-makers**	**70**	**70**	**81**

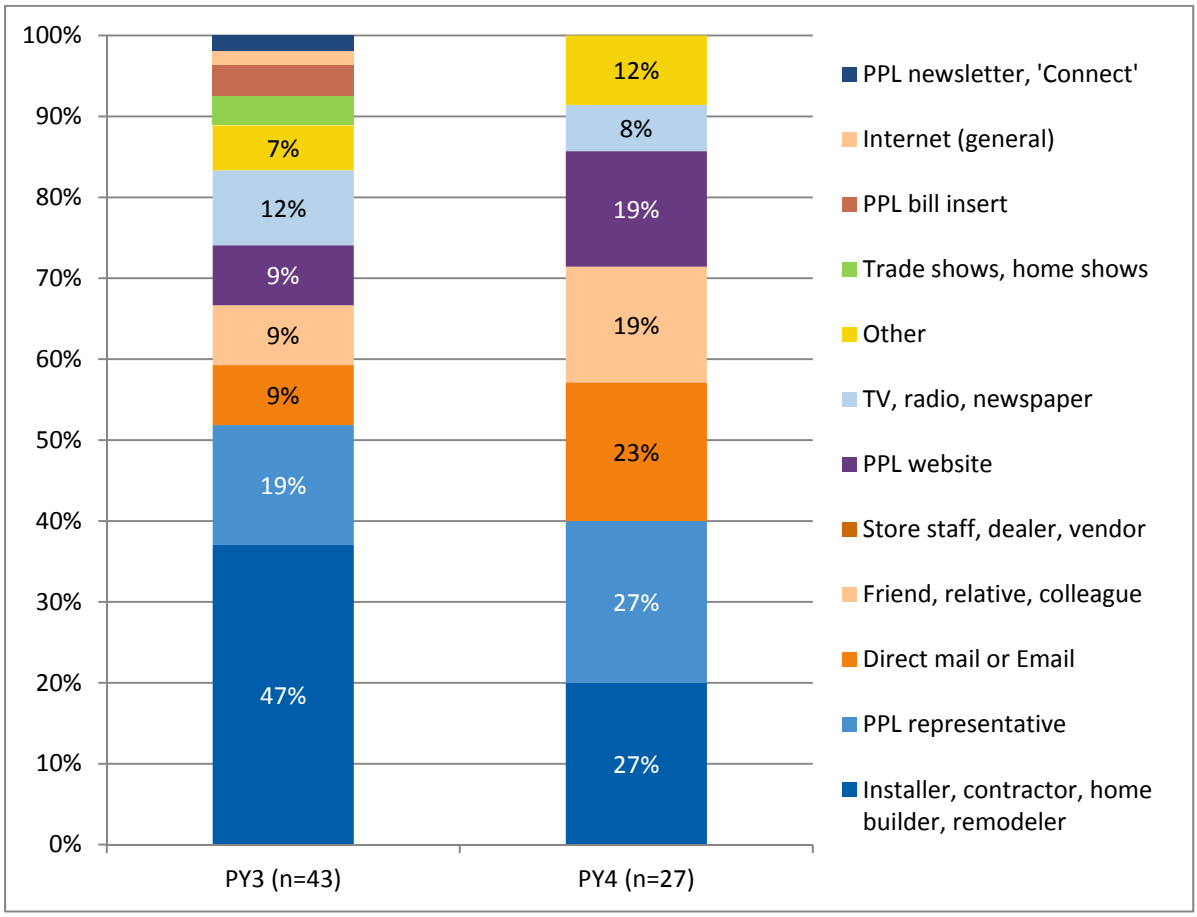
*PY4 population based on Q1-Q3 participation. Targets were modified from original sample plan based on the final number of unique decision-makers.

PPL Electric Marketing and Outreach

The top two ways that participants learned about the program in PY4 were from an installer or contractor (27%) and from a PPL Electric Representative (27%). This was followed by a PPL Electric e-mail and by researching the internet or PPL Electric's website. The ways participants learned about the program are illustrated in in Figure 36.

PY4 results differed slightly from PY3. While contractors and installers were a top method of hearing about the program in both years, in PY3 this channel was mentioned by 47% of respondents instead of 27% in PY4. Also, learning about the program from the PPL Electric website was reported more often by PY4 participants (19%) than by PY3 participants (9%).

Figure 36. How Participants Heard About the Program



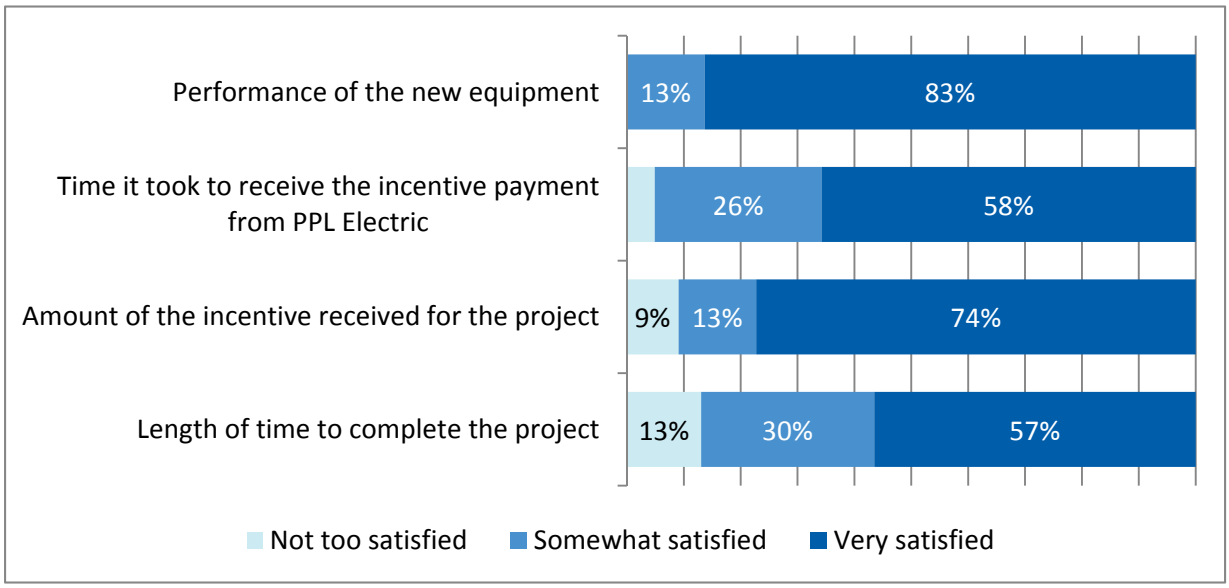
Source: M1. How did your company first learn about the Custom Incentive Program? (n=27) Response totals add up to more than 27 because respondents were able to provide multiple responses.

Satisfaction

The large majority of PY4 respondents rated their overall satisfaction with the program as *very* or *somewhat satisfied*. Seventy-three percent (73%) were *very satisfied* and 23% were *somewhat satisfied*. One participant reported being *not too satisfied* with the program because they received multiple requests for information and questions throughout the project. Overall satisfaction was very similar to PY3 (69% *very satisfied* and 26% *somewhat satisfied*).

We asked participants about their experiences with the application process, the data collection process, and other aspects of the program. In general, responses indicated that the program processes are functioning smoothly. Figure 37 illustrates satisfaction with additional aspects of the program. Findings were largely consistent with PY3 responses, although more PY4 participants reported being *very satisfied* with the incentive amount than PY3 participants did (74% compared to 55%, respectively).

Figure 37. PY4 Custom Program Satisfaction



Source: Questions F6, F7, F8, and F9. How satisfied were you with the length of time it took to complete the entire project? How satisfied were you with the amount of incentive received for the project? How satisfied were you with the time it took to receive the incentive payment from PPL Electric? How satisfied were you with the performance of the new…? (n=24)

Satisfaction with Key Account Managers (KAM) and E-Power Solutions Representatives

In PY4, 15 of 27 respondents reported that they had worked with their KAM. Of these, all reported the KAM was *helpful* or *very helpful,* and 95% of respondents who had worked with E-Power Solutions (the implementation CSP) said they were *very* or *somewhat satisfied* with their interactions with the E-Power Solutions representatives throughout the project. This is an improvement over PY3, in which just 88% of participants who had worked with their KAM described them as *helpful* or *very helpful.* Satisfaction with E-Power Solutions was similar across both years.

We asked program participants to identify the most important assistance their KAM provided during their participation with the program. Responses for both PY3 and PY4 included:

- KAMs helped put participants in touch with the right people
- KAMs answered questions about the application and kept participants on track
- KAMs answered general questions about the process and provided status updates
- KAMs provided information about the expected incentive amount

Program Areas that Worked Well

Cadmus asked respondents to provide the reason they were satisfied with the program, and which parts of the program they thought worked particularly well. The most common response for PY4 respondents was different from PY3 respondents. PY4 respondents most often indicated they were satisfied because the application and paperwork went smoothly, while the top response in PY3 was receiving the incentive (Table 36).

Table 36. Aspects Working Well, PY3 and PY4

Program Aspect	PY3 Responses	PY4 Responses
Application and paperwork went smoothly	2	8
Communication with PPL Electric and E-Power Solutions	6	4
Receiving the rebate; timeliness of incentive check	10	3
Working with the contractor	4	3
Everything works well	0	3
Installation	1	2
Outline/communication of rebate amount	0	2
Electricity savings	1	1
Design of project	0	1
Overall process was quick	1	1
Robust and straightforward M&V	2	0
Total	**27**	**28**

Source: Question PS11. Thinking about the overall program processes, what parts of the program worked particularly well? (PY4, n=25; PY3, n=40).

Areas for Improvement

Suggestions for improving the program from both participant groups are listed in Table 37. These findings were compiled from answers to seven different questions.

PY4 participants indicated challenges regarding the M&V process, project timelines, and general communication from various PPL Electric representatives about the project. Most participants found the application and paperwork process to work well, but some encouraged PPL Electric to simplify the process and reduce the amount of time spent modifying the application once it had been submitted. This was an improvement over PY3, in which the top suggestion for improvement was reducing the paperwork burden and limiting the project detail that was required (n=10). Specifically, the PY4 survey found:

- Improving the M&V process was a top suggestion. Three responses indicated that reducing the amount of data required would improve the process. Two respondents would have liked more help with the verification part of the project from E-Power Solutions or PPL Electric, and one respondent suggesting improving the overall M&V process in general.
- Respondents said they would have liked to see shorter project timelines (six respondents). One response mentioned the verification took a long time, while others were not sure which part of the process was taking a long time.
- Five respondents suggested increasing the incentive amount. One of these respondents said they installed the same product in their Pittsburgh location and PPL Electric covered less than half of what was covered in Pittsburgh.
- Five respondents said they would like PPL Electric to find ways to communicate the status of the project better. One person said PPL Electric should create a way to check the specific status of the project. One company said they checked the online status, but it said “in

progress" most of the time, and they did not know exactly what that meant. Three others would like to have received a status update throughout the process.

- Five respondents said PPL Electric or E-Power Solutions could improve communication by being more proactive in contacting businesses about the overall project process, program dates, and when money is available.
- Four responses mentioned paperwork. Three comments were about the amount of duplication and the number of times the application required changes or corrections.
- Three responses said customers would like a better understanding of each person's role and responsibility and would like to decrease the number of people involved in the project.
- Three responses called for increased training for PPL Electric staff regarding the overall process and more training for technical staff about gathering verification data.

Table 37. Suggestions for Improvement, PY3 and PY4

Suggestion	PY3 Responses	PY4 Responses
Improve the M&V process by providing more information about how much data will be needed and what type of information is needed; provide more assistance with the verification process	3	6
Improve the overall project time	5	6
Increase incentive amount	3	5
Provide more updates on progress; provide more descriptive status information than "in progress"	1	5
Reduce the paperwork burden; limit the project detail needed, limit duplication of information; reduce number of times we have to go back and forth	10	4
Reduce the number of people and companies involved with the process so that there is less confusion about responsibilities	1	3
Better communication; be more proactive	1	3
Provide information about program dates and whether money is available	0	2
Improve training for PPL Electric/E-Power Solutions staff so they understand the process better	0	2
Clarify the project parameters	2	1
Increase the technical staff's knowledge of the program and how to collect verification data	2	1
Turn around the incentive faster	1	1
Allow vendors to work on behalf of participants	0	1
Add the store number to the paperwork for companies so that it is easier for companies with multiple locations to manage the paperwork and projects	0	1
Implementers should do everything	0	1
Nothing to Improve	22	13

Source: Questions PS2. Could you briefly explain why you gave this rating?, PS6a, And why do you say that they were not helpful?, PS9, And why do you say that?, PS10, Was there anything PPL Electric or your KAM or E-Power Solutions could have

done to improve your experience with the program overall?, C2, You mentioned that some aspect of the process was difficult. Can you briefly describe why?, F10, You mentioned that you were not satisfied with some aspect of the program. Can you briefly describe why?, and LS5, Do you have any further comments on the Custom Incentive Program, or suggestions for improvement?(n=27). Response totals are greater than number of respondents because multiple answers were given.

Participant Motivations and Decision-making

Respondents said the most important factor in deciding to participate was to obtain the incentive (18 of the 26 respondents). This was lower in PY3 where 59% (23 of the 39 survey respondents) gave this as the most important factor. The next most important factor in PY4 was to save money on utility bills (46%). This was also lower in PY3 (33%). Table 38 shows the factors that contributed to participation in the program for both years.

Table 38. Decision Making Factors in PY3 and PY4

Decision-Making Factors	PY3 Responses	PY4 Responses
To obtain an incentive	23 (59% of 39 respondents)	18 (69% of 26 respondents)
To save money on utility bills; electric bills	13 (33% of 39 respondents)	12 (46% of 26 respondents)
To obtain a return on investment, quicker payback	3	3
To save energy	7	2
Use as a marketing tool; share with others in industry	0	2
To replace broken or old equipment	4	1
To acquire the latest technology	0	1
Recommended by another industry contact; word of mouth	0	1
Decision of corporate management who may be in another location	2	1
PPL Electric or E-Power Solutions representative	0	1
To help protect the environment	1	0
To improve comfort (better lighting, less noise)	2	0
Able to implement more parts of the study	0	1
Total Responses	**55**	**43**

Source: Question IN1. What were the most important factors that influenced your decision to participate in the Custom Incentive Program? (n=65). Response totals add up to more than 65 because respondents were able to provide multiple responses.

Corporate Policies

We asked program participants if their companies had corporate policies related to energy-efficiency standards that were considered when purchasing new equipment or making improvements to the facility. Corporate policies were more prevalent among PY3 participants than among PY4 participants, and they were also more important to customers in their decision to participate in the program in PY3.

Forty-two percent of PY3 program participants (16 out of 38) who answered this question said their company has corporate policies relating to energy efficiency. Of these respondents, 12 said the company purchases energy efficiency equipment if it meets payback or return on investment criteria. All of the companies said this policy was either *very important* (15 out of 16) or *important* (1 out of 16) in their decision to participate in PPL's Custom Incentive Program. In contrast, three out of 25 PY4 respondents (12%) said their companies had corporate policies. One company said this policy was *very important* and the other two said it was *somewhat important* in their decision to participate in PPL Electric's Custom Incentive Program.

Measure Installation Decision-Making for Custom Projects

Cadmus asked participants about decisions regarding the equipment they installed. The top three sources of information about which equipment to install and how to design the energy-efficiency project were the same: consultants, internal staff, and equipment distributors. Among PY4 participants, the top source for information about which equipment to install was equipment distributors (38%) while the top source of information when designing a project was consultants (38%). This differed slightly for PY3 participants, who reported using internal staff the most when determining which equipment to install (43%).

A large percentage of both PY3 and PY4participants (85% and 75%, respectively) replaced existing equipment with the equipment they installed through the program. Further, the majority (74% in PY3 and 65% in PY4) said their equipment was not scheduled for replacement or upgrade before they decided to participate in the program. Cadmus also asked those who were replacing existing equipment about the operating condition of the baseline equipment. Again, most participants reported that they replaced the equipment before the end of its useful life, that is, it was still in working condition when they participated in the program. This was true for 68% of PY3 participants and 83% of PY4 participants.

Technical Studies

We spoke with a total of nine companies that completed a technical study before installing measures (five in PY3 and four in PY4). Three of these companies cancelled their project after conducting the study, but Cadmus asked them about their experiences completing the study.

All respondents said the application process and finding a company to conduct the technical study was *easy* or *very easy* to complete, and all respondents were satisfied with the amount of incentive they received for the technical study.

Value of Technical Study

Most of the respondents (eight of nine) said the information included in the technical study was *very valuable* and one PY3 respondent said it was *not too valuable*. Four respondents said their firm had independently identified the same actions that were recommended in the technical study, and five said they had not.

We asked the seven PY3 and PY4 respondents who completed the technical study and went on to complete the custom project how important the technical study was in their decision to proceed with the project, and further, whether they would have implemented the same equipment or improvements without the study.

Table 39 shows the responses to these questions for participant groups.

Table 39. Technical Study Value

Respondent	How important was the Technical Study in your decision to proceed with the project?	If you had not done the Technical Study, how likely is it you would have installed the same equipment or completed the same project?
PY3		
1	Very important	Very likely
2	Very important	Not likely at all
3	Important	Very likely
4	Not too important	Likely
PY4		
1	Very important	Not likely at all
2	Important	Not likely at all
3	Very important	Not too likely

Implementation of Technical Study Recommendations

Three out of seven respondents who completed both a technical study and a custom project installed all the measures recommended in the study. Participants' reasons for not implementing all of measures included budgetary reasons and strategic or corporate changes within the company. Of the three cancelled projects, one company reported that they did not proceed because the return on investment was not high enough and have no plans to follow up with the recommendations. Two others reported that the delay was due to financial reasons, but indicated the company plans to follow-up with the technical study recommendations in one to three years.

Although not all respondents implemented 100% of the technical study recommendations, Cadmus found that projects in PY3 and PY4 that were associated with a technical study had higher kWh/yr savings than other projects, on average. Across both program years, 22 projects completed a technical study prior to implementation of the project, with an average savings of 896,349 kWh/yr per project. There were 194 projects without a technical study, with an average savings of 622,609 kWh/yr per project.

Cancelled Projects

Cadmus interviewed six other customers who began the process to complete either the technical study or a custom project but did not receive an incentive. Table 40 details the reasons for cancellation, whether they moved forward with the project even though they did not receive an incentive from PPL,

and the type of equipment they installed. Notably, three of the four cancelled projects in PY3 still moved forward with installing the high-efficiency equipment they planned.

Table 40. Cancellation Reasons

Cancelled projects	Reported reason for not continuing with program	Project Installed without Incentive?	Equipment
PY3			
1	Lack of available incentive funds	Yes	2 VS Compressors
2	Equipment did not qualify for program	Yes	High efficiency HVAC unit for a pump station; 1 rooftop unit and 3 room units.
3	Taxes on incentive amount were not worth going through the process	Yes	1 Free air system
4	Not Sure	No	n/a
PY4			
5	Not Sure	Not Sure	n/a
6	Corporate restructuring	No	n/a

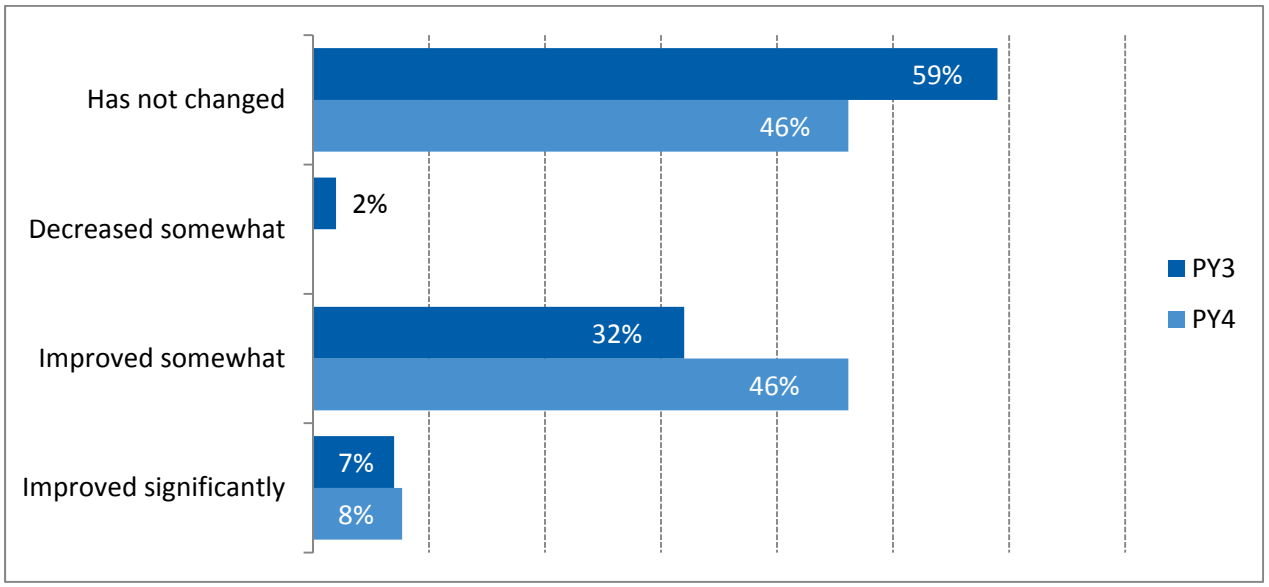
Utility Satisfaction

Overall, most PY4 survey respondents are satisfied with PPL Electric as a provider of electric service to their company; 80% of respondents ranked PPL Electric as an 8, 9, or 10 (on a scale of 1 to 10, with 10 being outstanding). This is consistent with satisfaction reported by respondents who participated in PY3 (83% ranked PPL Electric as 8, 9, or 10).

We asked respondents if their opinion of PPL Electric changed since participating in the Custom Incentive Program and more than half of PY4 respondents (54%) said their opinion *improved significantly* (8%) or *improved somewhat* (46%). Forty-six percent (46%) said their opinion had not changed. In PY3, 7% said their opinion had *improved significantly* and 32% said it had *improved somewhat*. Almost sixty percent (59%) said their opinion had not changed.

Opinions of PPL Electric have changed since PY3 and are represented in Figure 38. The percentage of respondents who said their opinion *improved significantly* or *improved somewhat* increased from 39% in PY3 to 54% in PY4.

Figure 38. Opinion of PPL Electric, PY3 and PY4



Source: Question LS2. Please tell me which description fits with your experience best. After having participated in the Custom Incentive Program, has your opinion of PPL Electric improved significantly, improved somewhat, decreased somewhat, decreased significantly, or has not changed? (n=27)

Suggestions for Additional Commercial Incentives and Services

Across both participant groups, 14 respondents mentioned equipment or programs they would like to see PPL Electric offer in the future. Responses included:

- Lighting: interior lighting for apartments, outdoor lighting, LEDs (5 mentions)
- Solar panels (3 mentions)
- Refrigeration (2 mentions)
- Wind energy (1 mention)

One customer said they would like PPL Electric to offer energy audits; that respondent was probably not aware of the opportunity to conduct a technical study.

Net-to-Gross Research

This memo section summarizes recommendations to reduce freeridership in Custom and prescriptive rebate programs. These recommendations were compiled from various Cadmus evaluations, recommendations from Cadmus program managers based on their experience, and an interview with Phil Degens, head of Evaluation at the Energy Trust of Oregon. It also summarizes net-to-gross ratios found in Cadmus' research of other Custom incentive programs offered by other utilities.

Recommendations to Reduce Freeridership

These recommendations are applicable to all energy efficiency programs, and not just Custom incentive programs. However, special emphasis is made to direct recommendations to Custom programs. Custom

programs, by their nature, are different from prescriptive programs and may be more prone to freeridership than prescriptive programs.

The best advice is to design or redesign energy efficiency programs for best effects and to encourage the kind of participation desired. Once the program has launched, we shouldn't second guess participation by adding restrictions. Once launched, it's best to let the implementer charge ahead (within reasonable program eligibility rules), and get as many participants as possible without a lot of restrictions, and without trying to winnow out free riders. This is accomplished through program design in such a way that makes the program easy to implement but not easy to game.

To update the program offering to reduce free ridership consider the following.

- Expect some freeridership and determine what is acceptable within regulatory requirements and funding limits. No program can expect zero freeridership. For many utilities and commissions, 20% is acceptable and a 'default.' See the summary tables in the next sections of this memo for a sample of results from recent evaluations. Also see the CA 2011 DEER tables listing NTG ratios applicable to CA.
- Require an application prior to measure purchase. Even though PPL allows retroactive projects, the application (and approval) must precede the purchase and equipment order.
- In general, ensure all projects and measures that are rebated are above the current code or standard. No incentives should be provided to bring old equipment up to current codes or standards, or for routine maintenance.
- Increase the measure specifications and perhaps the rebates to encourage customers to install measures beyond codes/standards.
- When equipment is expensive (equipment that goes beyond code to premium), help out with a worthwhile and hefty rebate. This is often needed to engage the customer to participate and go beyond code to the premium level.
- Do not place participation restrictions based on payback period. Even if measures have payback less than 12 or even 6 months, it is worth doing these if the customer would never have installed the measure in the absence of the program.
    - The key here is that the measure/project would never have been completed without the program. That is, the measure might not be installed because the customer doesn't know about the measure/action, or it just doesn't rise to the top of their list without help, or it's too small to think about, etc. Excluding these projects based on payback alone could leave easily obtainable savings on the table.
    - Follow up by investigating why short payback measures have not been done before.
    - Some utility programs do include eligibility restrictions based on payback period, e.g., measures that payback within 12 to 18 months are not rebated, but we do not recommend using this restriction.
- Consider reasonable measure bundles that don't force or delay participation. This is more easily accomplished in residential programs than in commercial programs. However, there are some examples where this can be accomplished in non-residential programs.

  - Consider requiring controls with lighting. As customers are upgrading lighting and EISA comes into play, oftentimes upgrades occur to bring installations into compliance. This is an opportunity to require going beyond by requiring controls.
  - The same may be true of many motor applications; require premium efficiency motors and VSD.
  - In other words, design the program to assist with controls.
- Make sure the customer has a clear understanding of the purpose of the technical study and/or the program rebate: that it enables things to happen that would not otherwise. Educate KAMs to identify and emphasize projects that would not have been completed in the absence of the program.
  - For example, the Focus on Energy program implementation manual and the application form state that the program's resources and financial incentives are designed help to implement projects that "otherwise would not be completed…" The application states:
    - Focus on Energy works with eligible Wisconsin residents and businesses to install cost-effective energy efficiency and renewable energy projects. Focus on Energy information, resources and financial incentives help to implement projects that otherwise would not get completed, or to complete projects sooner than scheduled. Its efforts help Wisconsin residents and businesses manage rising energy costs, promote in-state economic development, protect our environment and control the state's growing demand for electricity and natural gas.
- The application can include questions about the current status of the project (for example, the customer is considering the project, getting bids, received internal company approval, ordered equipment, etc.)
  - Here is an example application; however, we do not know whether project applications are rejected if the customer started installation (Section 8. Question 1). http://www.focusonenergy.com/files/Document_Management_System/Business_Programs/Applications/TM_Custom_Comprehensive_3.31.13.pdf
  - Consider including the projected start date (and completion date) on the application form.
  - An application form used in Arizona screens out projects where the measure has already been ordered or purchased.
  - We know of other utilities that ask screening questions about the stage of the project, reasons for applying to the program, payback period, etc. We are investigating how the questions are used to screen for eligible projects and to understand what message is given rejected applicants.

Computing the Freeridership Rate

The following are some of the good practice procedures that Cadmus follows when computing freeridership, particularly in non-residential programs.

- Compute freeridership for the individual measures and not the project as a whole if there are multiple measures.
- Consider all program components when assessing freeridership, including technical studies to identify applicable measures and technologies. If the study was important to the customer's decision to install the measure, the customer is not a free rider.
- Freeridership questions are asked specifically about the technical study/assessment and another set of questions are asked about the rebated measure.
- Determine whether the customer would have installed the measure/practice without the program and that no program component (including technical studies and assessments) was important (influenced) the customer's decision. The customer is a FR only if no facet of the program was important to the decision.
- Ensure the respondent is the financial decision maker who can answer questions about why the company decided to participate.

Once data are collected:

- Weight the freeridership scores by the verified energy savings so that larger projects have more weight than smaller.
- Review the measures with high freeridership to focus on those that may need rebate modification. If 50% of customers say they would install the equipment without any program component (e.g., the tech study or rebate was not important to their decision to proceed) then it's time to revisit the measure.
- As noted above, changes may include dropping the measure, increasing the energy efficiency requirement to the next level up (e.g., dropping rebates for SEER 14 air conditioners and only rebating minimum SEER 16 units), decreasing the rebate amount, or increasing the rebate if the specifications are increased.

Net-to-gross Ratios

This section provides tables listing freeridership rates Cadmus found in other programs. See also the DEER 2011 report and appendices for the NTGR that CA applies to compute adjusted gross savings.

