IMPACT AND PROCESS EVALUATION OF AMEREN ILLINOIS COMPANY'S RESIDENTIAL LIGHTING PROGRAM (PY5)

Final

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1. EXECUTIVE SUMMARY

This report presents results from the evaluation of the Ameren Illinois Company**'s** (AIC) PY5 (June 2012 to May 2013) Residential Lighting Program. The Residential Lighting Program is designed to increase awareness and usage of ENERGY STAR® (ES) lighting products among residential customers through marketing and outreach efforts at participating retailers, community events, and the AIC website. The Program partners with retailers and lighting manufacturers to sell ES lighting at a discount to bring the cost closer to less efficient lighting options on the market. The discounts encourage customers who are reluctant to pay full price for ES lighting to choose energy efficient over standard lighting.

The Program was launched in August 2008 and is implemented by Conservation Services Group (CSG) with subcontractors Applied Proactive Technologies (APT) and Energy Federation, Incorporated (EFI). Across the Program's five years, it has discounted 12,391,945 energy efficient light bulbs and fixtures. This evaluation reviews the Program's performance in PY5, which began in June 2012 and ended in May 2013.

The program is aimed at an eventual transformation of the residential lighting market in AIC territory. The expected savings from this program were 25% of the overall PY5 portfolio electric savings and 0% of the overall portfolio therm savings (including both residential and commercial programs).

To support the evaluation, we conducted in-depth interviews with program staff, reviewed program data and program materials, conducted interviews with customers who were purchasing lighting at participating retailers, and undertook a stocking study of lighting products at participating retailers. We also conducted additional analyses of the in-home lighting study we conducted in the spring and summer of 2012.

Impact Results

The Residential Lighting Program sold a total of 2,821,350 bulbs in PY5, exceeding the bulb sales goals the program had set at the beginning of the year by approximately 400,000 bulbs. Bulbs were sold at participating retail sites as well as an online website managed by AIC. While a large majority of bulbs sold were standard CFLs (88%), the percentage of specialty CFLs sold was double the percentage sold in PY4 (12% compared to 6%).[1] Though LEDs were not a focus of the program and made up less than 1% of total program sales, the number of LEDs sold increased dramatically compared to PY4 (1,541 compared to 18). More LEDs were sold through the web store than either standard or specialty CFLs.[2] Overall, the web store sold less than 1% of all bulbs sold through the program.

[1] Throughout this report, we employ the program definition of standard versus specialty CFLs. A standard CFL is a spiral CFL that does not have any special functions. A specialty CFL either has a glass cover over the spiral, or the bulb has special functions such as dimmability or is a 3-way bulb.

[2] The program discounted one LED in retail stores, the "L Prize" winner from Phillips. In addition to the prize-winning bulb, the program discounted two additional LEDs through the web store.

Table 1. Bulb Sales by Type and Sales Channel

Bulb Type	Markdown	Web Store	Total
Standard CFL	2,458,076	494	2,458,570
Specialty CFL	360,618	518	361,136
LEDs	914	730	1,644
Total	**2,819,608**	**1,742**	**2,821,350**

The carryover savings method outlined in the 2012 Illinois Statewide Technical Reference Manual (TRM) spreads program savings across the three years it takes for customers to install all of the bulbs they purchase. For evaluation purposes, AIC chose to begin using this method in PY3. As a result, PY5 savings are from bulbs that were *installed* in PY5 but could have been *purchased* in PY3, PY4, or PY5. As shown in Table 2 below, the program achieved net energy impact of 129,839 MWh and net demand impacts of 14.67 MW.

Table 2. PY5 Residential Lighting Program Net Energy Impacts

Energy Impacts	Energy (MWh)		Demand (MW)	
	Ex Ante	***Ex Post***	***Ex Ante***	***Ex Post***
Residential Lighting Program	108,226	129,839	11.44	14.67
PY5 Net Savings Realization Rate	*1.20*		*1.28*	

Note: Realization Rate = *Ex Post* Value / *Ex Ante* Value.