Cadmus Studies – Some Examples

Table 41 summarizes results from a number of recent Cadmus evaluations. Freeridership exists to varying degrees in all Custom incentive programs. These are sorted by state; not all reports are publically available. Freeridership ratios are often around 20%. Note that PPL (PA example) is higher, however, this survey was conducted early in Phase 1 and retroactive projects were allowed. We expect freeridership to be higher when retroactive projects are allowed. The next round of surveys for PPL should see a reduction in freeridership.

Table 41. Net-to-Gross Ratio Benchmarking Results

State	Public/Private Utility	Evaluation Period	Program Year	Program Type	Sector	NTGR	FR
AZ	Private	2011	3	Custom	C	87%	13%
AZ	Private	2011	3	Custom	C/I	79%	21%
AZ	Private	2011	--	Custom	C/I	99%	1%

AZ	Private	2011	1	Custom	C/I	94%	5%
ID	Public	2008	1	Custom	C/I	75%	25%
MD	Private	2009	1	Custom	C/I	73%	n/a
MD	Private	2010	1	Custom	C/I	73%	n/a
PA	Public	2011	2	Custom	C/I	31%	69%
UT	Public	2005-08	2000 or earlier	Custom	C/I/A	87%	13%
UT	Public	2007-08		Custom	C/I	84%	17%
WA	Public	2005-08	2000 or earlier	Custom	C/I/A	89%	11%
WY	Public	2009-10	--	Custom	C/I/A	80% (planning)	n/a
CO	Public	2011	DSM since 1996	Prescriptive Custom	C/I	83%	n/a
ME	Public	2010	8	Prescriptive Custom	C/I	66%	34%

California Methodology

In CA, adjusted gross savings are reported. In this procedure, verified gross savings are determined. These are adjusted by the net-to-gross ratio (NTGR) to report the adjusted gross savings. These are not considered net savings.

The bridge period of 2009 made the next California EE program cycle 2010-2012, and now CA is in a "transitional period" of 2013-2014. The CPUC's decision about net-to-gross, free-ridership and spillover for the current program cycle is Decision 12-05-015, "Decision Providing Guidance on 2013-2014 Energy Efficiency Portfolios and 2012 Marketing, Education, and Outreach."[36] Further information on the DEER database and decisions about the current NTGR can be found on the CPUC's website.[37]

QA/QC Review

This section summarizes factors affecting the Custom Incentive Program's realization rates during PY4.

The major factor that affects the realization rate is the extent to which the program implementation team bases the incentive and savings claim on evaluated and verified savings. For projects that have been verified prior to claiming savings and paying incentives, the realization rate is generally 1.0. Where a significant portion of savings comes from projects that are paid prior to verification, the realization rate is less certain. The "real-time" evaluation approach also involves a discussion of baselines and

[36] http://www.calmac.org/events/Decision_12-05-15.pdf

[37] http://www.energy.ca.gov/deer/ and http://www.deeresources.com/DEER2011/download/2011_DEER_Documentation_Appendices.pdf

measurement and verification approaches with the evaluator prior to application approval, which helps the implementer avoid large adjustments to the *ex ante* savings and minimizes the impact on customers by reducing or eliminating multiple metering and site-visits by the implementer and evaluator.

There were two large combined heat and power (CHP) projects in which PPL Electric paid the incentive prior to verification. This was done to avoid the long delay in customer payment; verification prior to payment would have required waiting several months for sufficient post-installation output data to be collected. For both of these projects, the realization rates for energy savings were slightly larger than 100%.

The projects classified in the EM&V small-strata are evaluated and savings verified after the incentive is paid. Verified savings generally do not equal the *ex ante* (reported) savings. However, small-strata projects contributed less than 20% of total program savings, so have a relatively modest impact on the program realization rate. All projects with reserved savings less than 500,000 kWh/yr are placed in the small strata.

No problems were encountered with the implementer's database, or project applications. A data tracking issue within EEMIS, the PPL Electric program database, was discovered early in PY4. This problem surrounded the use of generic measure codes which often did not correspond well to the types of projects being completed. This complicated the program cost-effectiveness calculations, because appropriate measure lives are needed for each project type. After identifying this issue, Cadmus, EPS, and PPL Electric revised the measure codes to include a greater level of specificity in Phase 2.

Conclusions and Recommendations

Based on the findings, we suggest PPL Electric consider the following recommendations in Phase 2.

Conclusion: Overall satisfaction with the Custom Incentive Program is high, but when asked how PPL Electric could improve the program, participants indicated challenges regarding project timelines and suggested that general communication from various PPL Electric representatives about the project could be improved.

Recommendation: PPL Electric should consider implementing some methods to improve communications, such as:

- ***Manage initial expectations regarding the timeline of the entire project, and possibly for each project stage or milestone.*** This would help address concerns some participants expressed about the project length and confusion about the process. This information could be communicated as a general guideline in the form of a program brochure or factsheet posted on the website, and then communicated more specifically based on unique project circumstances once the application has been received and accepted.
- ***Develop a protocol or tool for E-Power Solutions staff to communicate project status, needs, and timelines to the customer.*** Status updates were suggested by participants as a

way to improve the program so that they can stay aware of each phase of the project. This protocol could include either an online tracking tool, or a simple e-mail template for implementers to use for regular reporting on project milestones, expected completion dates for various stages, scheduling requests, and anticipated needs from facility staff, including M&V data.

- ***Develop a simple flow chart outlining roles and responsibilities for PPL Electric KAMs, E-Power Solutions technical staff, the customer, and any other parties involved in the program.*** Some participants expressed concern regarding the number of people involved in the project process. A flow chart with roles and responsibilities of each person or company would clarify the process, minimize duplication of efforts, and streamline customer touch-points.

Conclusion: Many participants found the application and paperwork process to work well, but when asked what PPL Electric could do to improve the program, some encouraged PPL Electric to simplify the process and reduce the amount of time spent modifying the application once it had been submitted.

Recommendation: PPL Electric should consider some possible methods to streamline the process, such as developing a simple document outlining tips and guidance on the application process. The document would be published on the website and would include information about how to avoid common application mistakes or roadblocks. Consider including examples of energy savings calculation worksheets for common measures, and an example of what PPL Electric expects for a measurement and verification plan. This information would help participants understand what is needed for a successful application and may decrease the amount of time spent modifying or updating application materials.

Conclusion: The Phase 1 measure codes used to track projects in EEMIS were too generic and sometimes not applicable to the types of projects submitted.

Recommendation: Program EEMIS with the new measure codes developed jointly by Cadmus, EPS, and PPL Electric during PY4 and use them in Phase 2 (PPL has already implemented this recommendation).

Conclusion: The program realization rate has remained high and consistent throughout Phase 1 partially due to the real-time evaluation approach and coordination between implementation and evaluation teams.

Recommendation: We recommend continuing this approach into Phase 2.

PY4 Process Recommendations Status: Custom Incentive Program

Table 42 contains the status of each PY4 process recommendation made to PPL Electric.

Table 42. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC
Commercial and Industrial Custom Incentive Program	
Consider ways to improve communications with customers.	**Being Considered.** PPL will review these recommendations with its C&I CSP and implement them if warranted to improve customer satisfaction or to achieve savings objectives within budget.
Identify opportunities to streamline the application and paperwork process.	**Being Considered.** PPL will review these recommendations with its C&I CSP and implement them if warranted to improve customer satisfaction or to achieve savings objectives within budget.
Add new measure codes in EEMIS, tailored to the Custom Program measures (PPL has already implemented this recommendation).	**Implemented.**
Continue the real time evaluation approach and coordination between implementation and evaluation teams.	**Implemented.**

Energy Efficiency Behavior and Education Program

For the Behavior and Education Program, Cadmus's main PY4 process evaluation activities included two telephone surveys with participants (n=175) and nonparticipants (n=152).

Achievements against Plan

In PY4, the program achieved 155% of its planned MWh/yr savings, 130% of its planned gross kW savings, and 140% of its planned top 100 hour kW savings. The program achieved 90% of its participation goal in PY4.

Table 43. Behavior and Education Program Achievements

Savings Category	PY4 Planned Impacts	PY4 Verified Impacts	Total Phase 1 Planned Savings*	Total Phase 1 Verified Impacts
MWh/yr[38]	23,504	36,470	23,504	36,470
kW[39]	5,397	7,000	5,397	7,000
Top 100 Hour kW[40]	n/a	n/a	5,000	7,003
Participants	104,000	93,924	257,790	253,404

*Program measures have a one-year measure life and savings do not carry forward after the year in which they occurred.

Survey Findings

The Behavior and Education Program is a randomized controlled trial with the key feature that all eligible customers are randomly assigned by the third party program administrator (the implementation CSP) to the participant group (the group that receives Home Energy Reports) or the nonparticipant group.

In PY4, Cadmus surveyed a random sample of 175 Behavior and Education Program participants and 152 nonparticipants. The participants and the nonparticipants are selected from two groups: legacy and expansion. The legacy group is defined as participants that have been receiving Home Energy Reports (HERs) since May 2010, and the expansion group is defined as those who began receiving reports in May 2011. In addition to the different start dates, the two groups had different criteria for being selected into the program.[41] Therefore, for some questions, the survey findings in this report are presented separately for legacy and expansion customers.

[38] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

[39] Ibid.

[40] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

[41] PPL Electric customers were eligible for the expansion group if their annual consumption exceeded 22,000 kWh or if their annual consumption exceeded 16,000 kWh and they had previously participated in another PPL

Table 44 shows the survey strata population, targets for completed surveys, and the achieved number of completed surveys. The participant sample included some customers who previously participated, but chose to opt out of the program. Results achieved 90% confidence with 10% precision at the program level.

Table 44. Targeted and Completed Surveys

Survey Group	Q1-Q3 Population*	Target	Achieved
Participants			
Legacy Group Participants	42,823	75	75
Expansion Group Participants	47,649	75	75
Opt outs	194	40	25
Total Participants	*90,666*	*190*	*175*
Nonparticipants			
Legacy Group Nonparticipants	42,674	75	75
Expansion Group Nonparticipants	21,880	75	77
Total Nonparticipants	*64,554*	*150*	*152*

* The sample was selected from three quarters but is representative of the full PY4.

This section provides key findings from the Behavior and Education Program's PY4 participant and nonparticipant surveys. We refer to all those customers who received Home Energy Reports (HERs) as participants, and all those who did not receive HERs as nonparticipants. When the survey was conducted in March 2013, the legacy group participants were almost 36 months into the program and should have received approximately 18 reports. The expansion group participants were almost 24 months into the program and should have received 12 reports.

Awareness of PPL Electric Programs

The survey began with questions to determine the level of awareness of PPL Electric energy-efficiency programs among the participants and nonparticipants.

- Sixty-one percent of the participants (n = 175) and 51% of the nonparticipants (n=152) said that they were familiar with PPL Electric's energy-efficiency programs.
- Participants reported that they were aware of PPL Electric energy-efficiency programs more often than nonparticipants. The percentage responses are shown in Table 45. The difference in responses between the participants and the nonparticipants is significant for the expansion group, but not for the legacy group.

Electric energy-efficiency program. In contrast, participants in legacy group were eligible for the program if their annual consumption exceeded 18,000 kWh.

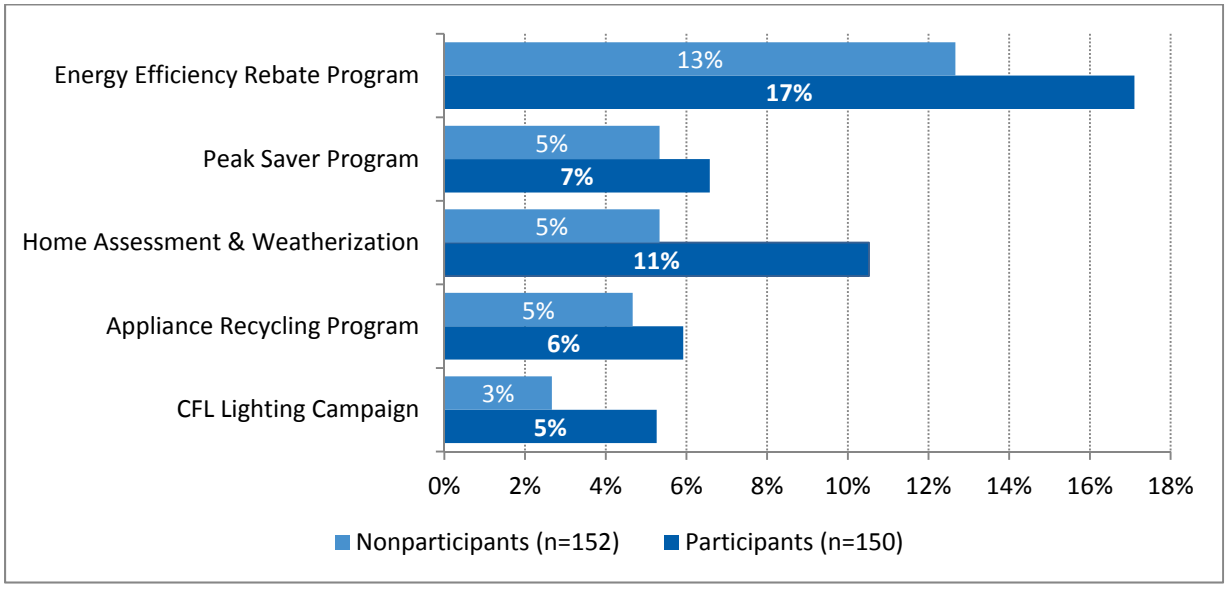
- The most common program both groups were aware of was the Efficient Equipment program, followed by the Home Energy Assessment and Weatherization Program (see Figure 39).
- Twenty-five percent of the all participants (n=106) and 36% of all nonparticipants (n=77) reported visiting the PPL Electric website to look for ways to save money.
- Almost 80% of the nonparticipants had heard or seen tips about how to save energy in the past six months. A bill insert was the most common place respondents in this group reported seeing the tips, followed by TV and the PPL Electric website.

Table 45. Percentage of Respondents Aware of PPL Electric Energy Efficiency Programs

Awareness Statement	Expansion Treatment (n=75)	Expansion Control (n=75)	p value*	Legacy Treatment (n=76)	Legacy Control (n=75)	p value*
Are you familiar with any energy-efficiency programs offered by PPL Electric to help you use less energy?	65%	51%	0.07	59%	51%	0.32

*A p-value ≤ 0.1 is a significant difference with 90% confidence.

Figure 39. Program Awareness among Participants and Nonparticipants



Attitudes toward Energy and the Environment

Cadmus asked both participants and nonparticipants a series of questions to determine their attitudes toward energy efficiency. Specifically, we designed the survey questions to determine whether respondents agreed with a particular statement. The assumption is that, following a treatment period,

people are likely to have developed a positive attitude toward saving energy; consequently, they are more likely to change their behavior toward energy conservation.

For most statements, attitudes toward energy use and conservation were similar across participant and nonparticipant groups and across legacy and expansion groups. However, when compared to nonparticipants, participants differed in their attitudes about home energy use in a number of ways.

- Of expansion group participants, 56% said they would like to save energy but did not know where to start, compared to 38% of expansion nonparticipants who reported the same.
- Fifty-three percent of legacy participants said that they would like to save more energy but do not know where to begin, as opposed to 40% of legacy nonparticipants.
- 67% of expansion group participants actively look for ways to reduce their carbon footprint, as opposed to 56% of the expansion nonparticipants.

Table 46 illustrates the percentage of respondents who agreed (*somewhat agreed* or *strongly agreed*) with various statements about energy use, and the instances where differences between participants and nonparticipants were statistically significant. These instances are indicated by blue shading for each of the three different groups: expansion, legacy and all participants.

Table 46. Percent of Respondents who agreed with Attitudinal Statements

Statement	Expansion Partici-pants (n=75)	Expansion Nonpar-ticipants (n=77)	Legacy Partici-pants (n=75)	Legacy Nonpar-ticipants (n=75)	All Partici-pants (n=175)	All Nonpar-ticipants (n=152)	Opt-outs (n=25)
It is important to conserve as much energy as possible.	92%	96%	97%	95%	93%	95%	84%
Using whatever energy is needed to keep my home comfortable is important to me.	93%	94%	89%	88%	91%	91%	88%
Saving energy helps the environment.	96%	95%	93%	96%	93%	95%	84%
I would like to save more energy but do not know where to start.	56%	38%	53%	40%	51%	39%	28%
I have already done as much as possible to save energy in my home.	72%	73%	69%	68%	72%	70%	80%

Statement	Expansion Partici-pants (n=75)	Expansion Nonpar-ticipants (n=77)	Legacy Partici-pants (n=75)	Legacy Nonpar-ticipants (n=75)	All Partici-pants (n=175)	All Nonpar-ticipants (n=152)	Opt-outs (n=25)
Energy-efficient products are too expensive for me.	32%	30%	29%	31%	31%	30%	32%
I actively look for ways to reduce my carbon footprint.	67%	56%	71%	65%	65%	61%	44%

* The shaded cells indicate that the differences between participant and nonparticipant pairs are statistically significant.

Some of the survey results about attitudes toward energy efficiency were very different from those obtained last year (PY3). For example, in PY3 more than 50% of the nonparticipants responded that they would like to save energy but did not know where to begin. The percentage response for nonparticipants is much lower in PY4. The difference could be due to a response bias called social desirability, in which respondents tend to give responses to present themselves favorably, or, due to general increased awareness about energy efficiency. Further, we questioned the respondents about their perceptions of their own home energy use. Eighty-three percent of expansion participants (n=75) versus 94% of the expansion nonparticipants (n=77) reported having *somewhat* or *very efficient* homes. This difference in response is significant (p-value 0.039). Since the expansion homes are selected because they have high consumption for both groups, the expansion nonparticipant response is evidence of the possible presence of this bias. Alternatively, the fact that participants believe their homes are less efficient than nonparticipants may be due to the education they receive through the program, such as neighbor comparisons. These materials provide an accurate view of home energy consumption, which could be less energy-efficient than homeowners would otherwise perceive their home to be.

Readership and Report Content

To explore readership and the ways participants use the Home Energy Reports, Cadmus asked survey respondents whether they agreed or disagreed with a series of statements about the reports (Table 47).

The expansion participants reported that they remembered receiving about four to six reports and the legacy group about 10 to 12 reports. Expansion group participants should have received 12 reports and the legacy group should have received 18 reports.

Almost all respondents (94%) said the reports were easy to understand, and 67% of the respondents (n=141) said that they learned something new from the reports.

In most cases, the legacy and expansion groups responded similarly to the questions about the actions they might have taken after reading a Home Energy Report (Table 47). However, 31% of expansion participants reported they discussed the reports with others outside their home while 20% of legacy participants reportedly did so. This difference in response is significant (p value = 0.067). This could be explained by the fact that the expansion group participants started receiving the reports one year after the legacy customers. Being newer to the program, they may be more likely to discuss it with outsiders than legacy group participants.

Table 47. Actions Taken After Reading the Home Energy Report

Statement	Percentage of Respondents Agreeing with Statement	
	Expansion Participants (n=69)	Legacy Participants (n=70)
Look for changes in how your family uses electricity	55%	61%
Discuss the reports with others living in your home	63%	63%
Discuss the reports with others outside your home	31%	20%
Save one or more reports for future reference	37%	36%

*The shaded cells indicate that the differences between the legacy and expansion groups are statistically significant.

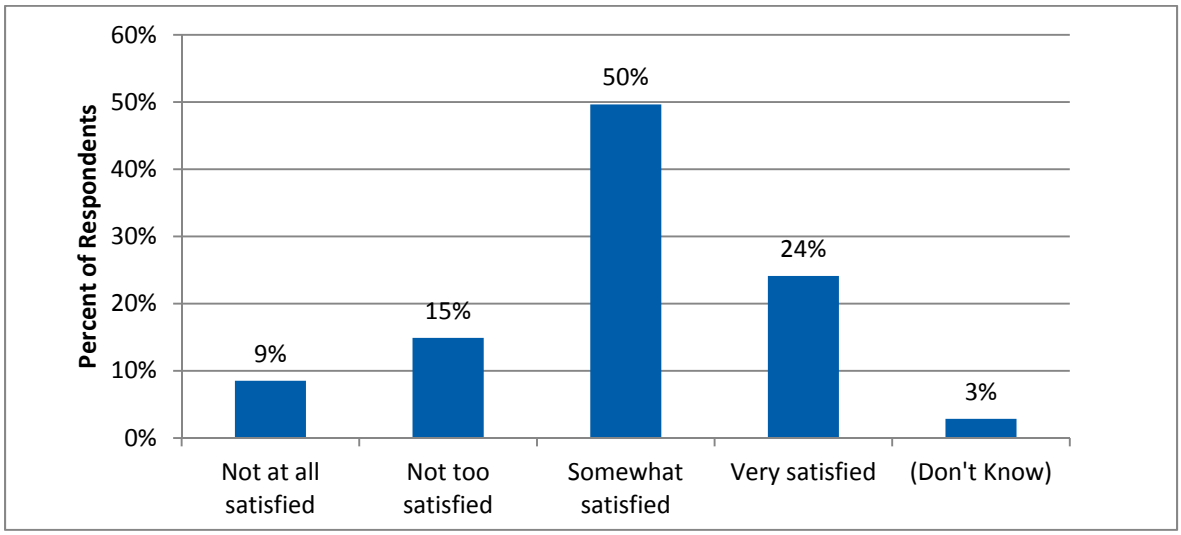
Each HER includes suggestions for ways the household can take action to save energy. Cadmus asked participants about their opinions of these steps and whether they took any action after reading the reports. Overall, survey findings indicated there seems to be low response to the suggestions contained in the reports. More than 50% of all participants (n=150) did not remember seeing the action steps. Of those who remembered seeing the suggested actions:

- 51% (n=67) reported having taken some steps provided in the HERs since June 2013
- 55% (n=67) agree that the steps give them enough information to take action
- 45% agree that the steps are easy for the household to do
- 37% (n=67) said that the steps gave them new ideas to save electricity
- 38% (n=67) installed CFLs and 35% (n=67) turned off lights or unplugged appliances when not in use.

Satisfaction with Home Energy Reports and with PPL Electric

Most participants were satisfied with the contents in the HERs. The majority of respondents (50%) indicated that they were *somewhat satisfied*, while 24% reported being *very satisfied* (see Figure 40). These findings are relatively consistent compared to last year's survey.

Figure 40. Satisfaction with Home Energy Reports



Neighbor Comparisons

Despite additional education about the neighbor comparisons provided in the HER in PY4, many participants expressed doubts about the validity of the neighbor comparisons, particularly in the expansion group. Almost 75% of expansion participants (n=69), and 61% of legacy participants (n=70) reported that, according to the home energy report, their household usage was more than that of their neighbors'.

Of those customers reporting dissatisfaction, most found fault with the neighbor comparisons or cited privacy concerns. Of the dissatisfied participants, 41% disapproved of the neighbor comparison, 11% found the home energy reports confusing, and 5% reported no improvement in usage after receiving the reports.

Table 48 shows the percentage of responses for the questions about whether the HER contents met the participants' expectations and whether respondents actively worked to improve their energy consumption compared to their neighbors. There are significant differences in the responses between the expansion and legacy participants. In general, the legacy participants seem to be more receptive to the contents in the HERs. Specifically, almost 44% agreed with the statement that the neighborhood comparison seems accurate as opposed to 26% of the expansion participants. Since legacy homes have been in the program for a longer period of time, it may be that they are more influenced by, and have a better understanding of, the HERs.

Table 48. Percentage of Respondents who Agreed with the Statements on Expectations from the HER

Statement	Expansion Participants (n=69)	Legacy Participants (n=70)	All Participants (n = 139)
My household electricity use was different than I expected compared to my neighbors.	49%	59%	54%

The neighbor comparison seems accurate to me.	26%	44%	18%
The neighbor comparison makes me more aware of my own household electricity use.	62%	69%	67%
My household actively works to improve how I compare to my neighbors.	43%	59%	75%

*The shaded cells indicate that the differences between the legacy and expansion groups are statistically significant.

Satisfaction with PPL Electric

When asked to rate PPL Electric overall as a provider of electric service, almost 82% of all surveyed (n = 327) reported above-average or outstanding performance (measured by a rating of 10 on a scale of 1-10). There was not much difference in the response between the nonparticipants and all the participants although more legacy participants (84%) than the expansion participants (79%) rated above average and outstanding.

Opt-Outs

A very small percentage of legacy and expansion group homes opted out of the program in PY4. (To opt out, the customer asks not to receive the HERs.) In the expansion group, 137 participants opted out of the program, and in the legacy group only 56 participants opted out of the program. For both groups, the total number of customers opting out in PY4 is much smaller than those opting out in PY3. Respondents who opted out of the program were, on average, older and less educated than those who did not.

The majority (70%) of those who opted out of the program did so because they felt their energy usage was misrepresented in the Home Energy Reports and the neighbor comparisons did not properly take into account some special feature of their home or household that affected energy consumption.

Energy-Efficiency Upgrades

The survey included questions about energy-efficiency improvements and actions undertaken since July 2012. Responses were used to examine the difference between participants and nonparticipants for this metric. .

Table 49 shows the differences between groups in reporting energy-efficiency improvements. Fewer legacy participants reported improvements than the nonparticipants, and the difference in the case of installing CFLs, changing the furnace filter, and installing a high-efficiency furnace or boiler is statistically significant. This could be due to legacy customers installing high-efficiency equipment in the previous years of the program. Overall, a higher percentage of expansion participants have taken more actions than the expansion nonparticipants, although the difference is not significant.

Table 49. Percent of Respondents who Undertook Energy Efficiency Action

Improvement	Expansion Treatment (n=75)	Expansion Control (n=75)	Legacy Treatment (n=76)	Legacy Control (n=75)
CFLs	33%	34%	44%	56%
Changed the furnace filter	32%	27%	40%	52%
Programmable thermostat	17%	17%	21%	21%
ENERGY STAR or high efficiency appliances	25%	27%	37%	39%
High efficiency furnace, boiler, heat pump, or central AC	5%	9%	3%	13%
Air sealing, caulking, or weather stripping	31%	27%	24%	32%
Insulation in the ceiling, walls, or foundation	16%	12%	13%	16%

* The shaded cells indicate that the differences between the treatment and control groups are statistically significant.

Energy-Saving Behaviors

The survey included questions to detect changes in energy-saving behaviors of the participants over nonparticipants during the program year. Cadmus asked participants and nonparticipants about the frequency with which they engaged in different energy-saving behaviors. Table 50 shows the percentage of respondents who said they *always* or *sometimes* engaged in the behaviors.

Table 50. Percent of Respondents who *Always* or *Sometimes* Modified Behavior

Behavior	Expansion Treatment (n=75)	Expansion Control (n=75)	Legacy Treatment (n=76)	Legacy Control (n=75)
Turn off lights in rooms that are unoccupied	97%	100%	100%	100%
Wash laundry in cold water	83%	82%	87%	87%
Switch off power strips when appliances or equipment are not in use	51%	69%	51%	53%
Adjust thermostat settings according to occupancy schedules and the time or day	72%	79%	89%	76%
Take shorter or fewer showers	56%	71%	56%	77%

Behavior	Expansion Treatment (n=75)	Expansion Control (n=75)	Legacy Treatment (n=76)	Legacy Control (n=75)
Use energy-saving or "sleep" features of your computer	73%	78%	76%	80%
Conducted home energy audit	1%	4%	4%	3%

* The shaded cells indicate that the differences between the treatment and control groups are statistically significant.

For most behavioral actions, the survey responses were similar between the participants and nonparticipants in both legacy and expansion groups, except in some cases:

- Of legacy participants, 89% reported adjusting thermostat settings as opposed to the 76% of the legacy nonparticipants (p value 0.02).
- On the other hand, significantly more nonparticipants reported taking fewer or shorter showers than participants (p value 0.003).
- A significantly higher percentage of the expansion nonparticipants (69%) reported to have switched off power strips when not in use than the expansion participants (51%).

Demographics

Since these programs are designed to be random control trials, in theory there should be no difference on average between socioeconomic characteristics of these households. Accordingly, we do not find statistically significant differences between the participants and the nonparticipants with regard to the income distributions, house age, education, and other demographics. The demographic findings are relevant for all participants and nonparticipants of the program:

- Almost 95% of all respondents own their homes and 78% have two to four people living in the homes full-time during the past 12 months.
- There is no statistically significant difference between the distribution of the home age of the participants and the nonparticipants. The majority of the respondents in both groups (34% of participants (n=175) and 31% of nonparticipants (n=152)) lived in homes that are more than 41 years old.
- There is no statistically significant difference between the distribution of the main type of fuel used for heating homes of the participants and the nonparticipants. More than 50% of all respondents use electricity for heating.
- Sixty-two percent of participants (n=175) and 68% of nonparticipants (n=152) had a household income above $50,000.

QA/QC Review

QA/QC review involves quarterly review and analysis of extracts from EEMIS. As the impact evaluation of the Behavior and Education program involves an end-of-the-year billing analysis, quarterly QA/QC reviews of EEMIS data and the CSP's data do not apply.

Conclusions and Recommendations

Based on the findings, we suggest PPL Electric consider the following recommendations in Phase 2.

Conclusion: Most participants were *satisfied* or *very satisfied* with the program, while some reported an improvement in their opinion of PPL Electric after receiving their first report. Opts-outs constitute a very small percentage of customers receiving reports, and should not represent a significant source of concern for program managers.

Recommendation: The program's Implementation CSP and PPL Electric should continue to educate participants about the neighbor comparisons in the Home Energy Reports. The comparisons should be made as transparent as possible, explaining the criteria used for determining "neighbors" for this comparison.

Conclusion: Participants used the reports to obtain information about their energy use and opportunities to save energy.

Recommendation: The Implementation CSP and PPL Electric should consider offering a way for participants to update details about their homes. HERs tailored to include these updates would be more informative to the customers and will allow for more accurate matching for the neighbor comparisons.

A possible approach to update home details would be to allow participants to update their home information via the web. The Home Energy Reports could account for features of the home and actions that have already been undertaken by participants.

Conclusion: The reports helped educate participants about PPL Electric's other energy-efficiency programs.

Recommendation: PPL Electric and the Implementation CSP should continue to promote other PPL Electric energy-efficiency program offerings in the Home Energy Reports.

PY4 Process Recommendations Status: Behavior and Education Program

Table 51 shows the status of each PY4 process recommendation made to PPL Electric.

Table 51. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Behavior and Education Program	
Provide additional information to educate participants about the neighbor comparisons in the Home Energy Reports.	**Being Considered.** PPL will review this recommendation with its program CSP in early 2014 and implement it if warranted to improve customer satisfaction or to achieve savings objectives within budget.
Consider offering a way for participants to update details about their homes. The Home Energy Reports could account for features of the home and actions that have already been undertaken by participants. A possible approach would be to allow participants to update their information on the web.	**Being Considered.** PPL will review this recommendation with its program CSP in early 2014 and implement it if warranted to improve customer satisfaction or to achieve savings objectives within budget.
Continue to promote other PPL Electric energy-efficiency program offerings in the Home Energy Reports.	**Implemented.** This is planned to continue in Phase 2.

Appliance Recycling Program

For the Appliance Recycling Program (ARP), the PY4 process evaluation activities were these:

- Participant surveys (n=142),
- Net-to-gross literature review and benchmarking, and
- Database review and QA/QC.

Achievements against Plan

In PY4, the program achieved 110% of its planned MWh/yr savings, 216% of its planned gross kW savings, and 103% of its annual participation target.

Overall, the Appliance Recycling Program exceeded its four-year planned MWh/yr savings goal by 834 MWh/yr, exceeded its gross kW reduction goal by 4,055 kW, and exceeded its top 100 hour demand reduction goal by 1,286 kW. The program did not reach its participation targets. At the end of Phase 1 (May 31, 2013), ARP had achieved:

- 101% of its 74,538 MWh/hr four-year planned savings,
- 133% of its 12,245 kW four-year planned gross demand reduction,
- 114% of its 10,000 kW four-year planned top 100 hour demand reduction, and
- 81% of its four-year participation target of 56,908 units.

Table 52. Appliance Recycling Program Achievements

Savings Category	PY4 Planned Savings	PY4 Verified Savings	Total Phase 1 Planned Savings	Total Phase 1 Verified Savings
MWh/yr[42]	20,302	22,308	74,538	75,372
kW[43]	2,654	5,740	12,245	16,300
Top 100 Hour kW[44]	n/a	n/a	10,000	11,386

The program did not have any significant structural changes in PY4, although November and December 2012 was a limited promotional period in which the incentive was increased from $35 to $50.

[42] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

[43] Ibid.

[44] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

Survey Findings

In PY4, Cadmus surveyed 142 participants in the Appliance Recycling Program. Results achieved 90% confidence and 10% precision at the program level. Table 53 shows the population, the targets for completed surveys, and the achieved number of completed surveys.

Table 53. Targeted and Completed Surveys

Survey Group	Q1-Q3 Population	Target	Achieved
Appliance Recycling Program Participants	13,285	140	142

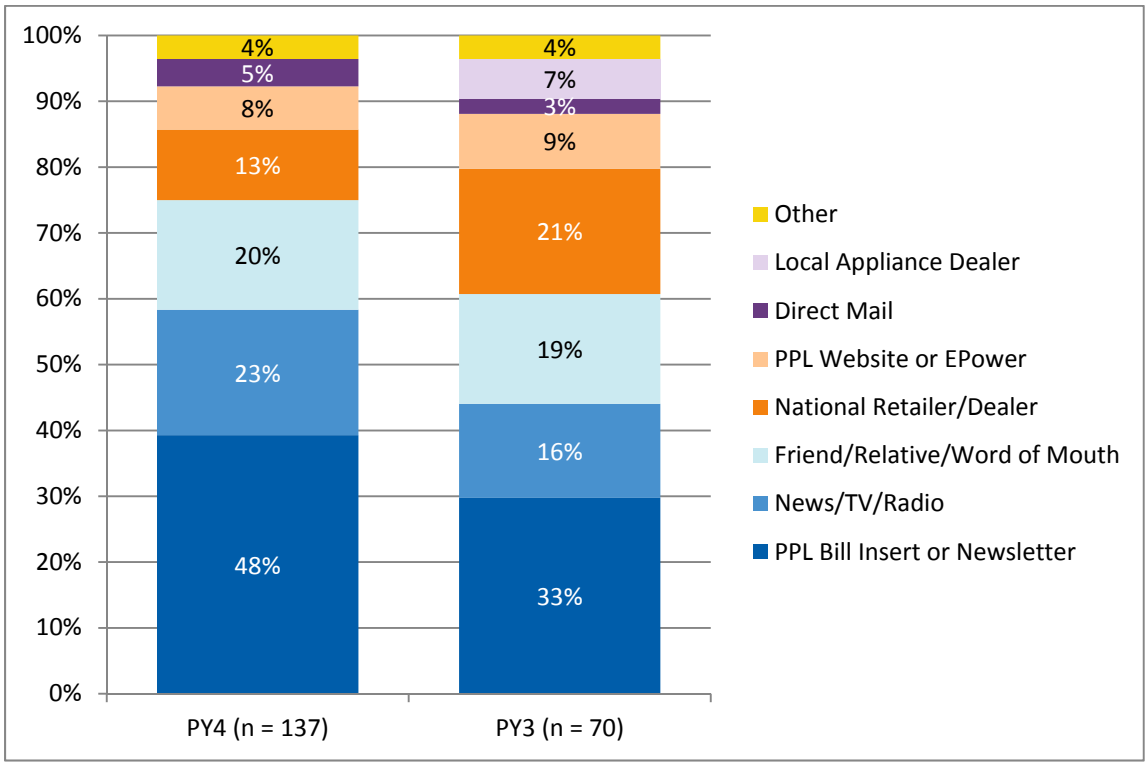
This section provides key findings from the Appliance Recycling Program's PY4 participant survey.

PPL Electric Marketing and Outreach

Cadmus asked participants how they had heard about the program. PPL Electric communications, including PPL Electric's newsletter, bill inserts, and advertisements in the newspaper, on the radio, or on TV, were cited by 71% of respondents (see Figure 41). Specifically, the majority of customers heard about the program through PPL Electric bill inserts or the *Connect* newsletter (48%). Of this group, 45% reported hearing about the program through a bill insert.[45]

[45] In PY3, survey bill inserts and the *Connect* newsletter were combined as one response option. In PY4, they were separated. The PY4 responses are combined in the graph, so they can be compared between program years.

Figure 41. How Respondents Learned About the Program



Source: QM1. How did you learn about the program? Note: Multiple responses allowed, percentages may add up to more than 100%.

Respondents also reported learning about the program from a friend or relative (20%), and from a retailer or appliance dealer (13%). The proportion who mentioned retailers declined from 21% in PY3 to 13% in PY4.

PPL Electric Advertisements

Of those respondents reporting that they had heard about the program through the media, the breakdown by media channel is outlined in Table 54.

Table 54. Respondents Learning about the Program through Media

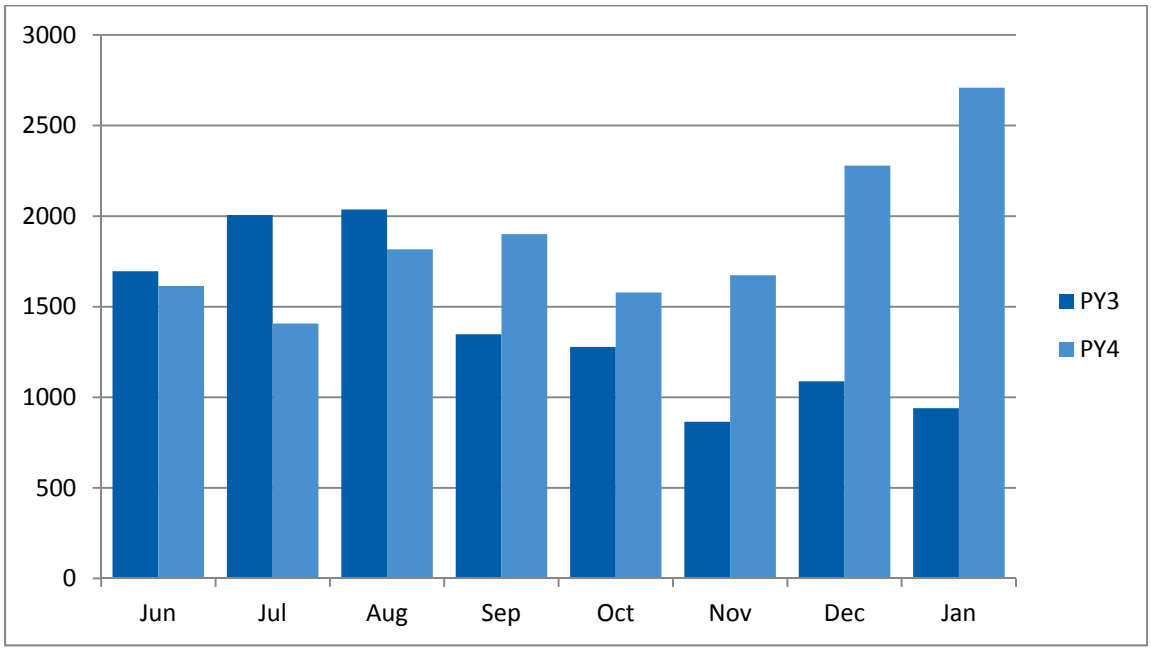
Program	Number of responses					Sample size	Percent of Respondents Reporting Media
	News-paper	TV	Radio	Other Respon-ses*	Total Respon-ses		
Appliance Recycling	15	10	4	3	**32**	137	23%

* Responses included "media," "advertising," or combination of more than one media outlet.

Incentive Increase

PPL Electric increased incentives from $35 to $50 during November and December of PY4, and advertised the increase in the *Connect* newsletter. Participation increased markedly over PY3 during these months. The number of recycled appliances increased by approximately 100% over PY3, and increased by 188% in January (Figure 42). This suggests the increase in incentive and related marketing in the *Connect* newsletter during November and December effectively increased participation.

Figure 42. Participation by Month: Number of Appliances Recycled



Source: EEMIS

Satisfaction

Satisfaction with the program overall was high in PY4. The percentage of respondents who rated their satisfaction as an 8, 9, or 10 (on a scale of 1 to 10) included:

- 92% for the program experience overall
- 98% for the scheduling process
- 90% with JACO Environmental
- 88% regarding the speed at which they received their incentive check
- 88% with the sign-up process
- 79% with the incentive amount

Although 92% of respondents rated their satisfaction with their experience overall as 8 or higher, this rating was a slight decline from 100% in PY3. Eight respondents (approximately 6%) indicated they were dissatisfied with some aspect of the program. The reasons respondents gave for their dissatisfaction were:

- Four said they had trouble scheduling a pick-up, including two respondents who said they had to miss work to be at home for the pick-up. One of the respondents had to reschedule after the originally scheduled pick-up did not happen; they also said it took the pick-up crew a long time to find the address.
- Three respondents thought the incentive should be higher, including one who said they were told the incentive would be higher than what they actually received.
- Three respondents mentioned poor service from the pick-up crew. One respondent said the crew seemed "in such a hurry" and the respondent was not given enough time to read what they were signing during the pick-up. Another said the members of the pick-up crew were "kind of arrogant."

Participant Awareness and Further Action on Energy Efficiency

The majority of respondents were not aware of other PPL conservation rebates or incentives (85%). Of those who were, 41% reported learning about the other rebates or incentives by participating in the ARP program.

Almost half (46%) of respondents reported they installed energy-efficient products since participating in the program without receiving an incentive.[46] The most commonly mentioned measures were:

- CFLs – 46%
- Clothes washers – 22%
- Refrigerator, freezers, and central air conditioners – 5%
- Dishwashers, stoves/ovens, room air conditioners, and heaters – 3%.

Participant Motivations and Decision-making

Approximately half the respondents said their primary motivation in deciding to recycle their appliance was to replace old, outdated equipment (46%). The second-most-common motivation was to receive the incentive offered by the program (20%). Both reasons were also the top motivators in PY3 (52% and 12% respectively).

Part-Use

Appliance recycling programs, including PPL Electric's, typically require that appliances be operable and turn "on" when plugged in, to qualify for an incentive. JACO verifies that appliances are operable when they pick up the units. While appliances work when plugged in at the time the unit is picked up (and therefore qualify for the program), it is not uncommon for a small portion of units to sit idle or unused prior to pick-up.

Because not all appliances are in use for a full year prior to being recycled, the Uniform Methods Project (UMP) ARP protocol states that the estimated annual consumption of an average appliance is not equal

[46] Spillover is reported in the PY4 annual impact evaluation report.

to the savings. To account for this, Cadmus applies a part-use factor to adjust the annual consumption to reflect the average portion of the year appliances were in use and more accurately reflect savings.

Although part-use is not included in the 2012 TRM, and therefore not part of the gross savings calculations for PY4, Cadmus asked survey respondents how many months their appliances were in use during the year prior to recycling through the program. Cadmus collected this information to inform program design for PY5, as part-use is included in the 2013 TRM (although the method to determine part use is not defined in the TRM).

Using the part-use methodology outlined in the UMP protocol, Cadmus determined that refrigerators were in use for 81% of the year on average, or just short of 10 months. Freezers were in use for 87% of the year on average, or, approximately 10.5 months.

The part-use found through the survey is substantially lower than the values outlined in the 2013 TRM, which provides a default part-use factor of 96.9% for refrigerators and 98.5% for freezers. To understand how the findings compared to ARP programs in other regions, Cadmus benchmarked the results against three other utilities. This exercise revealed that the PPL Electric results are largely consistent with part-use factors observed in other comparably mature appliance recycling programs, though the PPL Electric part-use for refrigerators is slightly lower than others (see Table 55).

Table 55. Comparison of Part-Use Estimates from Mature ARP Evaluations

Utility	Appliance	Program Year	Part Use
PPL	**Refrigerator**	**PY4**	**81%**
	Freezer	**PY4**	**87%**
Midwest Utility 1*	Refrigerator	PY4	88%
	Freezer	PY4	86%
Midwest Utility 2*	Refrigerator	PY4	91%
	Freezer	PY4	85%
Midwest Utility 3*	Refrigerator	PY3	84%
	Freezer	PY3	76%

*These results are from recent evaluations Cadmus conducted and are not publicly available.

The discrepancy between the deemed part-use value in the 2013 TRM and the part-use calculated from the survey responses is due to a relatively high proportion of respondents indicating they did not keep their units plugged in and running for *any* portion of the prior year (7%). Those who reported using their appliance for a portion of the year (17%) indicated they used it for only three months of the year on average.

Part-Use, Program Maturity, and Program Marketing

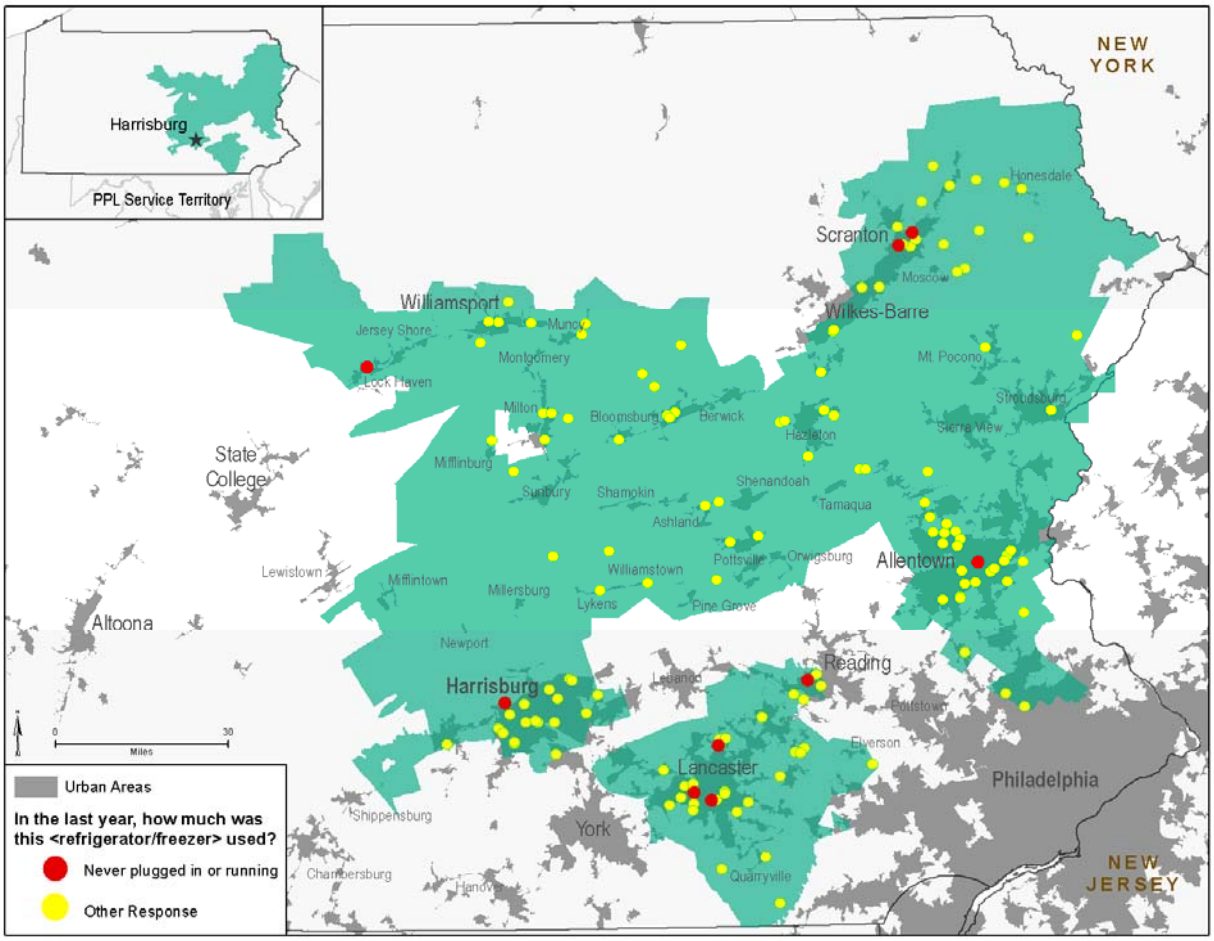
Part-use is typically lower in new appliance recycling programs, because the entry of the program into the market spurs a wave of secondary unit recycling. It is more common in younger programs to have

recycled units that have been unused for years. However, changes in program design such as incentive levels or outreach methods may also decrease part-use factors, if new regions or new sectors of the population are reached. Because part-use information was not collected in PY1 through PY3, the PY4 part-use factor could not be compared to prior program years. Cadmus did, however, explore differences in the populations between program years and found there were no differences between the survey respondents in PY2, PY3, and PY4 in demographic characteristics such as level of education or annual household income.

Geographic Representation

Cadmus explored whether there were any differences geographically between respondents who indicated their appliance was never plugged in and the remainder of respondents. The geographical distribution is shown in Figure 43.

Figure 43. Geographical Distribution of Part-Use Responses



The map of survey responses suggests two things. First, the survey respondents as a whole are representative of the program participants across the region. Both the survey respondents and the majority of all program participants are clustered around Harrisburg, Lancaster, Allentown, and

Scranton, with a small proportion spread across the less densely populated areas. This distribution was similar across PY2 and PY3, indicating that the program participation has not shifted over time across regions.

The map also suggests there is no visible difference in the distribution of respondents who said their appliance had not been plugged in or running for the past year and the remainder of the survey population or the program as a whole. The respondents whose appliances were not plugged in are largely from the same urban areas as the majority of respondents, with the exception of one respondent near Lock Haven. These findings indicate that the part-use estimate found through the survey is geographically representative of the population.

Net-to-Gross Research

Over the first three program years, PPL Electric's ARP Net-to-Gross (NTG) ratio remained relatively stable, with values increasing slightly each year (see Table 56).

Table 56: ARP NTG Ratios

Program Name	PY1	PY2	PY3	PY4
Appliance Recycling[1]	57%	61%	63%	68%

[1]NTG Result is weighted by savings

The continued increase of PPL's ARP NTG ratio may be related to the increased incentive levels, as incentive levels tend to inversely affect NTG.[47] Table 57 lists the program's PY3 reported NTG ratios by electric distribution company (EDC) reporting this information.

Table 57: PY3 Reported NTG Ratio by EDC

EDC	NTG Ratio
PPL Electric	63%
Duquesne Light	67%
PECO	64%

Table 58 compares PPL's NTG ratio with comparable programs. The NTG components are reported separately as freeridership and spillover.

[47] "A Meta-Analysis of Drivers of Freeridership in Appliance Recycling Programs" completed by Cadmus, 2011

Table 58. Appliance Recycling Freeridership Findings

State or Utility	Program Name	Program Start Year	Evalua-tion Year	Appliance	Freerider-ship Score	SO	NTGR
PPL	**Appliance Recycling**	**2009**	**2012/ 2013**	**Refrigerator**	**33%**	**.77%**	**68%**
				Freezer	**33%**	**.77%**	**68%**
Midwest Utility 1*	Appliance Recycling	2009	2012	Refrigerator	37%	1%	64%
				Freezer	36%	1%	64%
Midwest Utility 2*	Appliance Recycling	2008	2011	Refrigerator	32%	1%	68%
				Freezer	38%	2%	63%
Midwest Utility 3*	Appliance Recycling	2010	2011	Refrigerator	30%	4%	57%
				Freezer	20%	2%	62%

*These results are from recent evaluations Cadmus conducted that are not publicly available.

Factors Affecting Freeridership

Freeridership in appliance recycling programs has, in the past, been driven primarily by the proportion of participants who would have disposed of their appliance in a way that would have led to the appliance's removal from the utility's electric grid. This is no longer the case, as the program's effect on the secondary market must also be accounted for. The implementation of the Uniform Methods Project (UMP) methodology, specifically the inclusion of secondary market impacts, has had a substantial impact on NTG in ARP programs over the past year.

By removing an appliance from the secondary market, the ARP program will also affect the purchasing decisions of customers interested in secondary market appliances. These "would-be acquirers" can choose to:

1. Not purchase or acquire another unit
2. Purchase or acquire another unit

Adjustments made to the savings based on the decisions of the would-be acquirer are referred to as the program's secondary market impacts. If, absent the program, a participant would have directly or indirectly (through a market actor) transferred the program-recycled unit to another customer on the grid, we then have to consider what that would-be acquirer might have done since that unit was unavailable (due to the program). There are three possible scenarios:

1. ***None of the would-be acquirers would find another unit.*** Program participation would result in a one-for-one reduction in the total number of refrigerators operating on PPL Electric's electrical grid. In this case, total energy consumption for all avoided transfers (participating appliances that otherwise would have been used by another customer) should be credited as savings to the program. (This position essentially remains consistent with the theory that participating appliances should be considered convenience goods for would-be acquirers: a potential acquirer would have accepted the refrigerator, had it been readily available, but, as the refrigerator was not a necessity, the potential acquirer would not seek an alternate unit.)

2. ***All of the would-be acquirers would find another unit.*** Program participation would have no effect on the total number of refrigerators operating on the grid. (This position remains consistent with considering participating appliances necessities, and customers always seek alternate units when participating appliances prove unavailable.)

3. ***Some would-be acquirers would find another unit, while others would not.*** This reflects an awareness that some acquirers might be in the market for a refrigerator and would acquire another unit, while others were not (and would have taken the unit only opportunistically).

Because the questions to assess these potential actions are difficult to answer and utility-specific information is not readily available, the UMP recommends adopting the last possibility: that some would-be acquirers would find another unit, while others would not. UMP recommends that evaluators assume one-half (0.5, the midpoint of possibilities A and B) of would-be acquirers of avoided transfers found an alternate unit. Without information to the contrary, Cadmus applies UMP's recommendation to evaluations.

Once the proportion of would-be acquirers assumed to find alternate units has been determined (i.e., assumed to be one-half), a question arises as to whether the alternate unit would likely be another used appliance (similar to those recycled through the program) or, presuming that fewer used appliances result from program activity, the customer would acquire a new, standard-efficiency unit.[48]

Again, for reasons previously discussed, difficulty arises in definitively estimating this distribution. Thus, as primary research is unavailable, Cadmus uses a midpoint approach, assuming that one-half of the would-be acquirers of program units would find a similar, used appliance, and one-half would acquire a new, standard-efficiency unit.

Secondary market impacts, which are included in the Phase 2 ARP evaluation plan, have substantially reduced net savings (by 20%-30% in recent evaluations) from appliances that would have been transferred had they not been recycled through the program. This is often the largest portion of non-freeriders. Had the UMP methodology been applied to PPL's PY4 results, NTG would have been 55% and 44% for refrigerators and freezers respectively, without accounting for spillover (Table 59).

Table 59. Comparison of Phase 1 and Phase 2 Methodology NTG Results Applied to PY4 Participants

Utility	Appliance	Program Year	NTGR
PPL Electric Phase 1 Methodology	Refrigerator	PY4	68%
	Freezer	PY4	68%
PPL Electric Phase 2 UMP Methodology	Refrigerator	PY4	55%
	Freezer	PY4	44%

[48] A would-be acquirer of a program unit also could select a new ENERGY STAR® unit as an alternate. However, it seems most likely a customer in the market for a used appliance would upgrade to the new lowest price point (a standard efficiency unit).

QA/QC Review

This section summarizes factors affecting the Appliance Recycling program's realization rates during PY4.

Cadmus verified appliance replacement status with participant survey respondents. Survey results show significantly more customers reported replacing their refrigerator or freezer (63% replacement rate) than was reported to JACO during the sign-up process (31% replacement rate). The difference had a significant impact on the program realization rate, as savings associated with replaced units are lower than units recycled without replacement. As a result, the ARP PY4 MWh/yr realization rate was 89%.

These results are similar to the findings in the PY3 evaluation. PPL Electric has reduced the per-unit deemed savings assumptions in EEMIS for Phase 2 to reflect a weighted average based on the replacement rates found in the participant surveys. This should improve the realization rates in Phase 2.

Conclusions and Recommendations

Based on the findings, we suggest PPL Electric consider the following recommendations in Phase 2.

Conclusion: Although Cadmus found that participant demographics and geographic regions were largely consistent over time, it is possible that the increased incentive level in PY4 may have generated an increase in recycling of unused or secondary units, resulting in lower part-use factors. While PPL Electric's part-use factors were generally consistent with programs implemented elsewhere, some actions can be taken to increase average part-use.

Recommendation: PPL Electric should consider exploring incentives that would encourage participants to recycle primary appliances that are in use for a greater portion of the year which would lead to an increase in the part-use factor. Since the part-use factor directly impacts gross savings, an increase in the part-use factor would lead to an increase in gross savings. However, targeting primary units may increase replacements, which have lower per-unit savings because the deemed savings for replaced units is equal to the consumption of the retired unit less the consumption of the replaced unit. Therefore, these two possible impacts of targeting primary appliances should be weighed carefully based on future SWE guidance on gross savings calculations.

Conclusion: Awareness of other PPL Electric energy-efficiency programs among ARP participants is low; only 15% of program participants reported being aware of other rebates or incentives.

Recommendation: Consider ways to use the Appliance Recycling Program as a means for increasing awareness of other Act 129 programs, such as including program materials and brochures in JACO's drop-off materials during appliance pick-up.

Conclusion: The overall NTG ratio has remained relatively stable throughout Phase 1. However, changes introduced via the UMP protocols have had substantial impacts on the NTG ratio for ARP programs through the inclusion of secondary-market impacts.

Recommendation: Consider ways to target participants who would be most likely to keep their appliances in the absence of the program. The appliances recycled by these participants are more likely to be primary units, which would likely increase part-use and therefore gross savings. These participants would also not be considered freeriders, and the units that would have been kept and used absent the program are not subject to secondary-market impacts. This would have an effect of increasing the overall NTG ratio.

PY4 Process Recommendations Status: Appliance Recycling Program

Table 60 contains the status of each PY4 process recommendation made to PPL Electric.