The Residential Lighting Program's realization rate for PY5 net demand savings is 1.20, and the realization rate for net energy savings is 1.28. *Ex post* savings are different from *ex ante* savings for several methodological reasons:

- The program savings method assumes that 100% of program sales are installed in residential spaces. Our evaluation determined that 3% of bulbs are installed in commercial spaces that have greater hours of use and different waste heat factors.
- The program savings method uses the same hours of use (HOU) for standard and specialty bulbs. Our evaluation uses the different HOU for standard and specialty bulbs provided in the 2012 TRM, which are higher for some specialty bulb types.
- The program savings method uses a wattage-based approach to estimate the base wattage for each bulb. Our evaluation uses the lumen-based method outlined in the 2012 TRM, which resulted in nearly identical program savings (0.001% less with the lumen-based method).
- The program savings method assumes that 100% of bulbs purchased in PY5 are installed in PY5. The evaluation method uses the carryover method outlined in the 2012 TRM, which includes savings from a portion of sales made in PY3 and PY4. The program sold more bulbs in both PY3 and PY4 than in PY5, resulting in greater savings being attributed to the PY5 program.

Process Results

The Residential Lighting Program ran smoothly in PY5. The program was able to increase its goals by 19% during the year and still meet them. The program made use of increased incentives and off-shelf

product placement to meet these goals. Implementation staff credited long-running relationships with participating retailers as the key to securing these product placement promotions. The program expanded its reach to additional retailer types in PY5 by adding independent grocery stores and more small hardware and discount stores. According to program staff, some of these retailers started carrying additional efficient lighting products as a result of their participation.

In PY5, the program was promoted primarily through the use of point-of-purchase (POP) sales materials at participating retail stores. Our in-store stocking study found materials promoting the presence of AIC-discounted CFLs at all 10 participating stores we visited. We found additional AIC materials describing the benefits of CFLs at nine of the stores.

The program's field representatives conducted a number of in-store product demonstrations with customers and trainings with retailers. Our analysis of the in-store customer interviews show that these events increase sales of energy-efficient lighting at the time of the demonstration. Customers who purchased light bulbs while a lighting demonstration was taking place were more likely to purchase efficient lighting than customers who purchased light bulbs outside of an event. During an event, 54% of customers who purchased bulbs customers purchased CFLs compared to 43% of customers when an event was not present. When LEDs are included, close to two-thirds of event customers (64%) purchased an efficient bulb compared to half of non-event customers (49%). Though the events focus on CFLs and not LEDs, the events provide information about the benefits of energy efficient lighting that may encourage customers to investigate the wider variety of products available.

The results from our in-store stocking study and customer interviews provide key information on the state of the lighting market in AIC territory. Both studies show that most retailers in AIC territory continue to stock less-efficient lighting products, and large numbers of AIC customers continue to buy these products. We conducted an inventory of the lighting products on the shelves at the 10 participating retailers where we conducted in-store customer interviews in January 2013. This inventory showed that across all wattages and bulb types, the less-efficient bulb types—incandescents and halogens—comprised 55% of lighting products stocked.

When we examine only standard bulbs—the type impacted by the Energy Independence and Security Act (EISA)—CFLs are more common, but we still found that incandescent bulbs were available across all four wattage categories. We found 75-watt incandescent bulbs in eight of the 10 stores, while 100-watt bulbs were in seven of the 10 stores. Across all wattages of standard bulbs, the most commonly stocked bulb type in early 2013 was CFLs (45% of products stocked), followed by incandescents (38%). Fourteen percent (14%) of 100-watt or equivalent products on shelves were incandescents, while nearly one-third of 75-watt or equivalent products were incandescents. Incandescents are more common among 40- and 60-watt products (57% and 38%, respectively). This makes sense as these products which will be impacted by EISA in January 2014.

As incandescents phase-out, halogens may be phasing-in. EISA-compliant halogens are more common among 100-watt products than the other wattages. Halogens comprise one of every five 100-watt products stocked (21%), and roughly one in 20 of the other wattages (5% to 7%).

Without AIC discounts, our stocking study shows that the CFLs still cost more than halogens and incandescents. The average CFL costs close to $1 more than the average halogen, which costs just over $1 more than the average incandescent. Non-discounted CFLs cost twice as much as incandescents. With the AIC discount, the price of the average standard CFL is essentially equal to that of incandescents, and more than $1 less than the price of halogens.

The average specialty CFL would cost more than twice as much as the average specialty incandescent if AIC did not provide discounts. AIC discounts on specialty CFLs bring their price closer to that of incandescents, but CFLs are still more expensive.

Results from our in-store customer interviews show that not only are stores stocking less-efficient light bulbs, but also that customers are buying them. Despite the presence of AIC-discounted CFLs that are comparable in price to incandescents, just over half of the standard and specialty bulbs purchased at participating retailers are incandescents or halogens (53%). Incandescents were the most frequently purchased bulb type across all types (48% compared to 44% of CFLs).

Recommendations

Within this context, we offer the following recommendations for program improvement.

- **Attempt to increase sales of specialty CFLs to increase CFL socket saturation.** We understand that the program is increasing its focus on specialty CFLs in PY6 and increasing incentives. We recommend increasing the incentives on specialty CFLs so they are at least equal in price to incandescent bulbs. Our stocking study found that AIC discounts make the price of standard CFLs equivalent to incandescents, but specialty CFLs are still more expensive even with the incentive. In addition, the program may want to add more candelabra CFLs to its mix of products. Our in-home study found that candelabra bulbs are the most common type of specialty incandescent in AIC homes, though the program discounts and sells more CFL reflectors. We also found that lack of awareness of the variety of CFLs available is a barrier to CFL purchase. We recommend increased marketing to let AIC customers know that there is a CFL for nearly every light socket in their homes.

- **Explore the market for LED incentives.** Although the program's web store makes up less than 1% of program sales, sales through the store suggest that customers are interested in LEDs. The web store sold more LEDs than either standard or specialty CFLs. LEDs are also an avenue for increasing socket saturation of efficient specialty bulbs. CFL saturation of specialty bulbs lags behind that of standard CFL bulbs. Specialty CFLs are more expensive than standard CFLs, which accounts for some of the difference in saturation. However, specialty CFLs also do not perform as well as incandescents and LEDs when it comes to dimmability, which is a desired feature of many specialty bulbs. As the price of LEDs continues to drop, AIC may want to test consumer interest in these bulbs.

- **Track all of the data necessary to calculate program savings using the Illinois Statewide TRM method.** The official program-tracking database does not contain all of the information necessary to calculate program savings using the method outlined in the TRM. The TRM uses a lumens-based approach to calculate base wattages for CFLs, and the program does not track lumens for products sold. The 2012 Statewide TRM also has different savings assumptions based on bulb type (e.g., specialty, standard) and type of specialty bulb (e.g., globe, reflector), which the program does not track. The program uses a wattage-equivalency method to calculate base wattages and does not vary its savings assumptions based on bulb type. Including all necessary data in the tracking database would aid in program tracking, routine reporting, and evaluation.

2. INTRODUCTION

This report presents results from the PY5 evaluation of the AIC Residential Lighting Program. The Residential Lighting Program is designed to increase awareness and usage of ENERGY STAR (ES) lighting among residential customers. The program is aimed at an eventual transformation of the residential lighting market in AIC territory. The program seeks to increase awareness of energy-efficient lighting and its benefits through marketing and outreach efforts at participating retailers, community events, and the AIC website. The program partners with retailers and lighting manufacturers to sell ES lighting at a discount in order to bring the cost closer to that of less-efficient lighting options on the market. The discounts encourage customers who are reluctant to pay full price for ES lighting to choose energy-efficient over standard lighting. Most products are sold at participating retailers across AIC territory. AIC customers can also purchase discounted CFLs and LEDs online at the AIC website. The online store discounts a number of standard and specialty CFLs, and in PY5, three LEDs.