Table 60. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected and Explanation of Action Taken by EDC)
Appliance Recycling Program	
Explore incentives that would encourage participants to recycle primary appliances that are in use for a greater portion of the year. Monitor and weigh the impact of this strategy on replacement rates.	**Being Considered.** PPL will review this recommendation with its program CSP and implement it if warranted to achieve savings objectives within budget.
Cross-market other PPL E-Power programs to ARP participants, such as including program materials and brochures in JACO's drop-off materials during appliance pick-up.	**Implemented.** Expansion being considered for Phase 2. PPL did this in Phase 1 (see recommendations 2 & 3). PPL will evaluate expanding this recommendation further in Phase 2 and will implement it if necessary to achieve savings objectives within budget. Providing "too much" information to customers is not necessarily ideal and the level of information/program promotion must be closely matched to the desired savings objectives (i.e. actual progress compared to goal). Otherwise, programs will go dark (exhaust their funding) too early.
Consider ways to target participants who would be most likely to keep their appliances in the absence of the program.	**Being Considered**. PPL will review this recommendation with its program CSP and implement it if warranted to achieve savings objectives within budget or to prevent high freeridership.

Home Energy Assessment and Weatherization

For the Home Assessment and Weatherization Program, the PY4 process evaluation activities were these:

- Participant surveys (n=121),
- Net-to-gross literature review and benchmarking, and
- Database review and QA/QC.

Achievements against Plan

In PY4, the program achieved 521% of its planned MWh/yr savings, 1,233% of its planned kW savings, and 35% of its annual participation target.

Overall, the Home Assessment and Weatherization Program exceeded its four-year planned MWh/yr savings, but did not meet its planned gross kW or top 100 hour kW reduction targets or participation goals. At the end of Phase 1 (May 31, 2013), the Home Assessment and Weatherization Program had achieved:

- 308% of its 2,607 MWh/hr four-year planned savings,
- 37% of its 1,500 kW four-year planned gross demand reduction,
- 28% of its 1,450 kW four-year planned top 100 hour demand reduction, and
- 55% of its four-year participation target of 4,277 walk-through surveys and comprehensive audits.

Table 61. Home Assessment and Weatherization Program Achievements

Savings Category	PY4 Planned Savings	PY4 Verified Savings	Total Phase 1 Planned Savings	Total Phase 1 Verified Savings
MWh/yr	997	5,191	2,607	8,028
kW	0.0	270	1,500	540
Top 100 Hour kW[51]	n/a	n/a	1,450	410

During PY3 and PY4, PPL Electric attributed additional savings to the program from insulation installations that were not preceded or recommended by an audit or home survey offered by the program. Due to the inclusion of these additional savings, the Home Energy Assessment and Weatherization Program exceeded its four-year planned energy savings of 2,607 MWh/yr by nearly

[49] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

[50] Ibid.

[51] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

6,000 MWh/yr (or 208%) but had achieved only 35% its four-year planned demand reduction of 1.5 MW. Had the additional savings from weatherization measures not been attributed to the program, the program would have achieved only 53% of its four-year MWh/yr planned energy savings and only 10% of its four-year MW planned demand reduction.

The program did not have any structural changes in PY4.

Survey Findings

In PY4, Cadmus surveyed 121 participants in the Home Assessment and Weatherization Program. Results achieved 90% confidence and 10% precision at the program level. Table 62 shows the survey strata population, the targets for completed surveys, and the achieved number of completed surveys. To conduct the survey and analyze results in a timely manner, Cadmus drew the sample from participants in the first three quarters. These participants represented participants in all four quarters; there was no difference in Q4 participants.

Cadmus stratified surveys by participant group to collect measure verification data and to assess factors such as participant satisfaction, motivation for participation, and awareness of other PPL Electric programs.

Table 62. Targeted and Completed Surveys

Survey Group	Q1-Q3 Population	Target	Achieved
All Program Participants	**1,039**	**120**	**121**
Walk-Through Surveys	135	25	29
Comprehensive Audits	113	25	21
Weatherization	793	70	71

This section provides key findings from the Home Assessment and Weatherization program's PY4 participant survey. Cadmus spoke with 50 walk-through survey and comprehensive audit participants (the "audit-only" group), and 71 weatherization participants.

PPL Marketing and Outreach

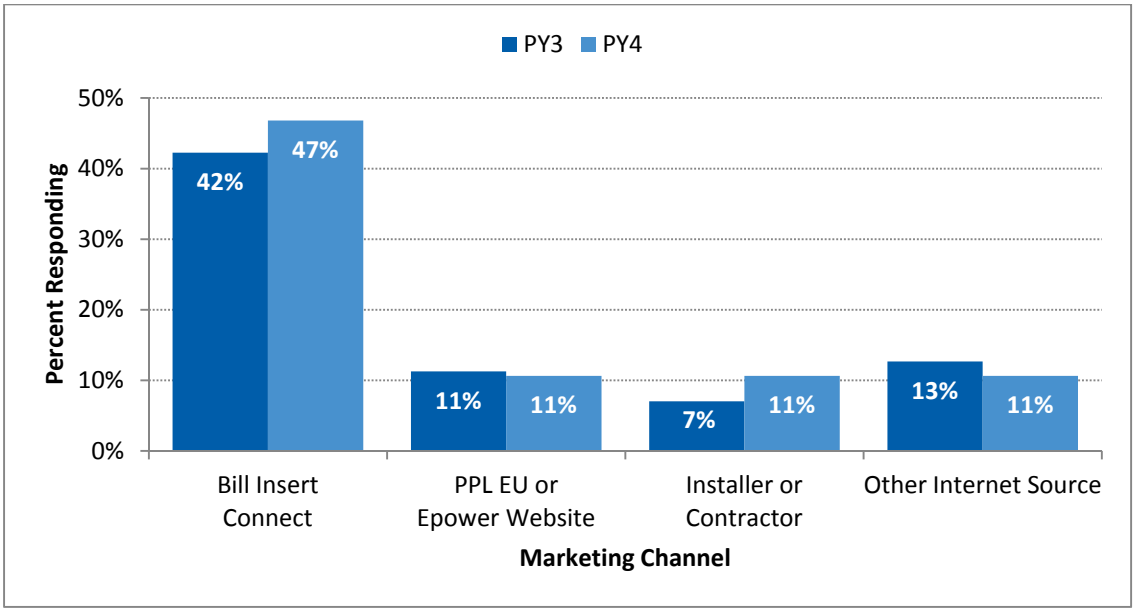
Audit-only and weatherization participants learned of the program through different marketing channels. As shown in Figure 44, PPL Electric bill inserts or the *Connect* newsletter (47%) were the primary channels by which PY4 audit participants learned about the program. Audit participants also learned of the program from the PPL Electric website (11%), an internet search (11%), or their installer, contractor, home builder, or remodeler (11%).

Of the respondents who were weatherization participants, 28% learned about the program through their installer, contractor, home builder, or remodeler. Another 22% of participants learned about the

program from the PPL Electric website, and 17% learned about the program from a friend, relative, or colleague.

Of the respondents who were audit-only participants, the primary marketing channels by which PY4 participants learned about the program are similar to the channels by which PY3 participants learned about the program. The largest percentage of participants in both program years learned about the program via bill inserts or the *Connect* newsletter (42% and 47%, respectively) as shown in Figure 44.

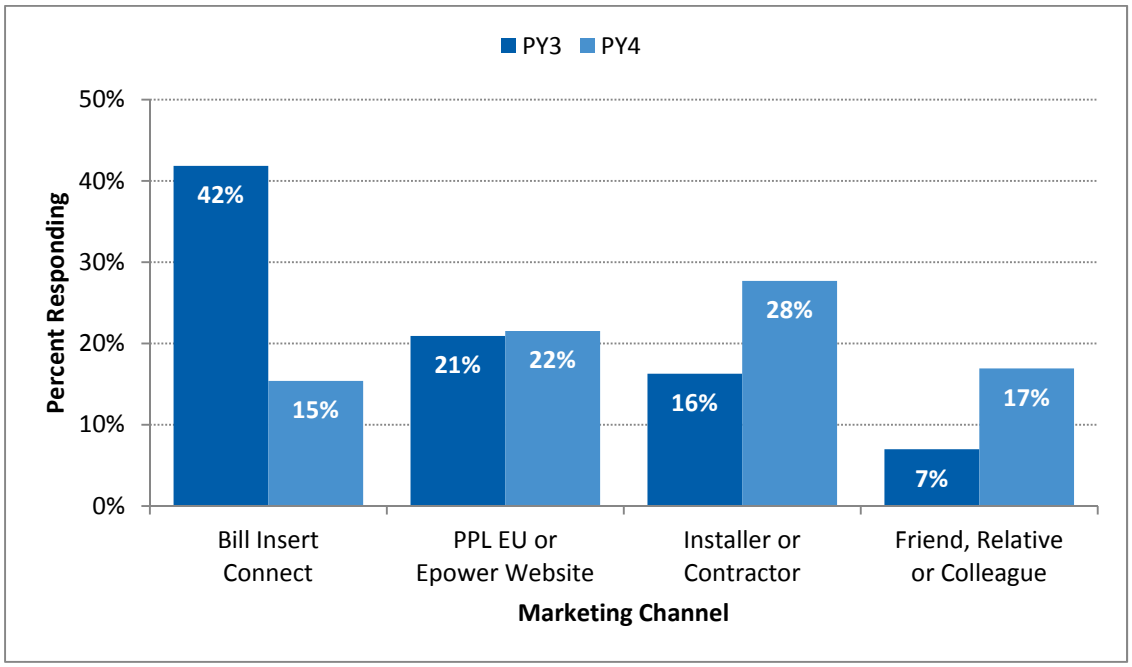
Figure 44. How Audit Participants Learned About the Program



Source: Question M1: How did you learn about PPL's Home Assessment and Weatherization program? (PY3 n=71, PY4 n=47)

In PY4, weatherization participants learned about the program via different marketing channels than PY3 weatherization participants, as shown in Figure 45.

Figure 45. How Weatherization Participants Learned About the Program



Source: Question M1: How did you learn about PPL's Home Assessment and Weatherization program? (PY3 n=43, PY4 n=65)

In PY3, 42% of weatherization participants reported learning about the program through a PPL Electric bill insert, the *Connect* newsletter, or ePowerlink, similar to the audit participants. However, in PY4, only 15% of weatherization participants learned of the program this way. The largest group of PY4 participants learned about the program via their installer or contractor (28%), compared to only 16% of PY3 participants. More PY4 participants (17%) learned about the program from close associates, such as friends, relatives, or colleagues. Only 7% of PY3 participants learned of the program from close associates.

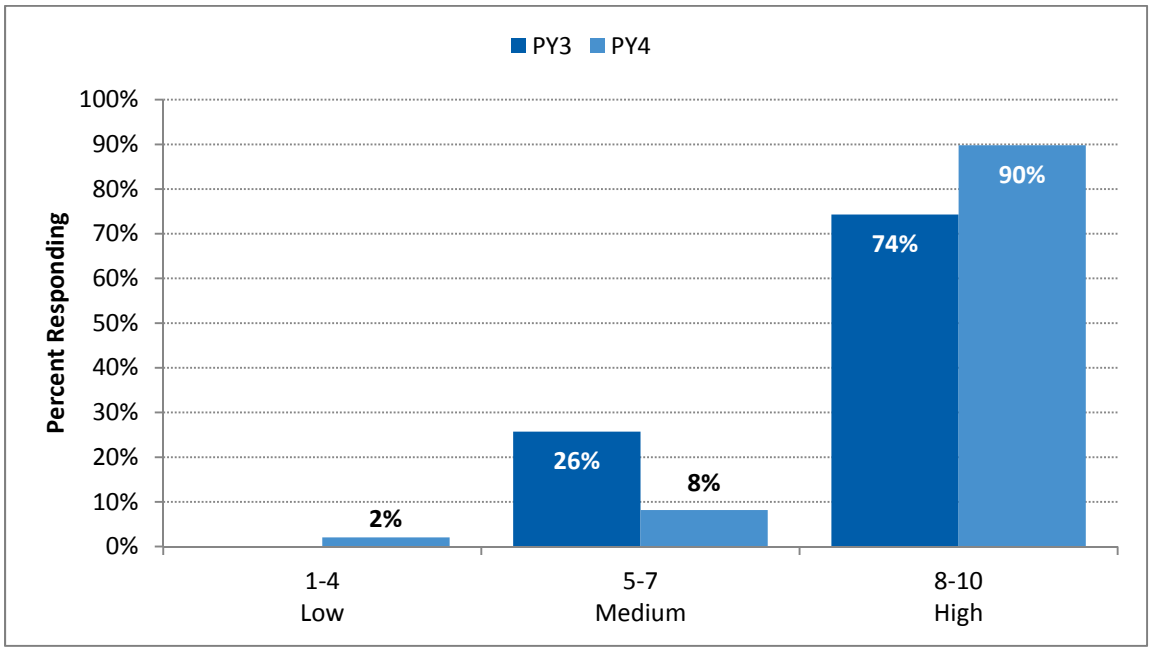
Awareness of Other PPL Electric Programs

We asked both audit-only and weatherization participants if they were aware of other PPL Electric programs. Approximately half (48%) of audit-only participants and one-third (34%) of weatherization participants said they were aware of other programs. When asked to specify the program, most respondents in both groups were aware of the Efficient Equipment Program or the Appliance Recycling Program.

Satisfaction

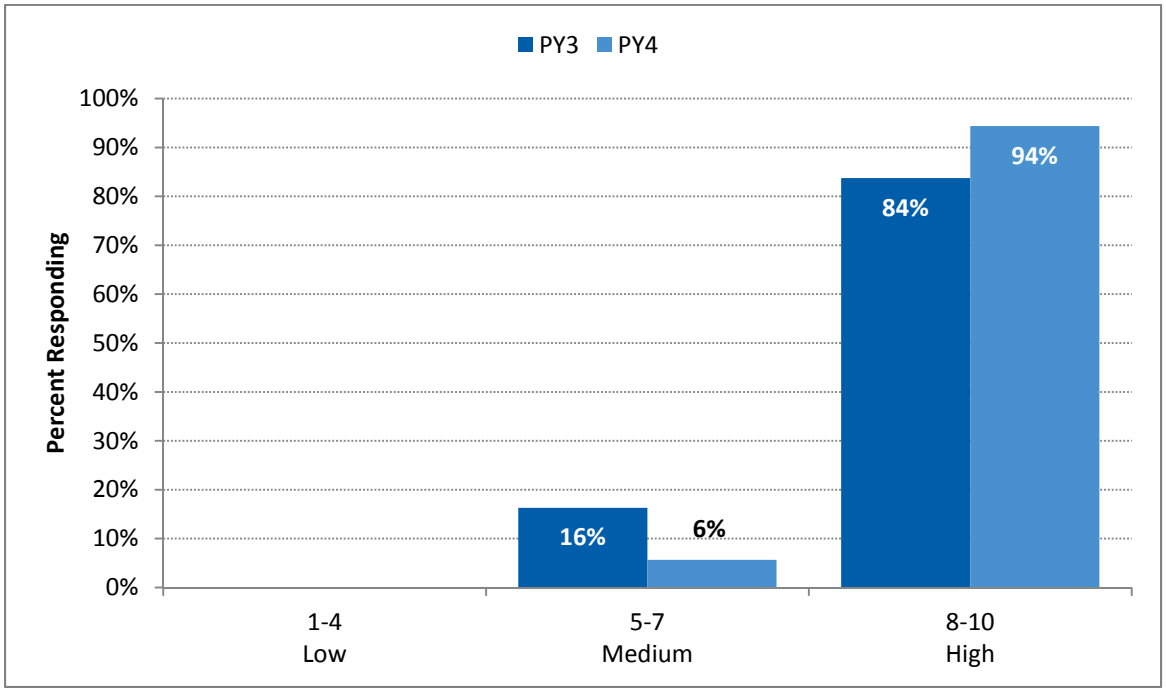
Satisfaction with the program overall was high for both the audit-only group and the weatherization group. In fact, satisfaction increased from last year. In both groups, the majority (90% and 94%, respectively) of respondents gave the program a rating of 8, 9, or 10 on a scale of 1-10, with 10 being highly satisfied.

Figure 46. Satisfaction with Program Overall: Audit-Only Participants



Source: Question PS1A and PS1B: Thinking about your overall experience, how would you rate your satisfaction with your program experience overall? (n=50)

Figure 47. Satisfaction with Program Overall: Weatherization Participants



Source: Question PS1: Thinking about your overall experience, how would you rate your satisfaction with your program experience overall? (n=71)

Only one audit-only respondent reported dissatisfaction with the program. This individual said the rebate process was slow and the information received was not valuable or helpful. Participants in both groups expressed high satisfaction with PPL Electric as an electric service provider, with approximately 78% of respondents in both groups giving the company a rating of 8, 9, or 10. This satisfaction level is similar to that provided by PY3 participants.

As a result of participating in the program, 48% of audit-only participants and 38% of weatherization participants said their opinion of PPL Electric improved. Approximately half of the respondents in each survey group indicated their opinion of PPL Electric had not changed as a result of their program participation. These ratings were similar to those provided last year by PY3 participants.

Participant Action on Energy Efficiency

Almost half (46%) of respondents reported they installed energy-efficient products since participating in the program without receiving an incentive.[52] The most commonly mentioned measures were:

- CFLs – 46%,
- Clothes washers – 22%,
- Refrigerators, freezers, and central air conditioners – 5%,
- Dishwashers, stoves, ovens, room air conditioners, and heaters – 3%.

Participant Motivations and Decision-Making

Reducing energy costs was the top motivation for program participation for both audit-only and weatherization participants. Of the PY4 audit participants, 64% participated to reduce energy costs, and 40% to increase efficiency of their home. For weatherization participants, 59% participated to reduce energy costs, and 17% participated to improve home comfort. Audit-only participants selected the lower-cost walk-through survey primarily due to the higher cost of the comprehensive audit. Those opting for comprehensive audit did so primarily to obtain more specific information on their home's efficiency. These results are similar to those provided by PY3 survey respondents.

Acting on Auditors' Recommendations

The program is designed so that during the audit or walk-through survey, the auditors recommend measures that would increase the energy-efficiency or comfort of the home. Customers installing recommended weatherization measures are eligible to receive rebates to offset the initial capital cost. The measures eligible for rebates include duct sealing, wall insulation, and attic insulation.

We asked respondents to the audit-only survey about their intent to follow through with the auditors' recommendations, and their motivation for installing the recommended measures. Of the 50 audit-only survey respondents, 29 said the auditor recommended they install ceiling insulation, 16 said the auditor recommended wall insulation, and 17 said the auditor recommended duct sealing. Only 17 respondents indicated they followed through and installed weatherization upgrades recommended by the auditor. Of

[52] Spillover is reported in the PY4 Annual Report.

those respondents who followed through with recommended measure installation, nine said they installed ceiling insulation, five installed wall insulation, and six said they had their ducts sealed.

We asked the 24 respondents who indicated they had not followed-through with installation of efficiency measures recommended by the auditor why they had not done so.

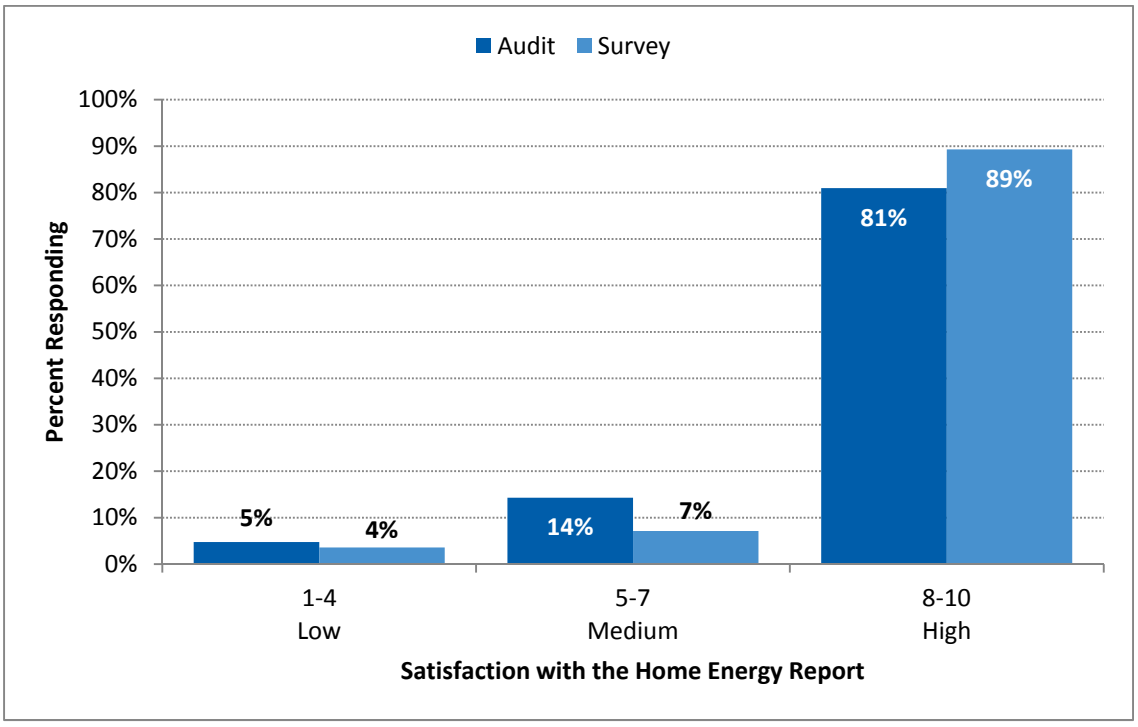
- Cost of the recommended measures was a major concern, with approximately half (11) of the respondents noting the measures were too expensive.
- Several of these individuals indicated they installed some less-expensive recommended upgrades, but the cost of the insulation and duct sealing was a barrier to installation of those measures.
- One respondent stated the payback would have been too long.
- Another reported having done some other work on the home that was also expensive but planned to install the recommended measures at a later date "when it's warmer."
- Seven individuals believed the recommended upgrades were not needed.
- Two people said they "just hadn't gotten around to installing the measures yet."

Many of these individuals have no plans to act on the auditors' recommendations. When asked *"which of the measures recommended by the auditor do you plan to install in the next 12 months?,"* half of the respondents indicated they did not plan to install any measures. Five individuals indicated they planned to install ceiling insulation, two said they planned to install wall insulation, and two planned to have their ducts sealed.

Influence of the Home Energy Report

Audit and walk-through survey participants received a customized Home Energy Report at the conclusion of their audit. Satisfaction with the report was high among both audit and walk-through survey participants, as shown in Figure 48. (Note that this is not the same Home Energy Report sent to customers in the Energy Efficiency Behavior and Education Program.)

Figure 48. Satisfaction with Home Energy Report: Audit-Only Participants



Source: Question PS1. Thinking about your overall experience, how would you rate your satisfaction with…the Home Energy Report you received? (n=49)

Seventeen of the 71 weatherization survey respondents also had a walk-through survey or audit through the Home Assessment and Weatherization Program. We asked these participants about the influence of the information in the Home Energy Report in their decision to install the weatherization upgrades. Of these 17 respondents, 14 indicated the information was *very important* to their decision.

Only a few individuals indicated dissatisfaction with the Home Energy Report. Of these individuals, one *"didn't find the 30-page report that helpful,"* and felt the report *"could have given me more concrete suggestions on what I could do to save more money."* Another respondent recommended that PPL Electric make the report easier to understand.

Installing Additional Efficiency Items

We asked all survey respondents if they installed additional energy-efficient products in their home without a rebate. Half of audit-only respondents and approximately 60% of weatherization respondents indicated that they had. The most often-cited measure in both groups was CFLs (36% and 32%, respectively), followed by refrigerators or freezers (16% and 12%, respectively), and clothes washers (8% and 10%, respectively).

Audit-only participants were more likely to say participation in the Home Assessment and Weatherization program was an important factor in their decision to install these items, with 80% to

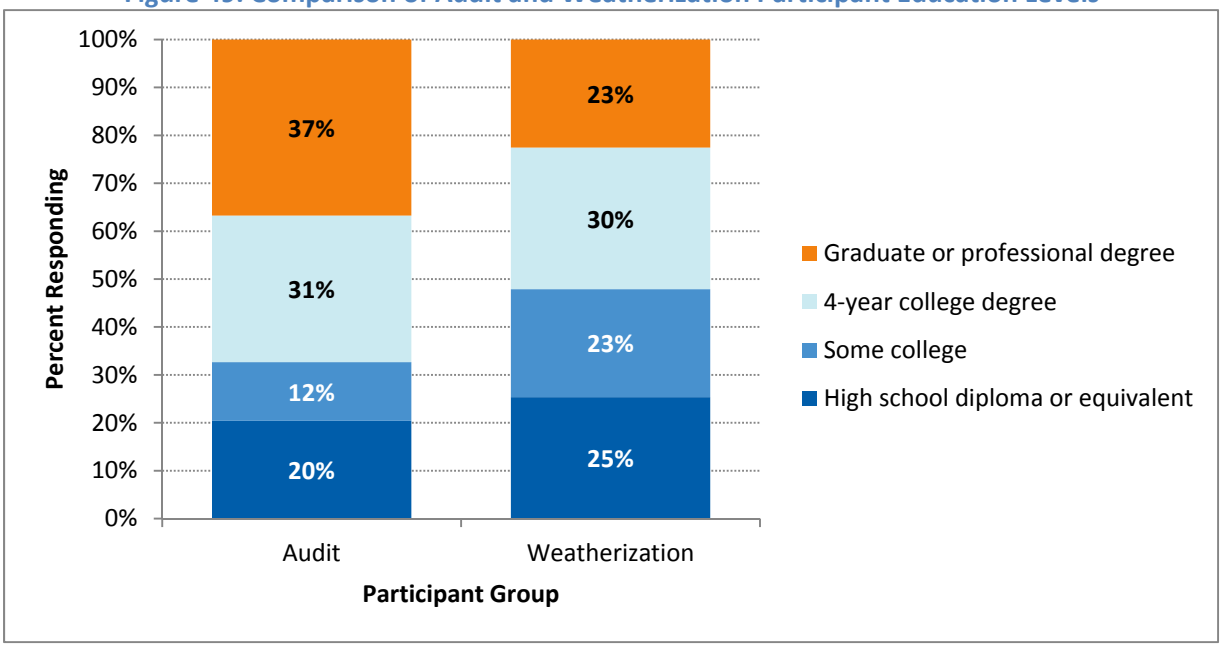
100% rating the program *somewhat* or *very influential* in their decision. Weatherization participants were less likely to credit their participation in the program as an important factor in their decision to install the items, with 62% rating the program *somewhat* or *very influential* in their decision to install CFLs. Their rating was 43% for refrigerators, and 33% for clothes washers.

Demographics

The majority of both audit and weatherization respondents (80% and 79%, respectively) have two to four individuals living full-time in their home. Approximately 50% of audit participant households and 41% of weatherization participant households have two full-time residents.

Sixty-eight percent of audit participants have a four-year or graduate degree versus 53% of weatherization participants, as shown in Figure 49. This difference is significant.[53]

Figure 49. Comparison of Audit and Weatherization Participant Education Levels

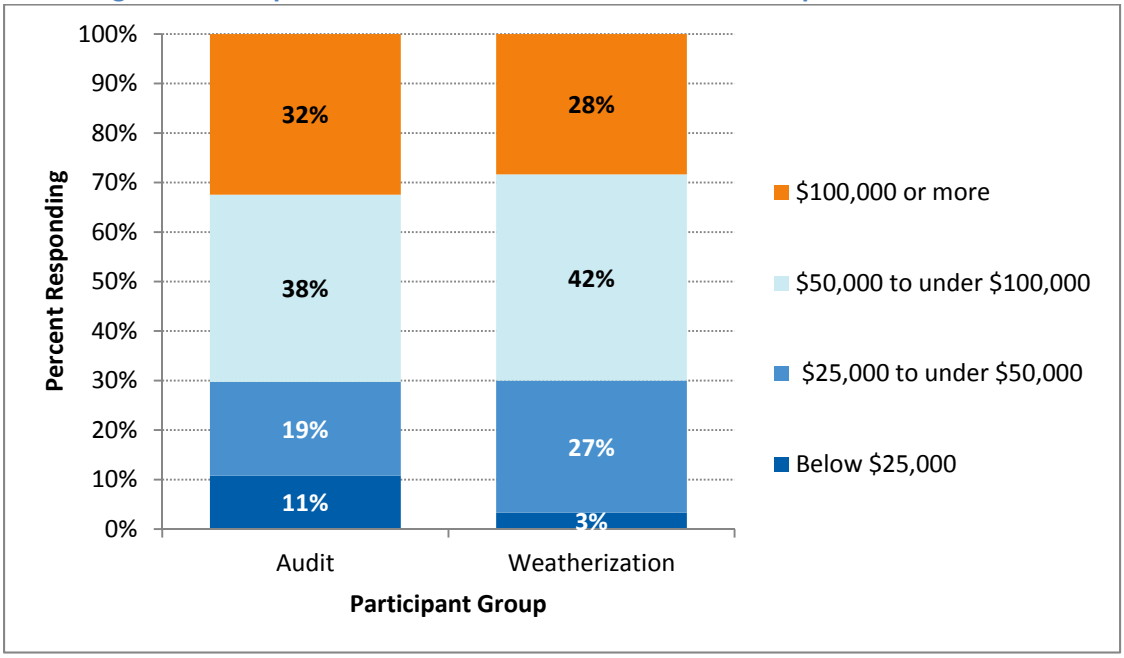


Source: D1. What is the highest level of education that you have completed? (Audit n=49, Weatherization n=71)

There is no statistically significant difference between the income levels of audit and weatherization participants, as shown in Figure 50.

[53] The chi-square test of independence yields a p-value of 0.096; therefore, these data provide evidence at the 0.10 level of significance.

Figure 50. Comparison of Audit and Weatherization Participant Income Levels



Source: D5-D7. Which of the following categories best represents your annual household income before taxes in 2012? (Audit n=37, Weatherization n=60)

Net-to-Gross Research

Unlike other rebate programs, the likelihood of a customer undertaking a home energy audit without the program is small. It is unlikely that a customer will pay for the full cost of an audit in the absence of the program; therefore, freeridership was not assessed for the audit component of the PPL Home Energy Assessment & Weatherization Program.

Freeridership may exist for customers installing recommended weatherization measures, however. Participant surveys were used to assess freeridership for these customers.

PPL Net-to-Gross Ratios over Time

PPL Electric first reported savings associated with follow-through installation of recommended weatherization measures in the fourth quarter of PY3. Cadmus assessed freeridership via analysis of a sample of 42 self-report surveys with PY3 weatherization participants. Additionally, we surveyed a sample of 71 PY4 weatherization participants and assessed freeridership from this group. These estimates are provided in Table 63. In PY4, freeridership increased by approximately 7%, lowering the program's overall NTG ratio.

Table 63. Phase 1 Weatherization NTG Ratios

Program Name	PY1	PY2	PY3	PY4
Home Assessment and Weatherization	-	-	82%	75%

Cadmus reviewed four similar audit and weatherization programs to understand other net-to-gross ratios and benchmark these against PPL Electric's.

Table 5 provides net-to-gross estimates from other audit and weatherization programs[54]. Ratios ranged from 77% to 89%. PPL's NTGR of 75% is in line with other programs, but only includes freeridership associated with weatherization.

Table 64. Comparison Net-to-Gross Ratios

Utility Region	Measures Offered	Program Launch Date	NTG Ratio
PPL Electric	Ceiling and Wall Insulation, Duct Sealing	2009	75%
South-Central Electric Utility	Air Sealing, Ceiling and Wall Insulation, Duct Sealing	2007	89%
Midwest Gas and Electric Utility	Air Sealing, Insulation, Windows	2010	77%
Southeastern Gas and Electric Utility	Air Sealing, Insulation, Duct Sealing, HVAC Replacement, DHW Blanket	2010	78%
Northeast Utility	Air Sealing; Basement, Ceiling, and Wall Insulation, Furnace/Boilers	2009	86%

QA/QC Review

This section summarizes factors affecting the Home Assessment and Weatherization Program's realization rates during PY4.

Audits and Direct-Install Measures

There are no savings associated with the surveys or audits alone; savings attributed to the program accrue from the measures provided at the time of the survey or audit (direct-install measures include CFLs, faucet aerators, water heater pipe wrap, smart power strips, and water heater temperature setbacks). Factors affecting these savings include:

- Corrections to measure counts
- Adjustments to the in-service rates

The TRM algorithms for two of the direct-install measures provided during the audit include in-service rates (ISR) that are subject to verification through evaluation; these are CFLs and faucet aerators. For the CFL ISR, the 2012 TRM indicates that the rate can be updated if evaluation findings reveal a value that differs from the default of 84%. Cadmus calculated an evaluated ISR of 99% using data gathered from the telephone survey responses.

Using the evaluated ISR of 99%, the ΔkWh/yr increases from 51 kWh/yr to 59 kWh/yr per bulb, and the ΔkW_{peak} increases from 0.002 to 0.003.

[54] These reports are Cadmus evaluations and are not public.

The evaluated ISR for faucet aerators—100%—is the same as the default value employed in the 2012 TRM. Using the algorithm in the 2012 TRM and the evaluated ISR of 100%, the evaluated energy savings from faucet aerators is 61 kWh/yr and the demand reduction is 0.0056 kW.

We found that the per-unit savings used to determine demand savings for aerators in the PY4 Q1 EEMIS extract and in the 2011 TRM—0.056 kW—was too high by a factor of 10. The text of the 2011 TRM states, "*the deemed energy savings for the installation of a low flow aerator compared to a standard aerator is ISR × 61 kWh/year with a demand reduction of ISR × 0.056 kW, with ISR determined through data collection*."[55] However, the value produced by the algorithm is *0.0056* kW. We adjusted the *ex ante* deemed savings value for aerators to equal 0.0056 kW per unit.

Insulation and Duct Sealing

PPL Electric reports savings per insulation measure based on a deemed kWh/square foot of insulation installed. All weatherization measures in the PY4 participant extracts were installed during PY3 and PY4, so weatherization measure savings calculations were governed by the TRMs in effect during PY3[56] and PY4.[57] Because the algorithms in the TRM also include parameters for heating and cooling fuel and system configuration and efficiency, climate zone, and pre- and post R-value of insulation, the factors affecting the difference between *ex ante* reported savings and TRM-adjusted *ex ante* savings include:

- Installed/treated square footage,
- Existing and installed R-values,
- Climate zone,
- HVAC equipment configuration and efficiency.

Factors affecting the realization rates (*ex post* evaluated savings / TRM-adjusted *ex ante* savings) are the accuracy of the following values recorded in EEMIS:

- Square footage
- Existing and installed R-values
- HVAC equipment configuration and efficiency

In PY4, the insulation rebate form provided one row each for ceiling and wall insulation. Each insulation measure on the form was recorded as one measure in EEMIS. The layout of the form created a problem if the contractor installed ceiling insulation, for example, in multiple areas of the attic. If the final R-value differed between the areas, some contractors improvised and attempted to enter all the information for

[55] Pennsylvania Public Utility Commission. *Technical Reference Manual*. June 2011. Pg 44. Available online: http://www.puc.pa.gov/electric/docs/Act129/Act129_TRM-2011.doc.
[56] Pennsylvania Public Utility Commission. *Technical Reference Manual*. June 2011. Available online: http://www.puc.pa.gov/electric/docs/Act129/Act129_TRM-2011.doc.
[57] Pennsylvania Public Utility Commission. *Technical Reference Manual*. June 2012. Available online: http://www.puc.pa.gov/electric/docs/Act129/Act129_TRM-2012.doc.

all insulated areas into one row. This resulted in entries that were difficult to read. Additionally, such entries created confusion for the rebate-processing CSP's data entry staff. Because they did not know how to record multiple values provided on one row, they sometimes added both the square-footage and R-values. When these summed R-value parameters were employed in the TRM energy savings algorithms, incorrect savings values were produced. Cadmus and PPL Electric discussed this concern during development of the Phase 2 forms. As a result, PPL Electric designed the Phase 2 forms with multiple lines per insulation type so that contractors could enter each weatherized area separately. Additionally, each row on the form will be recorded as a separate record in EEMIS which will allow accurate calculation of energy savings as per the TRM algorithms.

Conclusions and Recommendations

Based on the findings, we suggest PPL Electric consider the following recommendations in Phase 2.

Conclusion: The large percentage of participants installing weatherization measures without the benefit of an audit did not have the benefit of information the auditor and audit report would have provided, leaving them unaware of potential energy savings.

Recommendation: Continue to make eligibility for the weatherization rebates contingent upon participation in the audit portion of the program. The Phase 2 "Residential Home Comfort" program makes participation in the audit program a prerequisite to eligibility for a weatherization rebate. Given the low percentage of weatherization participants who also received an audit in Phase 1, Cadmus agrees with this program change and we encourage PPL Electric to continue the requirement during all of Phase 2 so that participants will be fully informed about potential energy-saving actions.

Conclusion: Cost is a large barrier to following through with installing measures recommended by the auditors.

Recommendation: Consider providing help locating additional financing for the upgrades. Financial institutions that can provide financing options such as grants or loans may increase the percentage of audit participants who are able to follow through and install the weatherization upgrades. PPL Electric should explore partnering with financial institutions or independent organizations to refer customers. For example, Clean Energy Works Oregon provides customers with rebates tiered by expected savings as well as no-money-down financing through local lender partners.[58] Some lenders offer the option of making the loan payment as part of the utility bill.

[58] http://www.cleanenergyworksoregon.org/rebates-financing/

PY4 Process Recommendations Status: Home Energy Assessment and Weatherization Program

Table 65 contains the status of each PY4 process recommendation made to PPL Electric.

Table 65. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Home Assessment and Weatherization Program	
Continue to make eligibility for the weatherization rebates contingent upon participation in the audit part of the program.	**Implemented.** In addition, PPL is proposing changes to its Ph 2 program that will increase the audit rebate if customers install measures recommended by the audit.
Explore partnering with financial institutions or independent organizations to refer customers to for help with financing weatherization upgrades.	**Rejected/Being Considered.** PPL will consider expanding the information/links to existing financing sources on its website. However, PPL's research does not indicate a widespread or compelling need for financing in order for PPL to achieve its savings compliance targets.

E-Power Wise Program

For the E-Power Wise Program, the PY4 process evaluation activities were these:

- A database review and QA/QC activities.
- Participant surveys for this program were conducted in PY2 and PY3 only, as stated in the E-Power Wise Evaluation Plan.[59]

Achievements against Plan

In PY4, the program achieved 107% of its planned MWh/yr savings, and 53% of its planned kW savings. The program achieved 108% of its annual participation target.

Overall, the E-Power Wise Program met its participation goal, but fell short of its four-year planned MWh/yr savings, gross kW reduction goal, and top 100 hour kW reduction goal. At the end of Phase 1 (May 31, 2013), E-Power Wise had achieved:

- 87% of its 4,268 MWh/yr four-year planned savings,
- 72% of its 761 kW four-year planned gross demand reduction,
- 47% of its 1,000 kW four-year planned top 100 hour demand reduction, and
- 100% of its four-year participation target of 2,249 participants.

Table 66. E-Power Wise Program Phase 1 Planned Savings

Savings Category	PY4 Planned Savings	PY4 Verified Savings	Total Phase 1 Planned Savings	Total Phase 1 Verified Savings
MWh/yr[60]	967	1,034	4,268	3,707
kW[61]	189	100	761	550
Top 100 Hour kW[62]	n/a	n/a	1,000	465

QA/QC Review

This section summarizes factors affecting the program's realization rates during PY4. For the E-Power Wise Program, these include:

[59] PPL Electric Utilities Act 129 QA/QC & EM&V Plans E-PowerWise Program, Rev. December 2011

[60] All planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

[61] Ibid.

[62] Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

- **Duplicate or inaccurate records in EEMIS.** Duplicate or inaccurate records identified in EEMIS are removed from the analysis; they lower the number of kits that are counted toward the program.
- **Participant-returned surveys.** Participant-returned surveys are used to adjust installation rates for the items contained in the take-home kits. This impacts the realization rate for these items as well as for the overall program.

Only minor issues were identified through the QA/QC review in PY4. The review of PY4 Q1 and PY4 Q2 EEMIS data identified issues with kit numbers, account numbers, and participant information contained in EEMIS. Cadmus communicated the identified issues to PPL Electric, and PPL Electric conducted research to identify and correct the errors. The QA/QC realization rates by quarter are presented in Table 67, along with the final QA/QC realization rate for PY4.

Table 67. E-Power Wise Program PY4 QA/QC Realization Rates

	Q1	Q2	Q3	Q4	Total PY4
QA/QC Realization Rate	98.7%	99.5%	99.9%	100%	99.5%

Conclusions and Recommendations

The E-Power Wise program was successful in Phase 1 and in PY4. In PY4, PPL Electric promptly resolved identified QA/QC issues. Cadmus did not provide recommendations for this program in PY4.

PY4 Process Recommendations Status: E-Power Wise Program

Table 68 contains the status of each PY4 process recommendation made to PPL Electric. However, no recommendations were provided to PPL.

Table 68. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC
E-Power Wise Program	
No recommendations for PY4.	N/A

Peak Saver Program

For the Peak Saver program, also referred to as Direct Load Control (DLC), the PY4 process evaluation activity was a participant survey (n=95). This program is not part of PPL's Phase 2 EE&C plan.

Achievements against Plan

In PY4, the program achieved 51% of its planned top 100 hour kW savings.

The Peak Saver program was planned and delivered as a one year program, targeting demand reduction only during the peak period in PY4, that is, from June through September, 2012. Overall, the Peak Saver Program fell short of its one-year planned kW goal by 17,414 kW. At the end of Phase 1 (May 31, 2013), Peak Saver had achieved a reduction of 18,230 kW, or 51% of its one-year planned savings.

Table 69. Peak Saver Program Phase 1 Planned Savings

Savings Category	PY4 Planned Savings	PY4 Verified Savings	Total Phase 1 Planned Savings	Total Phase 1 Verified Savings
MWh/yr[63]	-		-	
Top 100 Hour kW[64]	35,644	18,230	35,644	18,230

The program began to realize demand savings in June 2012 (PY4), after participants were recruited and the first conservation event occurred. In the first two events, PPL Electric and the program CSP experienced some difficulty with the DLC signaling technology. These issues were more fully explored in the PY3 Process Evaluation.[65]

Survey Findings

In PY4, Cadmus surveyed 95 participants in the PPL Electric Peak Saver program. The survey sample was drawn from the most recently enrolled group of participants in PY4 Q1. Results achieved 90% confidence and 10% precision at the program level. Table 70 shows the population, targets for completed surveys, and the achieved number of completed surveys.

63 Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

64 Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

65 See: Cadmus, 2012. "Process Evaluation Report, PPL Electric EE&C Plan, Program Year Three." Prepared for PPL Electric Utilities, pp. 40.

Table 70. Targeted and Completed Surveys

Survey Group	PY4 Q1 Population*	Target	Achieved
Peak Saver Residential Participants	6,130	70	90
Peak Saver Business Participants	52	25	5
Total	**6,182**	**95**	**95**

***** Population size is defined by accounts activated in PY4Q1.

The following sections provide key findings from the Peak Saver PY4 participant survey.

PPL Electric Marketing and Outreach

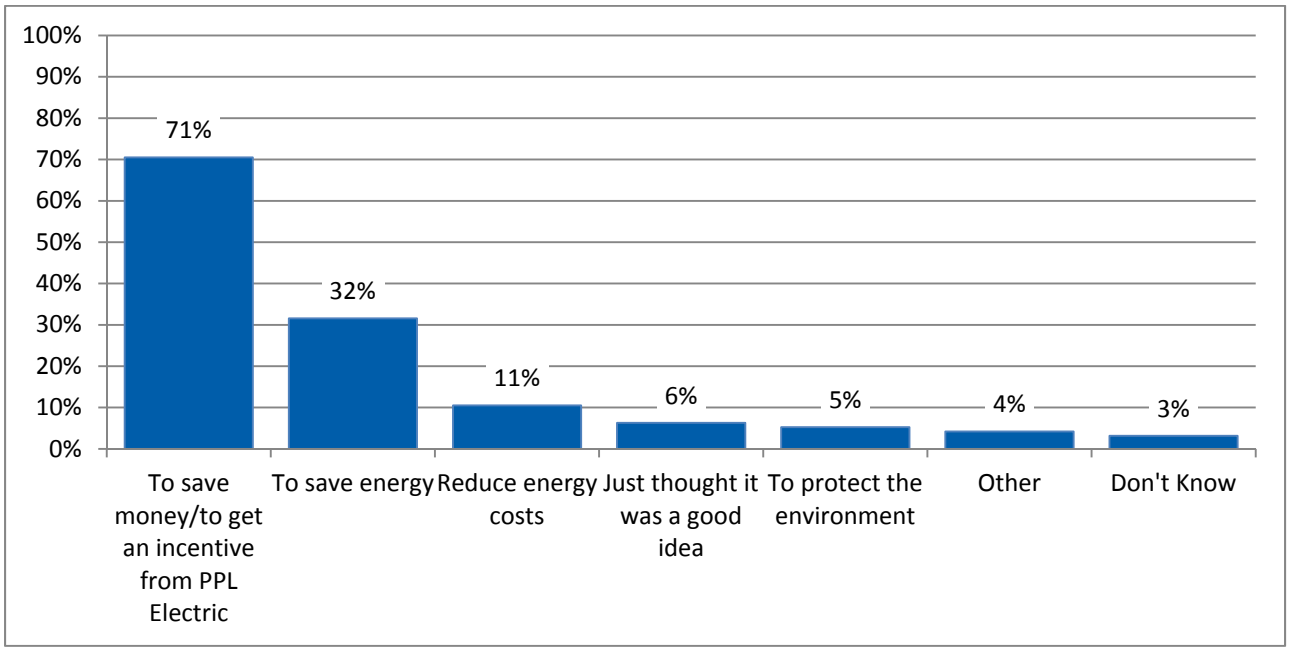
The majority of respondents (86%) learned about PPL Electric's Peak Saver Program from PPL Electric's bill insert, newsletter, or ePowerlink. Several respondents also mentioned learning about the program from other sources including a PPL Electric representative; PPL Electric's newspaper advertisement; a friend, relative or colleague; an e-mail from PPL Electric; and PPL Electric's website.

Only 24 respondents (26%) were aware of other PPL Electric energy conservation rebates or incentives. Of those 24, 16 knew of the Efficient Equipment Incentive Program, five knew of the Appliance Recycling Program, two knew of the CFL Lighting Campaign, and two others knew of the Home Assessment and Weatherization Program. Just over one-third of these respondents said they learned about these rebates or incentives through participation in the Peak Saver Program.

Reasons for Participating in the Program

When respondents were asked why they chose to participate in the Peak Saver Program, 71% (67 of 95 respondents) reported they were motivated by wanting to save money or receive an incentive from PPL Electric. Nearly one-third (32% or 30 out of 95) said they wanted to save energy, 11% (10 of 95) said they wanted to reduce energy costs, 6% (6 of 95) just thought it was a good idea, and 5% (5 of 95) wanted to protect the environment. Other motivating factors were mentioned, such as curiosity about how the program would work, a desire to help improve the operation of the electrical grid and system in their area, the perception that it would not require much effort, and a recommendation from someone else. Figure 51 illustrates these results.

Figure 51. Motivation to Participate



Source: Question M4. What were the major reasons that you participated in the Peak Saver Program? (n=95)

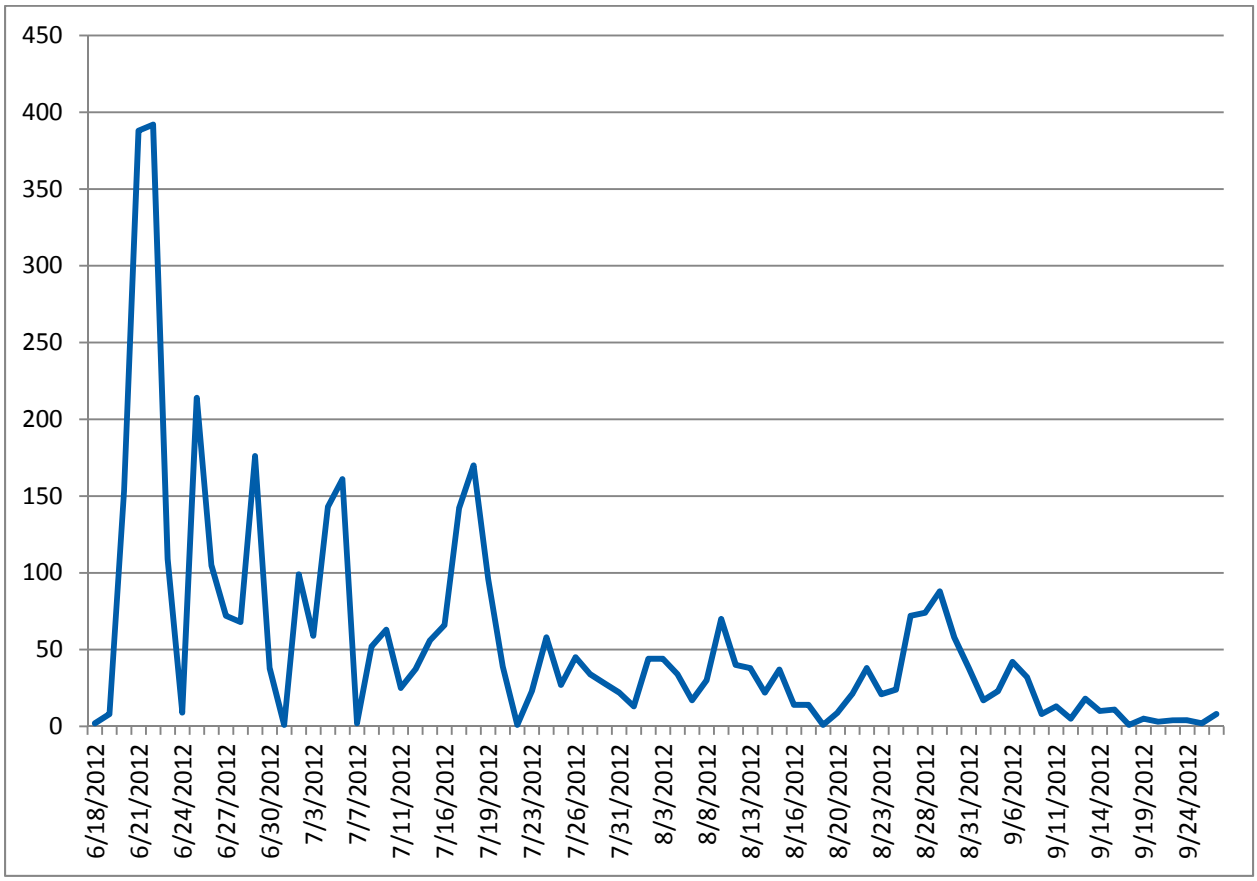
Opting Out of Events

Only 15 respondents (16%) reported opting out of an event and the majority said they chose to do so from one to three times. Two customers reported opting out of all events (referred to here as a permanent opt-out) and one said they opted out of more than 10 events. When asked about their reasons for opting out, most of the respondents (67%) stated that the cycling event made their home or business too hot and uncomfortable. Two respondents said they opted out because of the timing of the events, another two stated that their systems were malfunctioning, one said he had to opt out for health reasons. One felt he was misled by information provided by PPL Electric but provided no further explanation. Ten of the 15 respondents who opted out were aware of when their cooling units were cycled by the program. Four were not aware, and one did not know.

Over time, there were fewer households that permanently opted out of the program. The largest number of permanent opt-outs occurred after the first two conservation events, June 20 and June 21.

All program participants and opt-out rates are shown in Figure 52.

Figure 52. Daily Count of Permanent Opt-Outs



Source: Program Implementation CSP's data

Comfort Level and Cycling Awareness

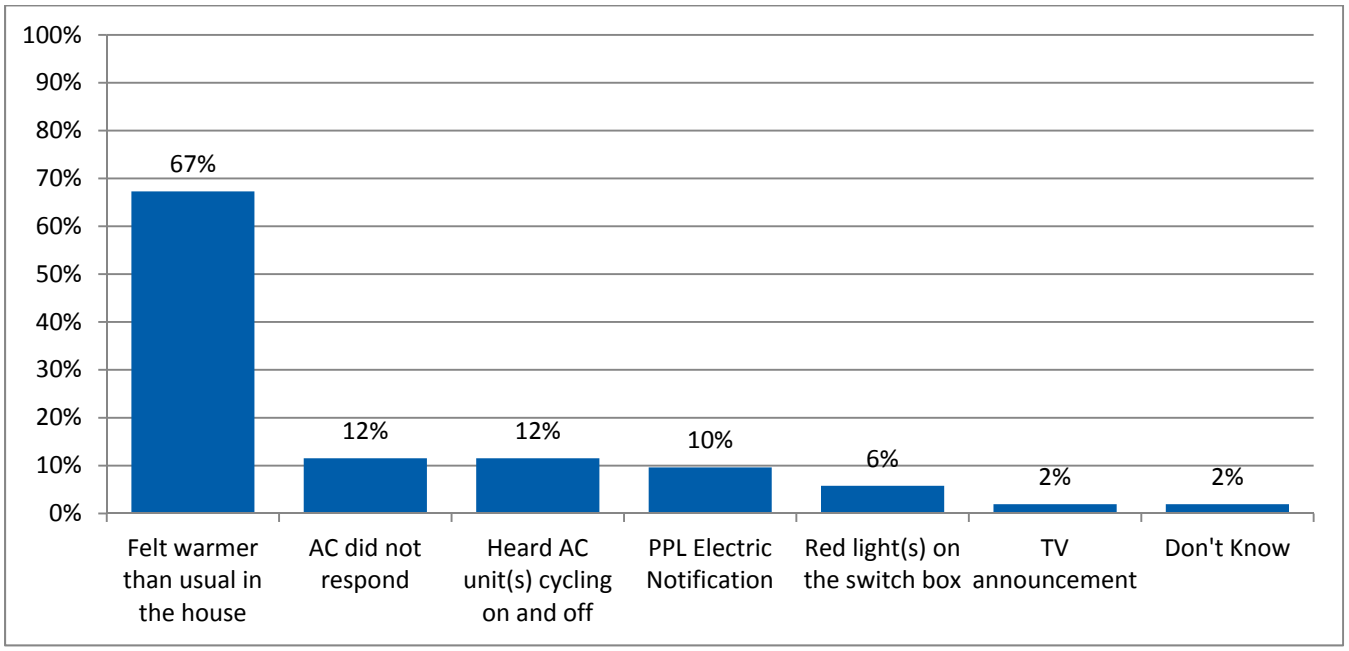
Participants were asked if a member of their household was home for conservation events. Just over half (56%) thought a member of their household was present for most or all of the events. For another 27%, someone was present for at least some of the events. Only 8% thought that no one was home for any of the events. Ten percent did not know if anyone was home during the events.

When asked if participants recalled when their cooling units were cycled on and off by the program, 41% were not aware of this cycling and 3% did not know. About half, 55%, said they knew the units were cycling. Respondents who were aware their unit was cycling noticed for different reasons (Figure 53).

- 67% (35 respondents) reported that they were made aware the units were cycling because it felt warmer than usual in the house.
- 12% said they were made aware because their air conditioner did not respond when they tried to make it cooler.
- Another 12% said they could hear the air conditioning units cycling on and off.
- 10% said they were notified by PPL Electric.

- 6% reported seeing a red light on their switch box.
- 2% reported learning about it from a television announcement.

Figure 53. Awareness of AC Cycling (Conservation Events)

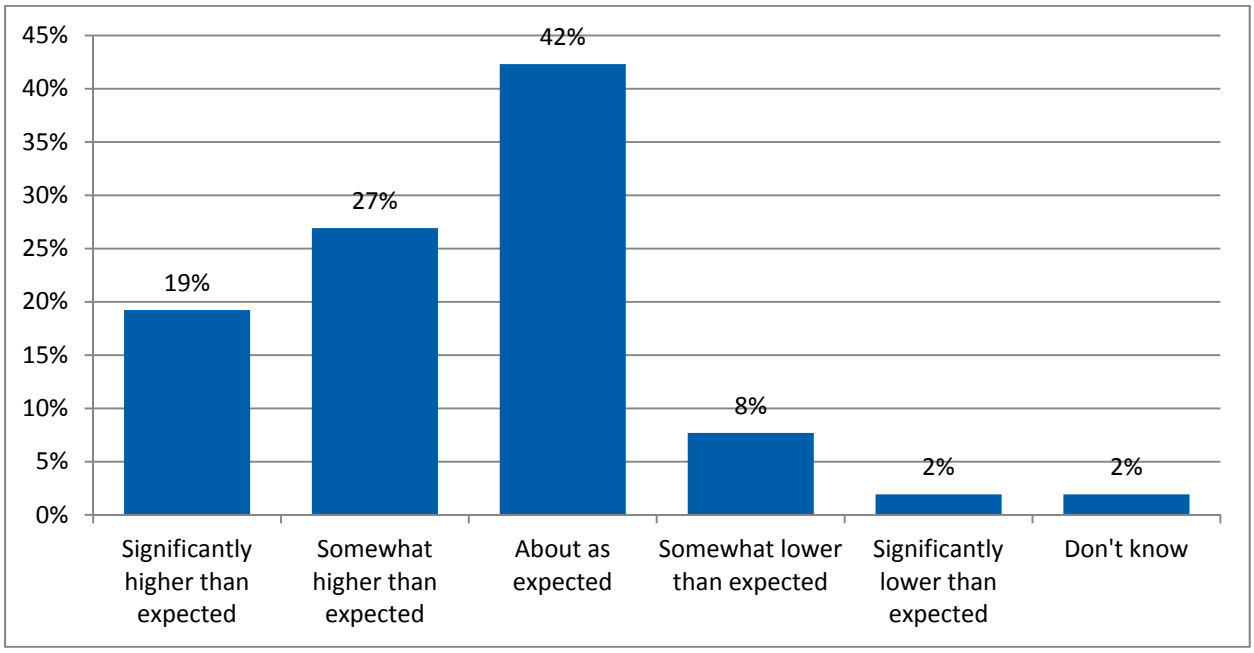


Source: Question CL2. What made you aware that the cooling unit was cycling? (n=52)

The majority of respondents (81%, 42 of 52) reported doing nothing different to manage the comfort level in their home or business in response to the cycling. Only 10 participants took actions to cool their homes, including lowering the temperature on their thermostat, turning on ceiling fans, opening windows, and shutting blinds.

When asked if the temperatures they experienced were consistent with their expectations, almost half (46%) felt that the temperatures were *somewhat* or *significantly* higher than expected. Forty-two percent reported that the temperatures were about what they expected, and 10% thought they were lower than expected (Figure 54).

Figure 54. Expectations about Temperatures During AC Cycling (Conservation Events)

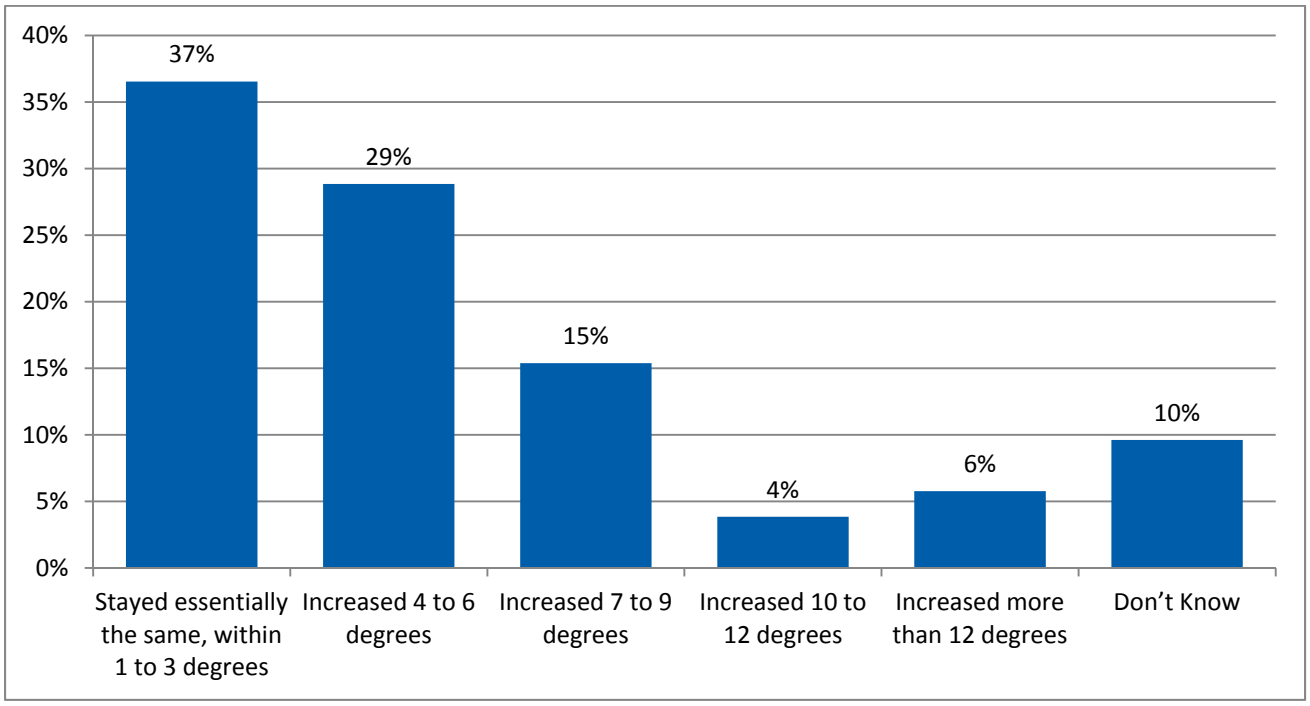


Source: Question CL4. Thinking back to the conservation events, would you say that the temperatures that you actually experienced in your [home/business] were… (n=52)

Most customers who said the temperatures were *about what they had expected* or *somewhat higher* than expected took no actions to cool their homes (34 out of 36 respondents) although one person mentioned turning on a ceiling fan and another said he shut his blinds. By contrast, eight of the 11 customers who reported that temperatures were significantly higher than expected took actions to cool their homes. Most customers who said the temperatures were *somewhat lower* or *significantly lower* than expected did not take any actions to cool their homes.

Respondents were asked to what extent indoor temperatures changed during the conservation events. Thirty-seven percent reported their temperatures stayed essentially the same, within one to three degrees (19 of 52 respondents). Almost one-third (29%) said their temperatures increased four to six degrees, and 15% reported an increase of 7% to 9%. Ten percent reported an increase of 10 or more degrees (Figure 55).

Figure 55. Reported Temperature Increases During Conservation Events



Source: Question CL5. Looking back on the conservation events over the summer, did you find that when your cooling device was being controlled, that your [home's/business's] indoor temperature usually…(n=52)

Program Satisfaction

Respondents were asked about their satisfaction with various aspects of the program, and asked to rank their experience on a four-point word scale of: *very satisfied, somewhat satisfied, not too satisfied, or not satisfied at all.*

In general, respondents reported high levels of satisfaction with their overall experience with the Peak Saver Program. Eighty-five percent (81 of 95 respondents) were either *very satisfied* or *somewhat satisfied*, only one respondent was neutral, 11% reported *dissatisfaction*, and three did not know.

Participants also reported high levels of satisfaction with the notification information received from PPL Electric about the events. Eighty-four percent (80 out of 95 respondents) were either *very satisfied* or *somewhat satisfied*, only one respondent was neutral, 13% reported *dissatisfaction*, and two did not know.

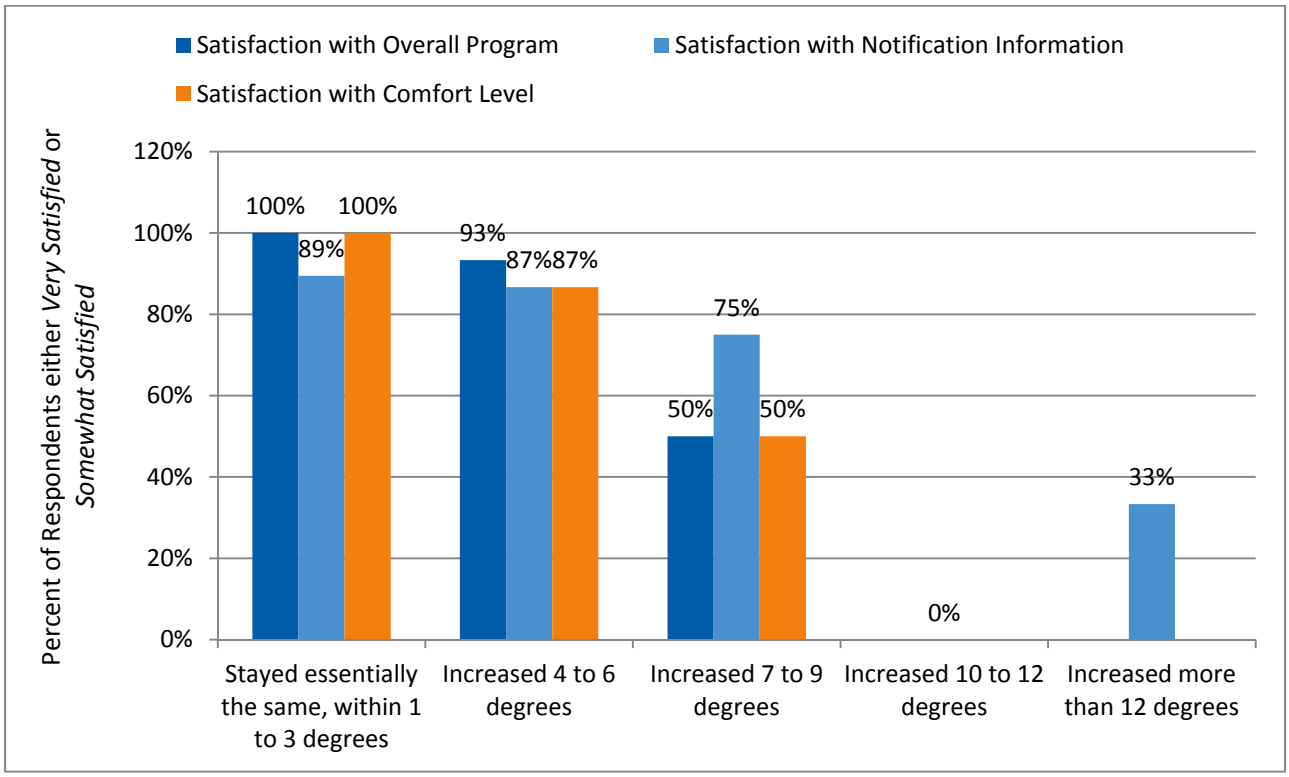
When asked about their satisfaction with the level of comfort in their homes and businesses, respondents reported high levels of satisfaction. Seventy-nine out of 95 respondents (83%) were either *very satisfied* or *somewhat satisfied*, only two respondents were neutral, 12 (13%) reported *dissatisfaction*, and two did not know.

Temperature increases during events affected the respondents' satisfaction with the overall program, PPL Electric's notification information, as well as the satisfaction with the comfort level of customers'

homes and businesses (Figure 56). All those who reported temperatures that stayed essentially the same, within one to three degrees, were either *very satisfied* or *somewhat satisfied* with the overall program and the comfort level in their homes or businesses. Similarly, 89% were either *very satisfied* or *somewhat satisfied* with the notification information.

As Figure 56 shows, satisfaction levels generally decreased as reported temperatures increased. No customers who reported an increase in temperature of 10 to 12 degrees were "satisfied" in any category (defined as a ranking of *very satisfied* or *somewhat satisfied)*. Only one person out of three who reported an increase of more than 12 degrees was satisfied with the notification information.

Figure 56. Temperature Increases During Events and Corresponding Satisfaction



Source: Question CL5. Thinking back to the conservation events, would you say that the temperatures that you actually experienced in your [home/business] were … AND Question PS2. Thinking about the information you received from PPL Electric notifying you about these events, how satisfied were you with that information? AND Question PS3. How satisfied were you with the level of comfort in your [home/business] during the hours of the events? (n=52)

Eighteen respondents who reported low levels of satisfaction (saying they were either *not too satisfied* or *not satisfied at all)* with the overall program, the notification information, or the comfort level of their homes. These respondents were then asked why they were dissatisfied with an aspect of the program.

- Eight of 18 (44%) said they felt their homes or businesses became too hot. One respondent said, *"It was blazingly hot in the house and it didn't work properly."*
- Others (39%, 7 of 18) were unhappy with the information provided by PPL Electric about the length of the event, the extent to which the temperatures could increase, and notification about when the events would happen.
- One respondent said, *"[PPL Electric] said we would not see a difference in the temperature in the house and we definitely did."*

The majority of respondents (81%, 77 of 95) said they would be *very likely* or *somewhat likely* to recommend the Peak Saver Program to a friend or relative. Eighteen percent (17 of 95) said they would *not be very likely* or *not at all likely* to recommend the program. One said he did not know.

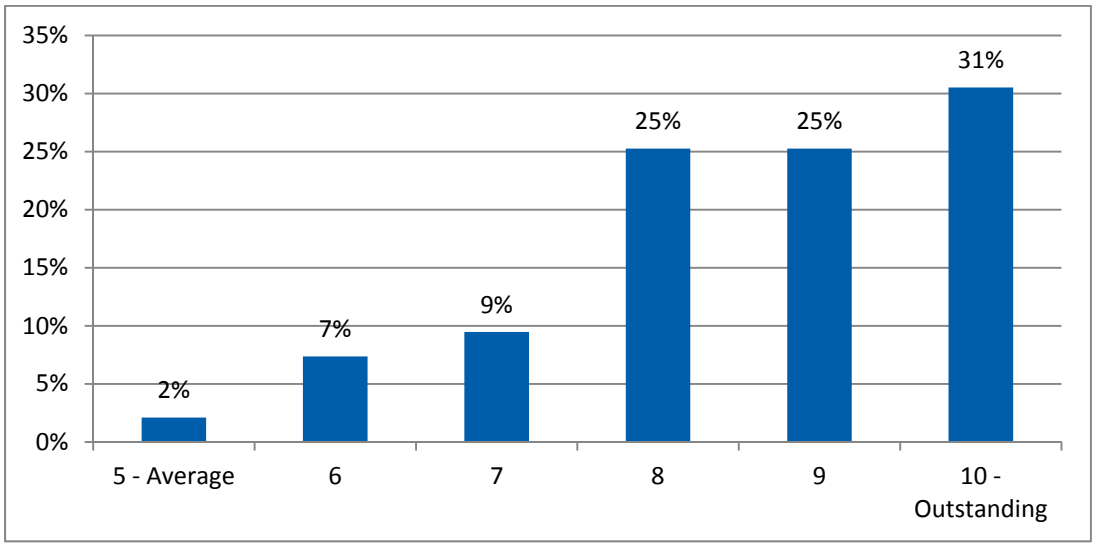
Peak Saver Hotline

Only 16 of 95 respondents (17%) reported calling the Peak Saver Program's hotline. Of these 16 participants, half did not reach a Peak Saver Program representative. The other eight who reached a program representative were *very* or *somewhat satisfied* with the information they received on the call. Only one person said they were *not satisfied at all*. Most who called (69%, 11 of 16), called one to two times. Five participants reported calling three or more times.

Satisfaction with PPL Electric

Respondents reported high levels of satisfaction with PPL Electric overall as a provider of electric service. When asked to rate PPL Electric using a 10-point scale (where 1 means unacceptable, 5 means average, and 10 means outstanding), all participants gave PPL Electric a rating of five or above, and 81% of respondents gave PPL Electric a rating of 8, 9, or 10. (Figure 57). Participants were asked if their opinion of PPL Electric changed after participating in the Peak Saver Program. Just over one-quarter (26%) said their opinion improved while three respondents said their opinion decreased. Sixty-seven percent (64 of 95 respondents) reported that their opinion had not changed.

Figure 57. Overall Satisfaction with PPL Electric



Source: Question PP1. 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 home? (n=95)

Conclusions and Recommendations

Based on the findings, we offer the following conclusions and recommendations. We suggest PPL Electric consider the recommendations if it offers a similar program in the future, recognizing that demand response programs are not currently planned for Phase 2 of Act 129.

Conclusion: Home comfort during the conservation events played a critical role in program satisfaction. Satisfaction levels generally decreased as reported temperatures increased, and those who experienced a temperature increase over 10 degrees were unsatisfied with the program overall. High temperatures were the main reason that customers decided to drop out of the Peak Saver Program.

Recommendation: Consider exploring ways to more clearly describe the potential for temperature increases during events and how long the events will last. This information could be provided to customers upon signing up to participate in a program, or directly prior to a conservation event. Consider ways to ensure temperatures do not increase beyond expectations (significant temperature increases were due to equipment malfunctions).

Conclusion: PPL Electric and the program CSP improved the information provided when customers called the Peak Saver Program's hotline, but did not improve the support capacity at the CSP call center after the first two conservation events.

Differences between PPL Electric's survey of participants in July (directly after the first two conservation events) and Cadmus' survey in November suggest that participants were more satisfied with the information provided by the service center over time. However, the number of respondents who

reported not getting through to a customer service representative after calling the hotline stayed consistent at 50% across both surveys.

Recommendation: Consider increasing the number of Peak Saver hotline representatives who are on call, or, explore options to improve the hotline experience. This could include using an automated callback system, announcing holding times, or announcing a place "in line" when customers call and are placed on hold.

PY4 Process Recommendations Status: Peak Saver Program

Table 71 contains the status of each PY4 process recommendation made to PPL Electric. This program is not offered in Phase 2. However, PPL might consider these recommendations if a residential demand response program similar to Peak Saver is offered in future Act 129 programs.

Table 71. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Peak Saver Program	
Should PPL Electric choose to implement a similar air conditioning cycling program in the future, clearly describe the potential for temperature increases during conservation events. Clearly describe how long the events will last.	PPL agrees.
Should PPL Electric choose to implement a similar air conditioning cycling program in the future, increase the number of Peak Saver hotline representatives who are on call, or, explore options to improve the hotline experience.	PPL agrees.

Load Curtailment Program

For the Load Curtailment program, the PY4 process evaluation activities were these:

- A statewide participant survey (n=86) developed by the Statewide Evaluator (SWE), and
- An interview with PPL Electric EM&V staff.

Achievements against Plan

In PY4, the program achieved 76% of its planned kW savings.

The Load Curtailment program was planned and delivered as a one year program, targeting demand reduction only during the peak period in PY4, that is, from June through September, 2012. Overall, the Load Curtailment Program fell short of its one-year planned kW goal by 38,100 kW. At the end of Phase 1 (May 31, 2013), the program had achieved a reduction of 118,200 kW, or 76% of its one-year planned savings.

Table 72. Load Curtailment Program Achievements

Savings Category	PY4 Planned Savings	PY4 Verified Savings*	Total Phase 1 Planned Savings	Total Phase 1 Verified Savings*
MWh/yr[66]	-	-	-	
Top 100 Hour kW[67]	156,300	118,200	156,300	118,200

* Determining using the PUC/SWE methodology, not PPL Electric's alternate method

In 2013, the SWE conducted a statewide demand response (DR) study to determine the cost effectiveness of the DR programs that were implemented during the summer of 2012.[68] Based on the study's findings, Pennsylvania electric distribution companies (EDC) are not required to implement DR programs in Phase 2. PPL Electric's Phase 2 EE&C plan does not include a Load Curtailment Program.

Survey Findings

- The statewide survey methodology and findings are contained in the SWE demand response study.[69]

Interview Findings

This section contains key findings from the in-depth interview conducted with EM&V staff in PY4.

66 Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

67 Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

68 GDS Associates, May 2013. "Act 129 Demand Response Study, Final Report." Prepared for the Pennsylvania Public Utility Commission. Available at: www.puc.pa.gov/pcdocs/1230512.docx

69 Ibid, pp. 29-31

Program Planning and CSP Selection

- PPL Electric issued the load curtailment RFP more than a year in advance of the curtailment season to begin the process of selecting a CSP. Staff reported that this lead time was critical to successfully negotiate the load curtailment contract, recruit customers, and implement the program. Due to the advanced planning and CSP hiring, staff felt they were very well prepared to implement the Load Curtailment program on June 1, 2012 and were pleased with the process.
- PPL Electric considered hiring multiple CSPs. Under that approach, multiple CSPs would have been responsible for recruiting customers in PPL Electric's territory. After several months of experience with the program, PPL Electric concluded that hiring a single CSP was the right decision, for two main reasons: (1) Participant recruitment was challenging and would have been even more challenging with multiple CSPs competing for customers; (2) It would have difficult for PPL Electric to coordinate day-ahead and event-day operations, communications, and planning with multiple CSPs.

Participation Barriers

- Recruiting sufficient participants to meet the program's goals was one of the main challenges of the program. PPL Electric reported several barriers:
- The program had a short timeframe for implementation and achievement of goals.
- Participants were reluctant to interrupt operations.
- "Information fatigue" from frequent utility and competitive supplier communications made participants skeptical about participating in the program.
- The uncertain future of the Act 129 DR programs in Phase 2 and beyond made planning difficult, and PPL Electric was not able to assure customers that the program would be available for a longer period of time.

Load Forecasting and Communication Surrounding Conservation Events

- PPL Electric was pleased with the process of load forecasting, predicting the top 100 hours, and tracking the status (including the likelihood that events may drop out of the top 100 hours). Staff reported that the process went smoothly. Staff noted that the warmer-than-normal summer helped them accurately predict the top hours more successfully than a cooler-than-normal summer would have.
- In general, the process for day-ahead and event-day planning, communication, and coordination with the load curtailment CSP went smoothly and as intended.
- Designing the Load Curtailment program to predict 50 of the top 100 hours as opposed to 100 of the top 100 hours helped with PPL Electric's ability to predict the load. Also, customers were more willing to curtail for fewer hours.

Conclusions and Recommendations

Cadmus has no recommendations for this program because it is not part of PPL Electric's Phase 2 EE&C plan.

PY4 Process Recommendations Status: Load Curtailment Program

Table 73 contains the status of each PY4 process recommendation made to PPL Electric. However, no recommendations were made.

Table 73. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Load Curtailment Program	
There were no recommendations made to PPL Electric in PY4 because the program will not continue in Phase 2.	N/A

HVAC Tune-Up Program

For the HVAC Tune-Up Program, the PY4 process evaluation activities were limited because PPL Electric is not continuing this program in Phase 2. Cadmus interviewed the program manager at PPL Electric to understand the key issues with the program and how the program exited the market. In PY3, Cadmus summarized the PPL Electric HVAC tune-up contractor survey findings and offered recommendations.[70]

Achievements against Plan

In PY4, the program achieved 43% of its planned MWh/yr savings, and 221% of its planned kW savings.

Overall, the HVAC Tune-Up Program fell short of its four-year planned MWh/yr savings goal by 398 MWh/yr, and exceeded its gross kW reduction goal and top 100 hour kW reduction goal. At the end of Phase 1 (May 31, 2013), the HVAC Tune-Up program had achieved:

- 81% of its 2,047 MWh/hr four-year planned savings,
- 221% of its 542 kW four-year planned gross demand reduction, and
- 113% of its 1,000 kW four-year planned top 100 hour demand reduction.

Table 74. HVAC Tune-Up Program Achievements

Savings Category	PY4 Planned Savings	PY4 Verified Savings	Total Phase 1 Planned Savings	Total Phase 1 Verified Savings
MWh/yr[71]	838	364	2,047	1,649
kW[72]	11	70	542	1,200
Top 100 Hour kW[73]	n/a	n/a	1,000	1,131

Stakeholder Interview Findings

PPL Electric made the decision to stop promoting the HVAC Tune-Up program at the end of PY3 (May 2013). However, PPL Electric kept the program open in PY4 so qualified contractors would still be eligible to receive incentives if they performed tune-ups with the Implementation CSP's (FDSI) diagnostic tool. According to program staff, contractors believed they were not seeing a return on their investment in the tool. Keeping the program open gave contractors the opportunity to recoup their investment.

The main reason that PPL Electric discontinued the program was the significant obstacle of requiring contractors to use the FDSI diagnostic tool. The tool was costly to obtain and time-consuming to use—two barriers that discouraged contractor's participation in the program.

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70 See: Cadmus, 2012. "Process Evaluation Report, PPL Electric EE&C Plan, Program Year Three." Prepared for PPL Electric Utilities, pp. 36.

71 All planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 112, TRC Benefits by Program Year, pp. 195-196.

72 Ibid.

73 Planned savings are based on PPL Electric's revised EE&C Plan (Docket No. M-2009-2093216) filed with the Pennsylvania PUC on May 25, 2012, Table 5a, Program Summary by Sector ($1,000), pp. 31.

Conclusions and Recommendations

Cadmus has no recommendations for this program because it is not part of PPL Electric's Phase 2 EE&C plan.

PY4 Process Recommendations Status

Table 75 shows the status of each PY4 process recommendation made to PPL Electric. However, no recommendations were made.

Table 75. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
HVAC Tune-Up Program	
There were no recommendations made to PPL Electric in PY4 because the program will not continue in Phase 2.	N/A

Small Business Lighting Survey

Survey Methodology

For the Residential Lighting Program, Cadmus surveyed a sample of small-business customers to determine how many business customers were purchasing and installing program-discounted CFLs in a business facility as opposed to a residence. Cadmus found that 17% (±4.7%) of program-discounted bulbs were being installed in the commercial sector. A full discussion of the methodology for determining the percentage of bulbs being installed in commercial applications is contained in the PY4 Annual Report.[74]

Cadmus surveyed a total of 920 business customers, as defined by PPL Electric as the *Small C&I* customer segment. Table 76 shows the population, the targets for completed surveys, and the achieved number of completed surveys. Results achieved 90% confidence and 10% precision at the program level.

Table 76. Targeted and Completed Surveys

Survey Group	Population Size	Target		Achieved
Small C&I Segment	201,159	Recent CFL Purchasers	300	301
		Non-Recent Purchasers	N/A	619
Total Surveys				**920**

*Excludes private area lighting customers (outdoor lighting schedule)

Survey Findings

This section summarizes key findings from the small business survey that are pertinent to the PY4 process evaluation. Cadmus asked respondents whether they had purchased any CFLs in the previous six months. Respondents who said they purchased bulbs were then asked questions regarding purchase patterns, installation rates, and disposal patterns. The survey also gauged respondents' awareness of CFL discounts and other PPL Electric incentive programs.

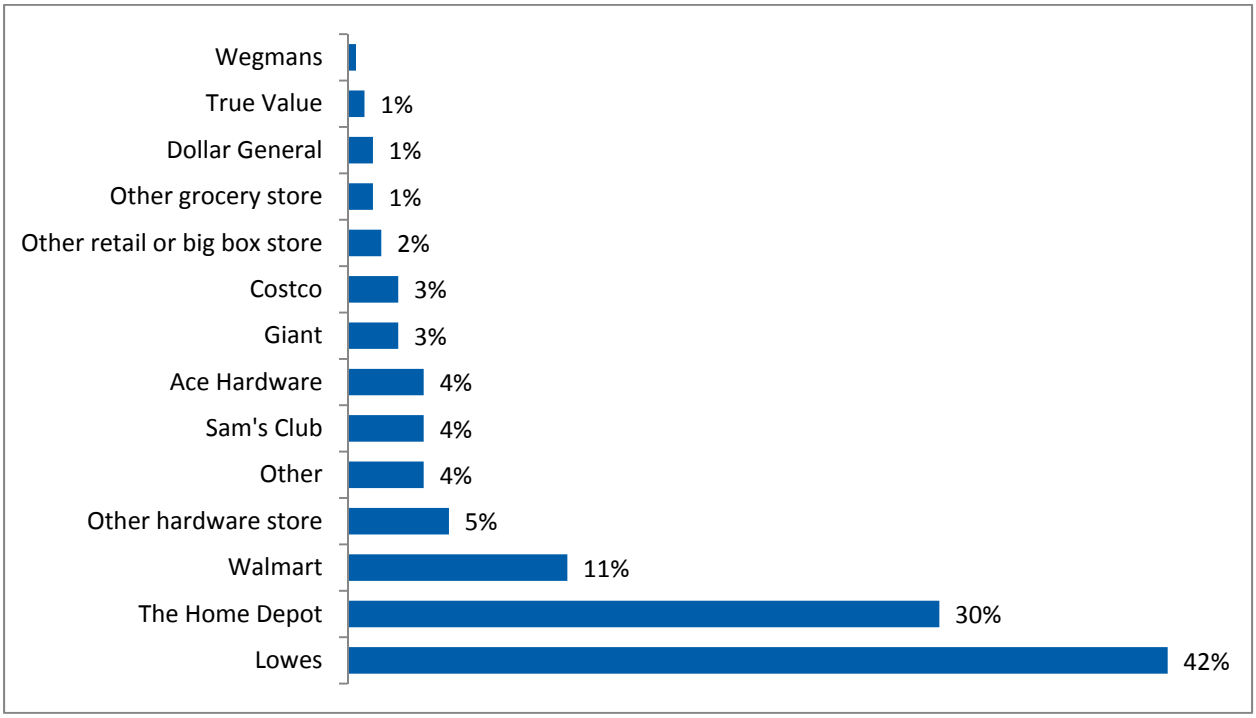
Bulbs Purchase Locations

Approximately one third of respondents reported having purchased CFLs.[75] Of those, the majority (81%) said they purchased the bulbs at a retail store as opposed to a wholesale distributor or vendor. Further, Cadmus found that, of those who purchased bulbs at a retail location, most respondents (78%) purchased bulbs from one of the retailers participating in PPL Electric's upstream Residential Lighting Program. Figure illustrates the retail locations at which respondents purchased bulbs.

[74] See Appendix E of the PY4 Annual Report

[75] Respondents who said they did not know or who did not answer the question about bulb purchases were excluded from the survey results. Respondents unaware of CFLs were screened out of the survey.

Figure A1. Reported Retail Locations for CFL Purchases



Source question: Which store, or stores, did you purchase the CFLs from? (n=230). Note: Percentages may add up to more than 100% due to multiple responses.

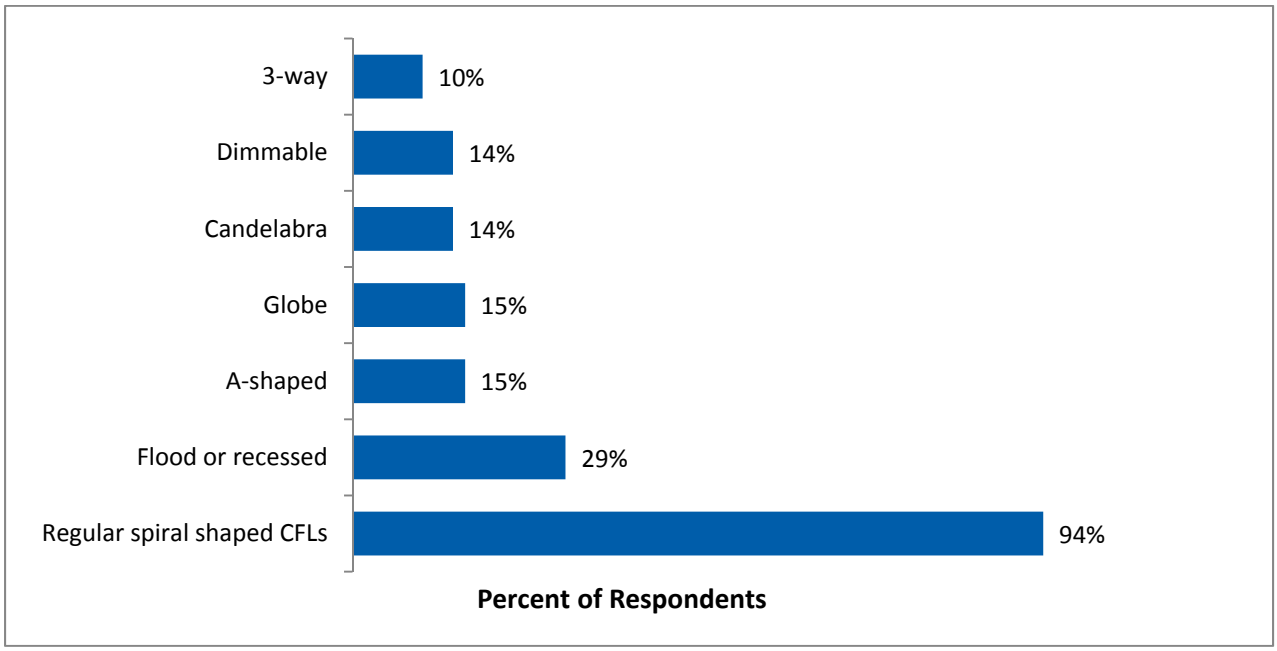
Most respondents said they purchased bulbs from Lowes, The Home Depot, or Walmart (approximately 83%). Of those who did not purchase bulbs at a retail location (n=57), most respondents reported buying the bulbs from a lighting vendor, distributor, wholesaler, or contractor (81%).

Of the respondents who purchased bulbs in the previous six months, 81% indicated they had purchased bulbs before that period, at some point during the previous three years, and more than 72% of those purchased their bulbs from the same source.

Bulb Quantity and Bulb Type

Small-business customers who bought bulbs from participating retailers purchased, on average, 24.04 bulbs per respondent for their entire business or organization. This is significantly higher than the average of 8.03 bulbs purchased by residential survey respondents for their household. Similar to residential customers, most respondents (94%) reporting buying standard, spiral CFLs as opposed to specialty bulbs (Figure 58).

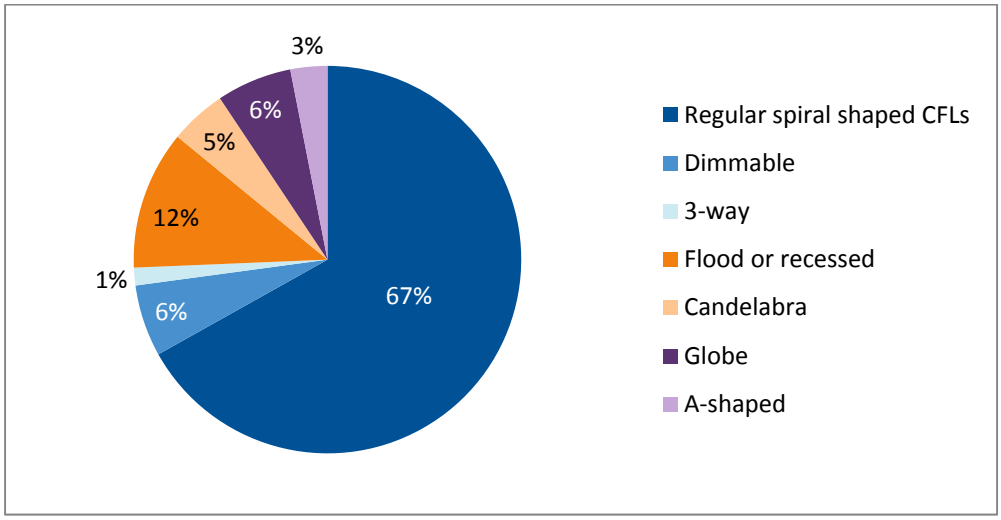
Figure 58. Type of CFLs Purchased



Source question: While most CFLs are spiral shaped, CFLs also come in other shapes and some have special features. I'm going to read you a list of different types of CFLs. Please let me know which type of bulbs you bought in past the six months. (n=301). Note: Percentages may add up to more than 100% due to multiple responses.

If a respondent reported purchasing more than one type of bulb, Cadmus asked how many of each type the respondent purchased. The proportion of regular spiral CFLs to other specialty bulbs is shown in Figure 59. Although 94% of respondents reported that they had purchased standard spirals, standard spiral CFLs made up only 67% of the total bulb share.

Figure 59. Proportion of Total Bulbs by Type



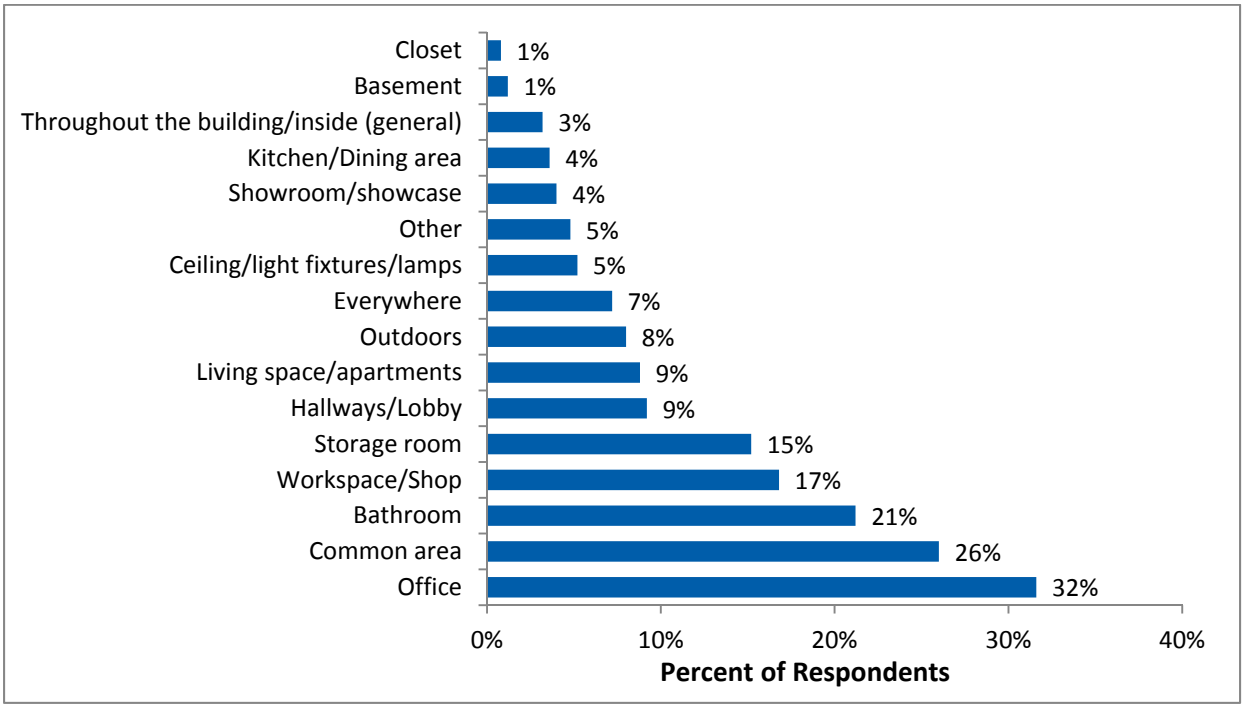
Source question: How many [bulbs] did you buy? (n=301)

Installation Rate and Location

The overall installation rate was 79%. The rate varied among respondent groups, depending on where they purchased their bulbs. The installation rate for respondents who said they purchased their bulbs from a retail store was 91%,[76] while for those who purchased from another source (i.e., contractor, distributor, or wholesaler), the installation rate was 78%.[77]

The distribution of responses regarding the bulbs' location inside the facility is shown in Figure 60.

Figure 60. Installation Location: All Bulbs



Source question: Where are the bulbs installed in your facility? (n=250). Note: Percentages may add up to more than 100% due to multiple responses.

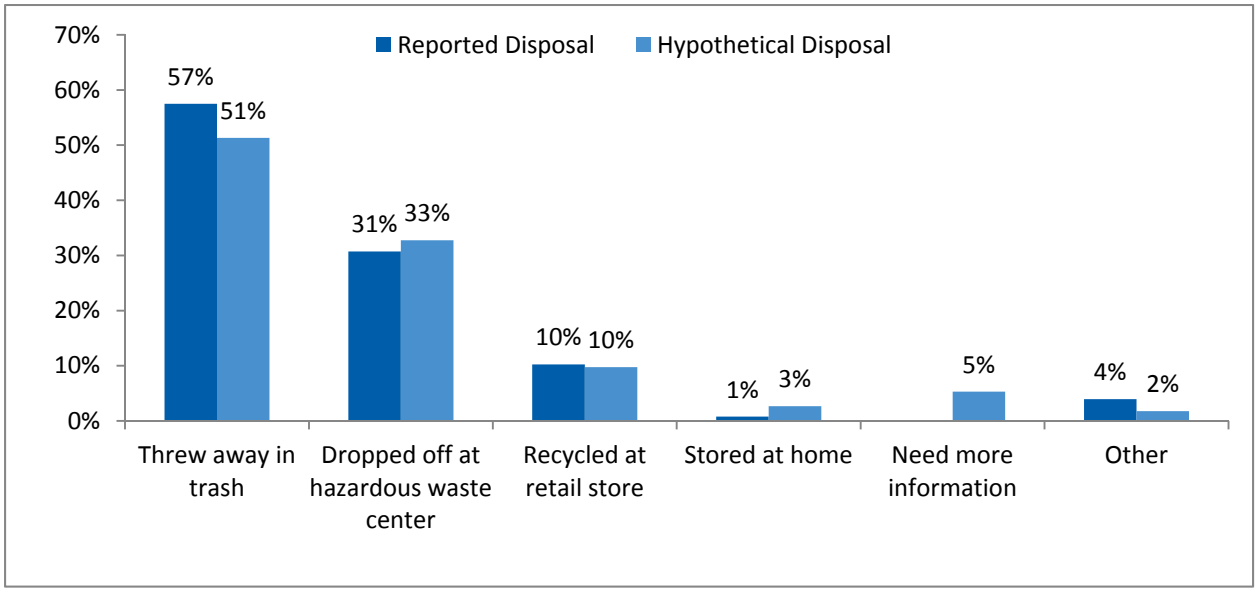
[76] The installation rate for respondents who purchased bulbs from a retail store was adjusted to eliminate those who subsequently indicated they installed the bulbs in their home. Respondents who said they installed bulbs in both their home and their business were not excluded.

[77] The bulbs purchased by respondents who indicated they only installed bulbs in their homes were excluded from average bulbs-per-respondent calculation. The bulbs purchased by respondents who indicated they installed bulbs in both their homes and business were prorated using the ratio of the number of purchased bulbs determined through residential surveys (8.04) to the initial average number of purchased bulbs determined through the small C&I surveys (24.89).

CFL Disposal

Approximately one half (48%) of respondents had disposed of CFLs in the past year. Those who had were asked how they disposed of the CFLs. Those who had not were asked hypothetically how they would dispose of them. The distribution of responses is shown in Figure 61.

Figure 61. CFL Disposal



Source questions: How did you dispose of the CFL(s)? (n=127) / If you were to dispose of a CFL, how would you do so? (n=113). Note: Percentages may add up to more than 100% due to multiple responses.

Disposal habits varied between small business survey respondents and residential survey respondents. Slightly fewer commercial respondents than residential respondents (57% vs. 68%) reported disposing of CFLs in the trash. About 10% more commercial respondents (31% vs. 21%) dropped them off at a hazardous waste center. Interestingly, 62% of commercial respondents had no concerns with CFL disposal, compared to 50% of residential respondents.

All respondents who purchased CFLs were asked if they had any concerns regarding disposal. Most small business customers reported they did not have any concerns (62%). A small fraction expressed concerns about mercury (16%) and some respondents (14%) said that their concern was that special disposal was required.

Program Awareness and Participation

Approximately one quarter (24%) of respondents who completed the survey (N=301) said they were aware that PPL Electric subsidizes CFLs. About 44% had seen promotional or education materials about CFLs. The majority (67%) had not heard of other PPL Electric programs. Of those that had heard of PPL Electric programs (n=98), approximately half had participated.

Respondents who said their business had not participated (n=44) were asked how likely their business was to participate in the future. Approximately 30% said it was *very likely*, 43% said *somewhat likely*, and about 27% said *not very likely* or *not likely at all*.

Satisfaction with PPL Electric

The majority of respondents (64%) ranked their overall satisfaction with PPL Electric as their provider of electric service as an 8, 9, or 10 on a scale of 1 to 10, with 10 being highly satisfied. Approximately 14% ranked their satisfaction at 5, or average. Only 3% ranked PPL Electric below average.

Conclusions and Recommendations

Based on the findings of the survey, Cadmus recommended that PPL Electric adjust the savings for the Residential Lighting Program to account for cross-sector sales. PPL has already made these adjustments which are reflected in the PY4 Annual Report. There are no further recommendations based on the above findings.

Online Trade Ally Survey

In PY4, Cadmus conducted an online survey to assess whether PPL Electric's programs influenced commercial trade allies and their standard practices. The survey was made available to the list of commercial contractors that were registered as PPL trade allies. The primary purposes of the survey were to assess the market effects of PPL Electric's programs, the effectiveness of PPL Electric's marketing efforts, and to understand market barriers from a trade ally's perspective.

Methodology

Cadmus developed the online survey. The survey was distributed to registered trade allies via PPL Electric's monthly electronic newsletter in PY4 Q2. To maximize response rates, the link to the online survey remained live until August 2013 and was included in three PPL Electric e-newsletters. The survey was completed and submitted anonymously. Table 77 shows the number of completed and partially-completed surveys.

Table 77. Completed Surveys

Response Type	Number of Respondents
Partially Completed Surveys	7
Completed Surveys	35
Total	**42**

Although the survey link was sent to all registered trade allies via the e-newsletter, the majority of respondents specialized in lighting. Table 78 illustrates the total number of trade allies that completed projects in PY4 by their specialty and survey respondents by specialty. "Other" included building controls and lighting controls.

Table 78. PPL Electric Trade Allies in PY4

Contractor Specialty/Job	Trade Ally Population*	Survey Responses**
Commercial Lighting	330	40
Commercial HVAC	20	10
Commercial Insulation	4	1
Commercial Motors and Variable Speed Drives	6	14
Commercial New Construction Lighting	43	0
Other	9	2
Total	**412**	**71**

*Source: DNV KEMA, Contractors by Project Type for the Efficient Equipment Program, PY4 Q1-Q2
**Source: Question 6, Please select the top three types of equipment that your firm specified, sold, and/or installed to commercial and industrial customers since June 2011 through PPL Electric's Energy Efficient Equipment, Direct Discount, or Custom Incentive program. By top three, we mean the

equipment you installed most often. (n=42). Note: This question allowed for multiple responses. Total responses equal 71.

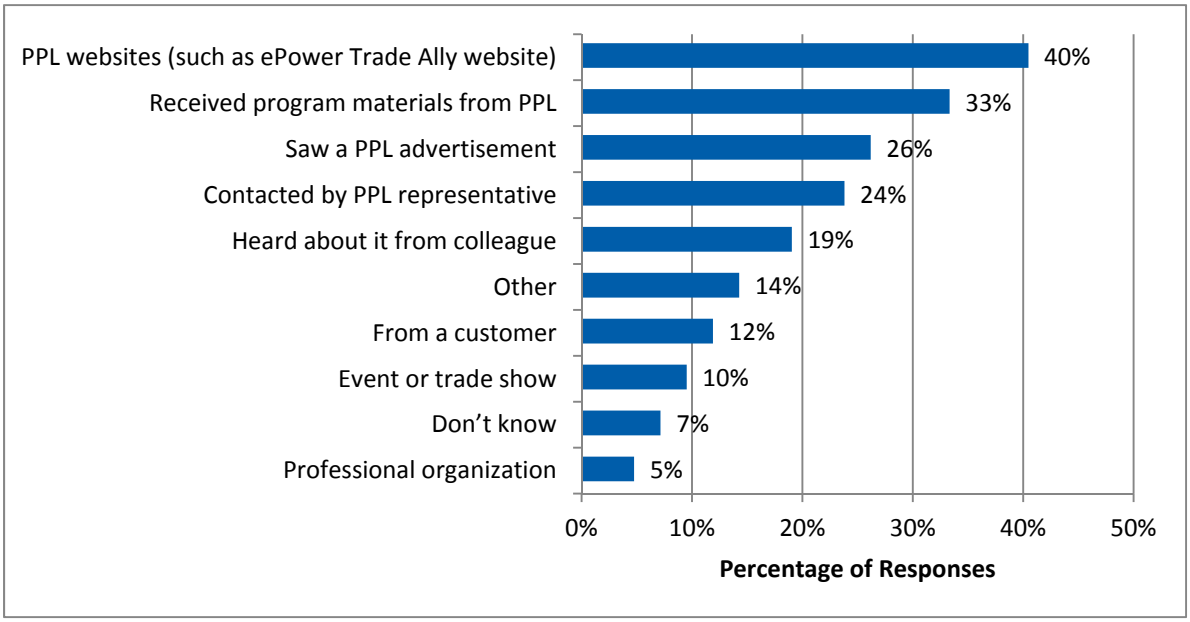
Findings

This section contains a summary of the survey findings. Because respondents could skip questions on the survey, the number of respondents (n) varies by question.

How Trade Allies Heard about PPL Electric Programs

Trade ally respondents reported hearing about Act 129 programs from a variety of sources; most commonly, they heard through the PPL Electric website and PPL Electric materials. As shown in Figure 62, the top four mentioned sources were those directly coming from PPL Electric.

Figure 62. How Trade Allies Heard about E-power Programs



Source: Question 1, Please tell us how you heard about PPL Electric's E-power rebate programs. Select all that apply. (n=42). Note: This question allowed for multiple responses; percentages may add up to over 100%.

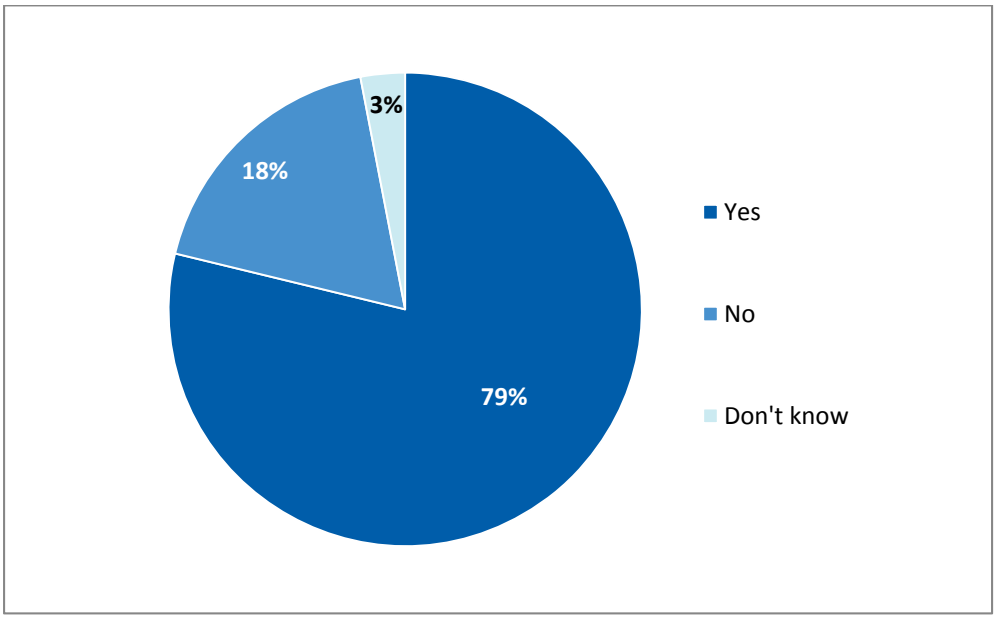
Market Effects

Cadmus asked survey respondents a series of questions to understand how Act 129 programs have affected contractors' standard business practices. This could include changes in how contractors interact with customers, types of equipment that they stock or recommend, or other changes in the marketplace. Further, we identified cases in which contractors recommended or installed energy-efficient equipment that qualify for a rebate under the PPL Electric programs, but the end-use customer did not receive a rebate. These types of market effects can be indicative of freeridership, spillover, or market transformation, and provide insight into market effects due to the program. Cadmus did not use the survey data to quantitatively measure freeridership or spillover, but we discuss the impacts qualitatively.

Changes in Standard Practices

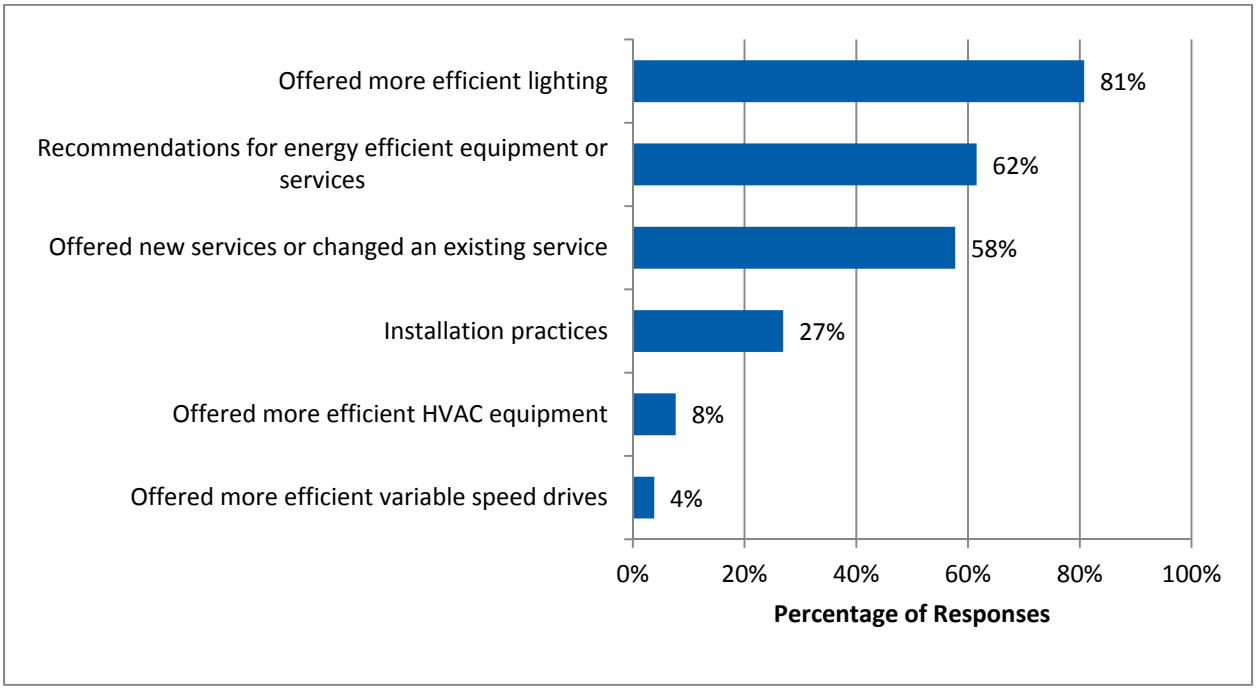
The vast majority of respondents (79%) reported they changed their business practice since the implementation of PPL Electric's Act 129 programs (Figure 63). Specifically, the most mentioned business practice changes included changes in lighting equipment offerings, changes in recommendations for efficient equipment, and new service offerings and/or changes to existing services offered (Figure 64).

Figure 63. Changes in Standard Practice since Act 129 Program Implementation



Source: Question 50, Have any of your equipment, services, recommendations, or installation practices changed since the E-power programs started in June 2009? (n=33)

Figure 64. Types of Changes to Trade Ally Business Practice



Source: Question 50.1, What has changed? Please select all that apply. (n=26). Note: This question allowed multiple responses; percentages may add up to over 100%.

PPL Electric Influence on Changes in Standard Practice

Respondents who reported they had changed equipment offerings, services, or recommendations since Act 129 programs were launched (n=26) were then asked a follow-up question about the influence of PPL Electric's programs on that change. Results in Table 79 show that 88% of respondents either *strongly agreed* or *agreed* that PPL Electric's programs were important to their decision to change their business practice.

Table 79. Respondents' Agreement with Importance of PPL Electric's Programs in Changing Practice

Level of Agreement	Number of Responses	Percent of Responses
Strongly agree	12	46%
Agree	11	42%
Neither agree nor disagree	1	4%
Disagree	2	8%
Strongly disagree	0	0%
Total	**26**	**100%**

Source: Question 50.3, Please rate your level of agreement with this statement: PPL Electric's programs were important to my firm's decision to change its equipment, services, recommendations, or installation practices since June 2009. (n=26)

Some survey respondents elaborated on how PPL Electric programs influenced their practice. Several comments underscored the importance of the Act 129 programs in promoting energy-efficient equipment:

> *"Efficient lighting really became an important aspect of our business. It became a main focus for many of [our] sales calls."*
>
> *"We now focus exclusively on energy-efficient projects."*
>
> *"We are actively informing our customer base of the time-sensitive money saving and energy saving opportunities available to them through lighting upgrades."*

Other responses conveyed that the programs had little influence on business practice and specifically customer demand:

> *"[It depends] almost entirely upon the customer being open to spending more money up front on energy-efficient products."*

Lastly, two respondents reported that Act 129 programs had a negative impact on their business:

> *"We have become less customized and modified to the PPL Electric system which is less granular and more generic."*
>
> *"I have tried to sell more but have been beaten [by] Direct Discount and the professional sales people. I do however offer the rebated fixtures when and [where] I can."*

Although the majority of trade allies reported that their practices had changed since 2009 when Act 129 programs came into effect, few respondents were able to estimate the proportion of projects specified or installed that were more efficient than standard practice prior to 2009.

Sales Outside of the Program

Cadmus asked respondents about PPL Electric program-eligible projects for which customers did *not* receive a rebate. This question was asked for each equipment type that was originally specified in Question 6. Therefore, total responses (n=39) are greater than the number of respondents. For example, some contractors may have specified they sold both HVAC equipment and variable speed drives, and were asked about both equipment types.

As shown in Table 80, between 33% and 50% of trade allies reported that they sold, specified, or installed some portion of equipment outside of the program. Respondents said that they installed some portion of projects without a rebate for nearly all measure groups except refrigeration.

Table 80. Program-Eligible Projects that Did Not Receive a Rebate

Equipment	Yes	No	Don't Know	Total Responses	Percent of Responses Indicating Projects Outside Program
Lighting	17	14	5	36	47%
HVAC	3	5	1	9	33%
Variable Speed Drives	2	2	2	6	33%
Motors	2	1	1	4	50%
Other	2	1	1	4	50%
Refrigeration	0	1	2	3	0%
Total	**26**	**24**	**12**	**62**	**42%**

Source: Questions 8/14/20/26/32/38/44. Please think about all the program-eligible <equipment> you specified, sold, and/or installed for PPL Electric customers since June, 2011. Did you specify, sell, and/or install any of the program-eligible <equipment> for PPL Electric customers without the customer participating in a PPL Electric rebate program? (n=39). Note: Depending on the types of equipment installed by the respondent, the number of responses may vary.

Next, Cadmus asked a follow-up a question about the volume of projects that were specified, sold, or installed outside of the program. Most respondents were not able to estimate the number of projects sold outside of the program. Ten respondents specializing in a combination of lighting, HVAC, variable speed drives, motors, or other equipment selected a range of projects they thought were sold or installed without a rebate. This information is presented in Table 81. Of the ten responses, the majority (six) indicated that just a small proportion of projects (between 1% and 24%) did not receive rebates. One respondent, referring to HVAC equipment, estimated that 75% to 100% of their projects were sold outside of the program.

Table 81. Proportion of Program-Eligible Projects That Did Not Receive Rebate

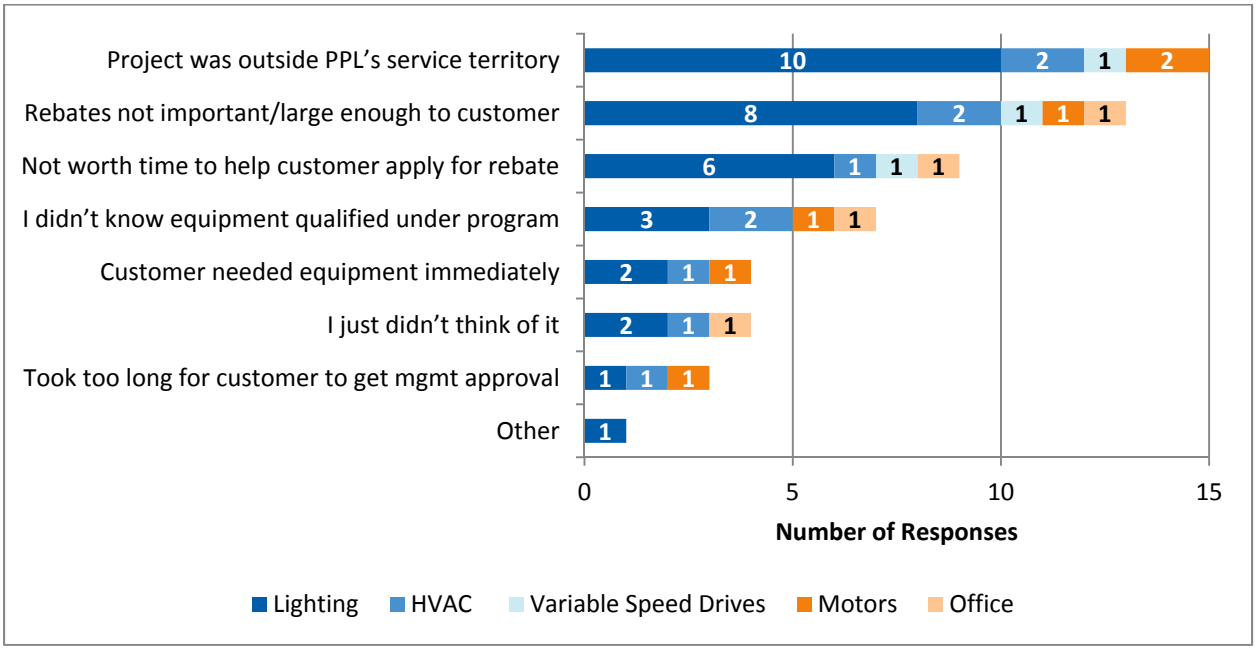
Equipment	1% to 24% of Projects	25% to 50% of Projects	51% to 74% of Projects	75% to 100% of Projects	Don't Know
Lighting	5	1	0	0	11
HVAC	0	0	0	1	2
Variable Speed Drives	0	1	0	0	1
Motors	0	0	0	0	2
Other	1	1	0	0	0
Refrigeration	0	0	0	0	0
Office	0	0	0	0	0
Total Responses	**6**	**3**	**0**	**1**	**16**

Source: Questions 9/15/21/27/33/39/45. About what percent of all the program-eligible <equipment> you specified, sold, and/or installed for PPL Electric customers since June 2011 did not receive a rebate through a PPL Electric program? (n=26). Note: Depending on the types of equipment installed by the respondent, the number of responses may vary.

Reasons Why Customers did Not Receive a Rebate

If a respondent indicated that they had specified, sold, or installed outside of the program, they were then asked why their customers may not have received a rebate although they installed qualifying equipment. For lighting projects especially, the results in Figure 65 show that in the majority of cases, it was because projects took place outside PPL Electric's service territory (15 responses). Respondents also reported that in some cases, program rebates were not valuable enough for customers (13 responses), or that it was not worth their time to assist the customer with the rebate (9 responses).

Figure 65. Reasons Why Trade Allies Did Not Recommend PPL Electric's Rebate



Source: Question 10/16/22/28/34/40/46. In most cases, what were the main reasons why either you or your customer did not apply for rebate for this equipment? Please mark all that apply. (n=26). Note: This question allowed multiple responses; number of responses may add up to more than 26.

PPL Electric Program Attribution

Next, respondents were asked to rate their agreement with a series of program attribution statements, listed in Table 82.

Table 82. Program Attribution Statements

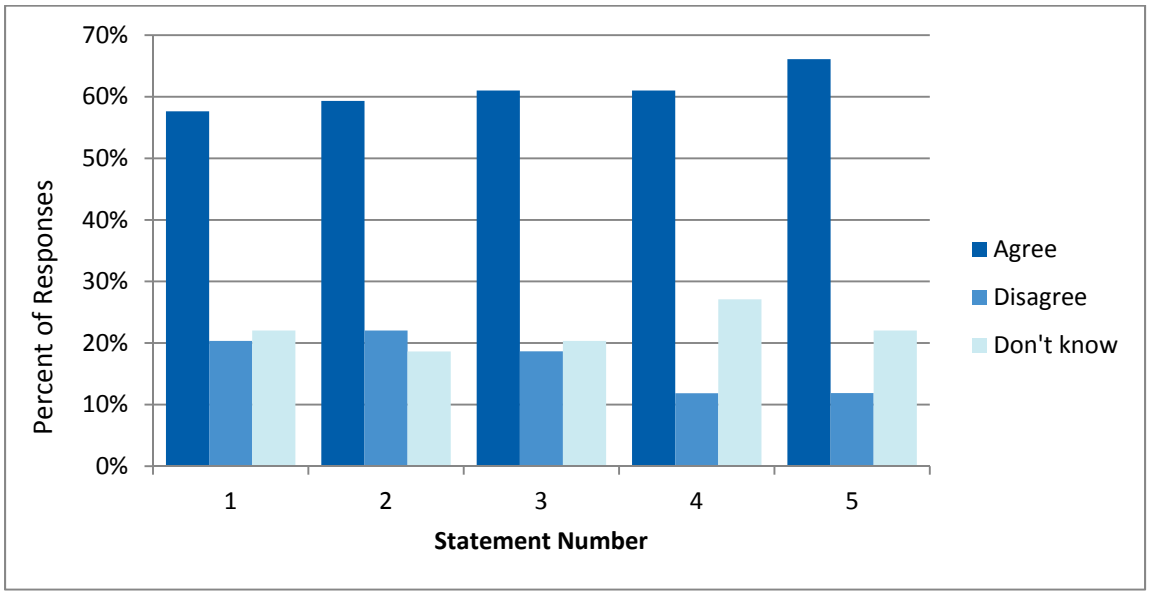
Statement
1. My business is better able to identify opportunities for using high-efficiency <equipment> because of my experience with the performance of the equipment installed through PPL Electric's program.
2. My business is better able to identify opportunities for using high-efficiency <equipment> because of what we learned by working with PPL Electric.

3.	My business is more likely to discuss energy-efficient options for <equipment> with all of our customers because of what I learned by working with PPL Electric.
4.	My business is more likely to discuss energy- efficient options for <equipment> options with all of our customers based upon our experience with the performance of the equipment installed through PPL Electric's program.
5.	Our experience specifying or installing high-efficiency <equipment> through PPL Electric's program has demonstrated that this equipment is cost-effective or beneficial even without a rebate.

Program attribution across all measure groups was moderately high, with respondents "agreeing" with statements between 58% and 66% of the time, depending on the question. Figure 66 illustrates the percentage of responses for each attribution statement. Respondents were most likely to agree with Statement Number 5, "*Our experience specifying or installing high-efficiency <equipment> through PPL Electric's program has demonstrated that this equipment is cost-effective or beneficial even without a rebate."* They were most likely to disagree with Statement Number 2, "*My business is better able to identify opportunities for using high efficiency <equipment> because of what we learned by working with PPL Electric."*

Attribution differed slightly among measure groups. Program attribution was strongest in the lighting equipment category where 66% to 77% of respondents showed agreement. HVAC equipment showed moderate program attribution with 50% to 75% respondent agreement, followed by variable speed drives, where 33% to 67% of respondents agreed with statements. For motors, refrigeration, and other equipment categories, the number of respondents was very small (n=3-4) with 33% to 75% of respondents answering *Don't know*. The office equipment category had no responses, therefore results are not provided. Attribution statements referenced in Figure 66 are listed in their entirety Table 82.

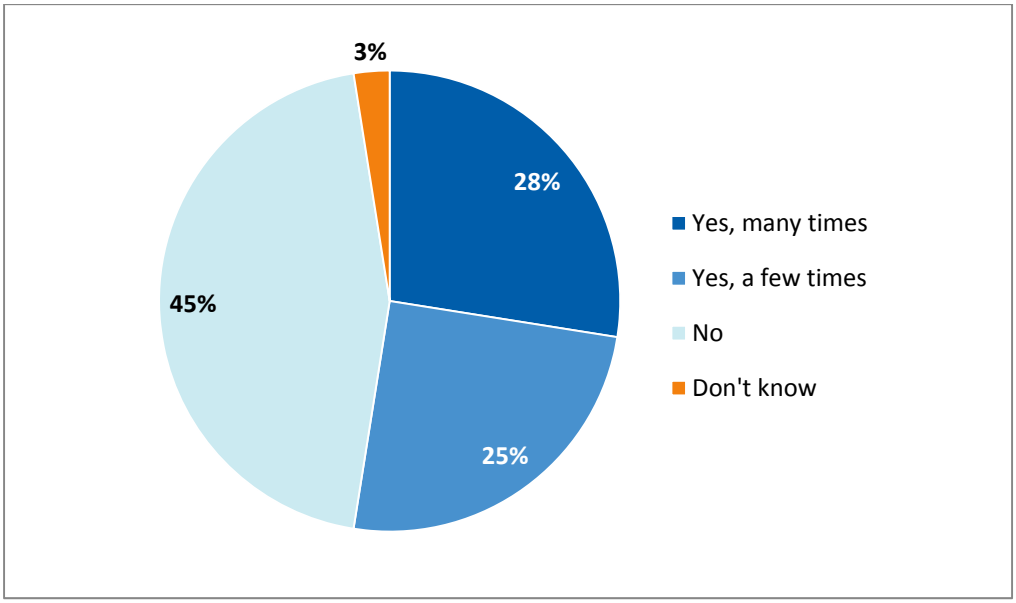
Figure 66. Agreement with Attribution Statements, All Measures



PPL Electric Marketing Materials Use and Effectiveness

Cadmus asked trade allies about their use of PPL Electric marketing materials. Figure 67 illustrates that just over half (53%) of respondents reported using marketing materials, with 28% reporting that they used the marketing materials *many times*. One quarter of respondents said they used the materials *a few times,* and 45% of respondents said they had not used PPL Electric materials at all.

Figure 67. Trade Allies Using PPL Electric Marketing Materials

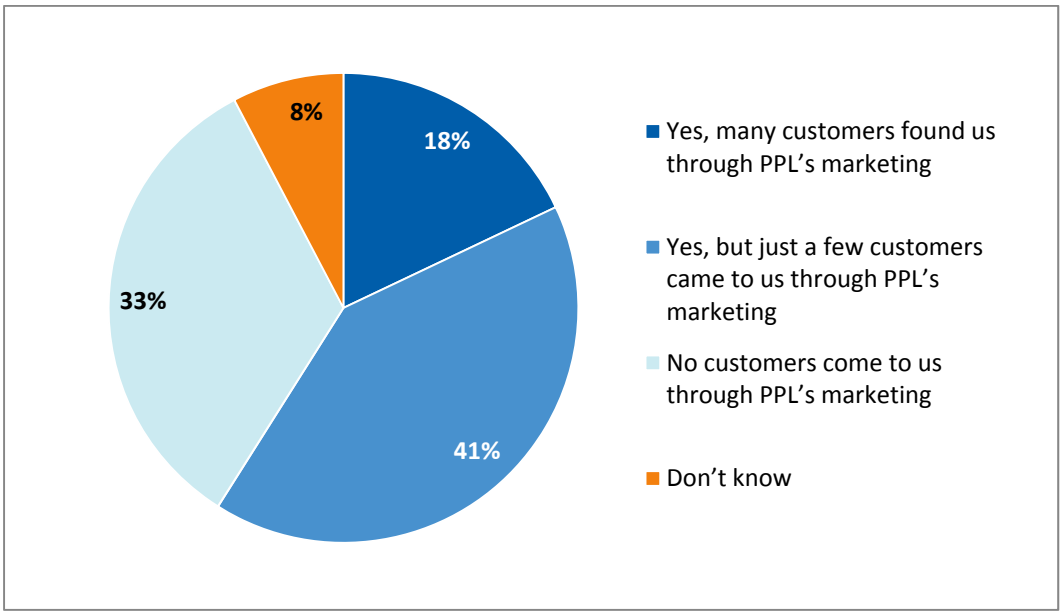


Source: Question 4. Has your business used any of PPL Electric's marketing materials (brochures, postcards, logos, and other items on the PPL Electric E-power website) to market Act 129 programs? (n=40)

Responses also indicated that PPL Electric marketing materials have a positive influence on sales and trade allies' ability to promote energy efficiency, but this impact is moderate. When asked about the impact of marketing on sales, most respondents (61%) reported advertising and marketing had a *moderate impact*. Few respondents were reported a *significant impact* (21%), and just 18% of respondents said *no impact at all*.

Nearly 60% of respondents said that PPL Electric marketing or advertising helped to generate at least some customer leads. Figure 68 illustrates the range of responses on this topic.

Figure 68. Customer Leads Generated by PPL Electric's Marketing



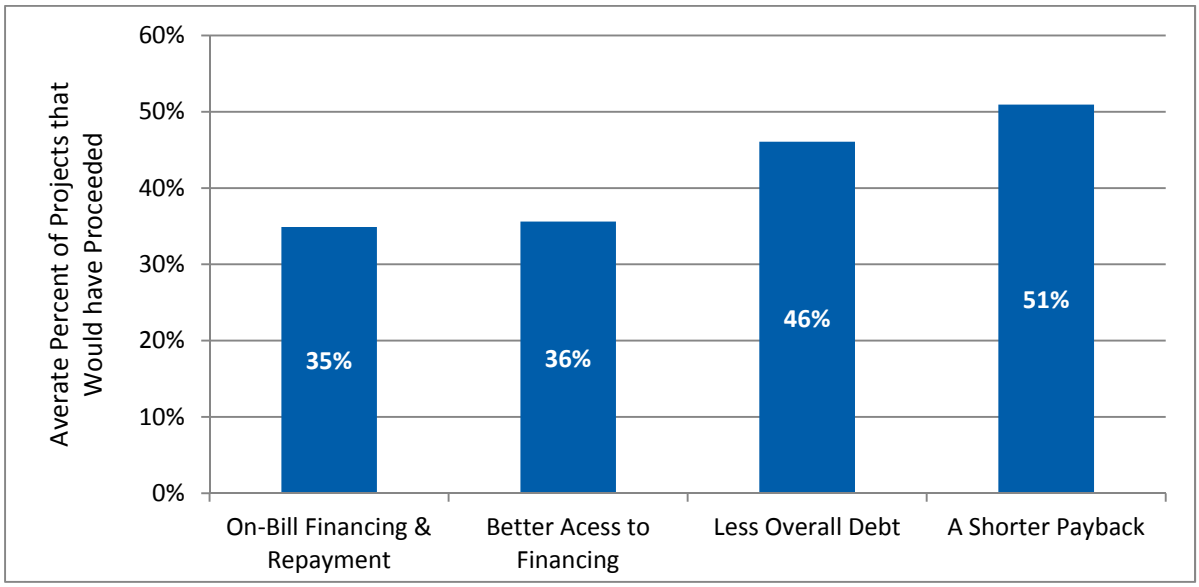
Source: Question 5. Has your business been contacted directly by customers who heard about PPL Electric's rebates through PPL Electric's marketing effort? (n=39)

Market Barriers and Solutions

Length of payback period, customer finances, and unique business situations were all identified by respondents as the main market barriers in proceeding with energy-efficiency projects. In addition to identifying barriers, Cadmus asked trade allies to assess how effective various solutions would be in helping customers proceed with projects. Specifically, the survey asked respondents to consider potential projects that did *not* move forward in the past year, and estimate the percentage of those projects that may have proceeded given different circumstances.

As Figure 69 indicates, the market solution with the greatest potential was shorter payback periods. On average, respondents said they would have had 51% more projects with customers if the project had *a shorter payback*. Other market solutions assessed by respondents such as *less overall debt*, *better access to* financing, and *on-bill financing and repayment* showed potential project gains ranging from an average of 35% to 46%.

Figure 69. Average Potential Project Gains from Various Market Solutions



Source: Question 52/53/54/55. Thinking about the customers who made a decision NOT TO PROCEED with an energy-efficiency project in the past 12 months, what percent of those projects do you think would have moved forward if they had… (n=31-33)

Respondents' qualitative responses to other reasons why customers did not proceed with projects included mention of customer finances, unique business situations, and lack of information and trust.

- Around nine respondents gave reasons related to customer finances such as up-front costs and general "financial stress and uncertainty."
- For obstacles related to business situations, four respondents cited reasons such as the customer leasing the building instead of owning; non-profit status; and being part of a larger national company with other decision-making factors at play.
- Two respondents indicated that customers were skeptical of the energy savings and costs savings that would materialize from the project.

Conclusions and Recommendations

Based on the findings of the trade ally survey, Cadmus suggests PPL Electric consider the following recommendations for Phase 2.

Conclusion: PPL Electric's energy-efficiency programs have significantly influenced the market, especially for CFLs and non-residential lighting. Further research is required to determine the extent to which PPL Electric's programs have transformed the market for other measures. Nearly 80% of trade allies reported that their standard practices have changed since 2009 when Act 129 programs went into effect, in ways such as equipment offering changes and types of recommendations to customers. However, less than 50% of trade allies reported that they have sold high-efficiency equipment to

customers without a rebate. In the majority of cases where that occurred, the reason was due to geographical eligibility.

Conclusion: Based on a qualitative analysis of the survey responses, it is likely that some nonparticipant spillover is occurring. That is, trade allies (1) sold or installed some equipment outside of the program, (2) agreed that PPL Electric was important in changing their standard practices (88%), and (3) agreed somewhat with several direct program attribution statements (approximately 60%). Cadmus does not have the available data to calculate kWh/yr savings attributable to spillover, but can provide a conservative estimate by undertaking several steps.

Conservative Nonparticipant Spillover Estimate

To calculate nonparticipant spillover savings, Cadmus would need to know the kWh/yr savings associated with each individual contractor—data that were not collected as a part of this effort. However, the survey did collect data on the number of PPL Electric projects each contractor completed in the past year. Using lighting contractor data from EEMIS provides an understanding of the range of savings associated with these various activity levels (Table 83).

Table 83. kWh/yr Savings per Contractor Based on Number of PPL Electric Jobs Completed

Number of Jobs Completed	Average kWh/yr per Contractor, from EEMIS	Range of kWh/yr per Contractor, from EEMIS	Low end of Range (kWh/yr)
1 to 10	223,657	470 - 7,047,496	470
11 to 20	930,940	72,656 - 5,895,655	72,656
Over 20 projects	3,813,851	375,105 - 28,265,343	375,105

Using the low-end of the kWh/yr savings range as a conservative estimate, we calculate that approximately 63,500 kWh/yr in nonparticipant spillover savings could be occurring annually. This estimate was based on just three contractors who provided an estimate of sales occurring outside the program and who answered affirmatively to the attribution questions in Table 84.

Table 84. Questions Used to Assign Nonparticipant Spillover to Survey Respondents

Survey Question No.	Survey Question	Use of Response
6	Please select the **top three** types of equipment that your firm specified, sold, and/or installed to commercial and industrial customers since June 2011 through PPL Electric's Energy Efficient Equipment, Direct Discount, or Custom Incentive Program.	Determine equipment type*
7	About how many projects has your firm specified, sold, or installed through PPL Electric's E-power Programs for which the customer received a rebate or discount since June 2011?	Determine low-end range of kWh/yr associated with contractor
8	Did you specify, sell, and/or install any of the program-eligible	Determine if sales

	<equipment> for PPL Electric customers without the customer participating in a PPL Electric rebate program?	occurred outside of program
9	About what percent of all the program eligible **<equipment >** you specified, sold, and/or installed for PPL Electric customers since June 2011 did not receive a rebate through a PPL Electric program?	Determine % of sales outside the program
12	Overall, how important would you say the PPL Electric energy-efficiency programs were in your firm's decision to specify, sell, or install high-efficiency **<equipment>** to your customer base?	Determine program attribution
50	Have any of your equipment, services, recommendations, or installation practices changed since the E-Power programs started in June 2009?	Determine program attribution
50.3	Please rate your level of agreement with this statement: PPL Electric's programs were important to my firm's decision to change its equipment, services, recommendations, or installation practices since June 2009.	Determine program attribution

*The only contractors for which nonparticipant spillover may have occurred was for lighting contractors
** Spillover savings were only estimated if the contactor replied consistently to questions 12, 50, and 50.3. If answers were inconsistent, spillover savings were not estimated.

Considering the relatively small sample size of the survey, and the use of the lowest possible kWh/yr associated with each contractor, it is likely that this estimate is low and the true value of nonparticipant spillover occurring due to PPL Electric's programs could be much higher.

Recommendation: In Phase 2, Cadmus will conduct additional trade ally surveys. We will work with PPL to build on the Phase 1 research and to assess non-participant spillover. To assist with this effort, we will work with PPL should ensure that contractor information is tracked carefully for all projects and provided in quarterly EEMIS extracts for all measures. These data will allow us to assign kWh/yr savings to contractors and measures, and calculate spillover based on contractors' survey responses.

Conclusion: A large portion of trade allies (45%) do not take advantage of PPL Electric marketing materials to promote energy-efficient equipment. Those who do take advantage of the materials indicated that the materials' effectiveness in influencing sales is moderate.

Recommendation: In communications to trade allies, such as e-newsletters, webinars, and trade shows, highlight the marketing materials that are available for download to ensure contractors are aware of what is available to them. In regular online surveys that E-Power Solutions conducts, consider adding a question about the types of marketing materials that would be most helpful to trade allies. Cadmus will also explore this topic in PY5 and PY6 surveys.

PY4 Process Recommendations Status: Trade Ally Survey

Table 85 contains the status of each PY4 process recommendation made to PPL Electric.

Table 85. Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
E-Power Solutions Trade Allies	
Work with implementation CSP (E-Power Solutions) to include contractor name and information in quarterly EEMIS extracts for all measures in Phase 2. (PPL has already begun to include this data in PY5).	**Implemented.** The C&I CSP has implemented this change for PY5.
Because a large portion of trade allies reported they did not use PPL marketing materials, highlight marketing materials that are available for download to ensure contractors are aware of what is available to them to promote the programs.	**Implemented.** Expansion being considered for Phase 2. PPL provided marketing and collateral information for Trade Allies on its website and in face-to-face training sessions and individual meetings in Phase 1. It would be helpful to understand why a large portion of survey respondents (trade Allies) do not use those marketing materials. PPL will review this recommendation with its program CSP in Phase 2 and expand or refine these materials if warranted to achieve savings and customer/trade ally satisfaction objectives within budget.

Appendix A. Completed Telephone Surveys in PY4

Table A1 contains the number of completed surveys conducted in PY4 by program and by strata, and the associated confidence and precision levels.

Table A1. PY4 EM&V Surveys

Survey	Field Start Date	Field End Date	Target Completes	Achieved Completes	Conf./ Prec.
Direct Load Control (Peak Saver)	11/13/2012	12/3/2012	**95**	**95**	90/10
Residential			70	90	
Small Business			25	5	
Load Curtailment (fielded In-House for SWE)	1/22/2013	1/27/2013	**19**	**17**	80/10
Efficient Equipment (Commercial Sector)	1/28/2013	2/18/2013	**142**	**137**	90/10
Lighting (Large Stratum)			90*	95	
VSDs, ASDs, and Refrigeration (Medium Stratum)			2*	2	
HVAC, Office Equipment, other (Small Stratum)			50*	40	
Efficient Equipment Direct Discount delivery service	1/31/2013	2/10/2013	**70**	**76****	90/10
Efficient Equipment (Residential Sector)	2/4/2013	2/19/2013	**70**	**76**	90/10
HVAC measures (Large Stratum)			50	61	
Energy Star Refrigerators (Medium Stratum)			10	10	
White goods, office equipment, central air conditioners, other (Small Stratum)			10	5	
Fuel Switchers (reported by Efficient Equipment residential sector participants)			**34**	**18**	
Residential Lighting Campaign	2/6/2013	2/28/2013	325	301	90/10
Energy Assessment & Weatherization – Audit participant	2/11/2013	2/22/2013	50	50	90/10
Energy Assessment & Weatherization – Weatherization participant	2/19/2013	2/23/2013	70	71	90/10
Appliance Recycling	2/26/2013	3/5/2013	140	142	90/10
Behavior and Education Program Participants and opt-outs	3/5/2013	3/24/2013	190	175	90/10
Behavior and Education Program Nonparticipant	3/12/2013	3/28/2013	150	152	90/10
Custom Program (fielded In-House)			70	70	90/10
PY3 Participants	3/21/2013	4/30/2013	43	43	
PY4 Participants	5/10/2013	5/31/2013	27	27	
Small Business CFL (Cross Sector Sales Survey Research)	5/20/2013	6/19/2013	300	920	90/10
Recent CFL Purchasers			300	301	
Non Purchasers			N/A	619	

*Survey targets for Commercial & Industrial small, medium and large strata were modified from the original sample plan after analyzing the number of unique account holders in each stratum and removing accounts that had been contacted in the past year for EM&V efforts. These adjustments reduced the sample size of the medium stratum significantly. Sample points were reallocated to the small and large strata to achieve 90/10 for the non-lighting measure group and at the program level.
**Cadmus conducted 71 telephone surveys and six on-site surveys during EM&V site-visits.

Appendix A. Efficient Equipment Program: Differences is Ex Ante and Ex Post Savings by Measure Type, Non-lighting Measures

This section explains how Cadmus determined *ex post* savings values for ASD/VSDs, residential air source heat pumps, central air conditioners, display cases, DX packaged air conditioners, ductless heat pumps, copiers, printers, scanners, faucet aerators, HVAC motors, and evaporator fans.

- **ASDs/VSDs**. We verified ASD/VSD measures at 11 sites. All verified sites had realization rates between 27% and 43% for energy savings. All 11 sites had submitted applications in 2010 and used the 2010 TRM algorithm which was incorrect and overestimated energy savings. We used the corrected algorithm from the 2012 TRM to calculate the *ex post* energy and demand savings for these sites.
- **Residential air source heat pumps.** We verified eight residential air source heat pump measures and found variation between the *ex ante* adjusted and *ex post* demand reduction. We found during record review that one measure was actually a ductless heat pump, and so calculated energy savings for this measure using the ductless heat pump algorithms in the TRM. For the other measures, we found a difference in the EER values used to calculate savings in EEMIS (which are derived from the SEER value by assuming 13 SEER is equivalent to 11 EER) and those verified using the AHRI database. The AHRI values were lower, resulting in lower demand reduction than the *ex ante* adjusted values.
- **Central air conditioners.** We verified four central air conditioner measures. The *ex post* savings decreased for all four because the verified cooling capacity per the AHRI database was slightly lower than that reported in EEMIS.
- **Display cases.** We visited two sites with display cases. *Ex post* savings differ from the reported savings because the reported values in EEMIS are based on assumptions and the data required to look up savings in the TRM are not collected. We collect these data during the site visit and to update the *ex post* savings.
- **Commercial DX packaged air conditioners**. We verified three records at one site. The *ex post* savings decreased because of rounding during conversion of the capacity of the equipment in BTU to tons. The customer reports the capacity in tons on the application, while the AHRI data reports the capacity in BTU. In this case, the customer rounded the capacity up to the nearest whole number, which resulted in a larger capacity than that verified using the AHRI database.
- **Ductless heat pumps**. One record that was reviewed had an incorrect room type in EEMIS which impacted the energy savings. We also verify the capacity and efficiency values by looking up the manufacturer and model number in the AHRI database. For some cases, this resulted in negative demand reduction as the EER values found in AHRI were lower than those in EEMIS, which are calculated by converting SEER to EER.
- **Copiers**. For copiers, we verified three records. One record with 24 copiers could not be verified as ENERGY STAR as the manufacturer listed appeared to be a company that manufacturers

copier components, and not the entire copier itself. Because we could not verify this equipment as ENERGY STAR, zero savings were assigned.

- **Printers and scanners.** For printers, we verified seven records and for scanners we verified one record. We looked up the images per minute based on the manufacturer and model number and updated the *ex post* savings.
- **Faucet aerators.** We verified one record for faucet aerators. We looked up the manufacturer and model number and found that the flow rate for the aerator was 2.2 gallons per minute, which does not qualify for the program and therefore we assigned zero savings. This record was selected at random for the verification sample and represented 10% of the rebated aerators.
- **Evaporator Fans.** We visited four sites with evaporator fans. For three of these sites, the *ex post* savings differ from the reported savings because the reported values in EEMIS are based on assumptions and the data required to look up savings in the TRM were not collected. During the site visit, Cadmus collected the case temperature (freezer or refrigerator), old motor type, and new motor type, and then used these data to update the *ex post* savings.