The Residential Lighting Program was launched in August 2008 and is implemented by Conservation Services Group (CSG) with subcontractors Applied Proactive Technologies (APT) and Energy Federation, Incorporated (EFI). Across the program's five years, it has discounted 12,391,945 energy-efficient light bulbs and fixtures. This evaluation reviews the program's performance in PY5, which began in June 2012 and ended in May 2013.

3. EVALUATION METHODS

3.1 DATA SOURCES AND ANALYTICAL METHODS

The assessment of the fifth year of the Residential Lighting Program included both process and impact analyses. Table 3 below summarizes the activities performed by the evaluation team in support of the PY5 evaluation.

Table 3. Summary of Evaluation Methods

Task	PY5 Impact	PY5 Process	Details
Program Staff In-Depth Interviews	√	√	Gathered detailed information on the step-by-step operational conditions and implementation efforts to gain an understanding of program design and delivery.
Program Data Review	√		Verified program-reported savings.
Program Materials Review		√	Reviewed program implementation plan and marketing and outreach materials.
In-Home Lighting Study	√	√	Completed 226 lighting audits. Collected information on the quantity and type of lighting in use and in storage in customers' homes.
In-Store Customer Intercept Interviews	√	√	Conducted interviews with 343 customers at 10 participating retailers. Asked questions used to estimate program free ridership, residential versus commercial usage of program lighting, and leakage rate. We also used the interviews to assess barriers to ES lighting purchases and program processes.
Lighting Shelf Stocking Study	√	√	Conducted a stocking study of lighting products on shelves at 10 participating retailers to gain information on the availability and pricing of ES lighting and less-efficient products, including the continued presence of EISA-regulated incandescent bulbs. We also collected information on the presence and type of marketing materials in stores.

Program Staff In-Depth Interviews

The evaluation team interviewed the program managers from CSG and APT about their roles in the Residential Lighting Program, program processes, and day-to-day program administration. Topics addressed included program goals, marketing, data management and tracking, quality assurance, and incentives.

Review of Program Materials and Data

The evaluation team conducted an extensive review of all program materials and data available, including marketing materials, field reports, and tracking databases.

In-Home Lighting Study

As part of the PY4 and PY5 evaluations, we conducted in-home audits of the lighting installed and in storage in 226 homes in AIC service territory.[3] We drew a stratified simple random sample from the AIC residential customer database. The strata were eight geographic regions across AIC territory. The regional divisions made it easier to conduct the study from a logistical standpoint, and ensured that the study participants were representative of the entire AIC service territory. The number of target visits in each region was proportionate to the region's share of the overall AIC customer population. We recruited audit participants via the telephone in May 2012. The visits were completed in June and July 2012.

A detailed lighting study of this nature provides the most accurate "snapshot" of the number, type, and location of residential lighting products. During each home visit, the auditor recorded the quantity and type of lighting installed in each room inside the home, as well as lighting installed in the exterior or garage. The auditor also recorded lighting found in storage but not currently in use.

We reported partial results in the PY4 evaluation report and full results in a memo delivered in February 2013 (see Appendix B). Throughout this evaluation report, we reference the in-home study results where appropriate.

In-Store Customer Intercept Interviews

Opinion Dynamics conducted interviews with 343 customers purchasing lighting at 10 participating retail locations in January 2013. We had to make use of a convenience sample of stores for budgetary reasons and also because not all retailers allow in-store customer research. Despite these constraints, we selected a sample of stores that represent a large percentage of program sales across AIC territory.

We conducted interviews at do-it-yourself (DIY), warehouse, and big box retailers. We selected retailers who sold the most bulbs through the program and would allow us to conduct the interviews. Because PY5 was only halfway complete at the time of the interviews, we used PY4 sales to identify the top-selling retailers. In the end, four retailers agreed to allow us to conduct in-store interviews; these retailers sold 86% of bulbs sold through retailers in PY4.[4]

[3] The target sample size was selected to ensure that we achieved 90% confidence and 10% precision for estimates of CFL penetration and saturation. Because these numbers can be highly variable across the population, we completed more audits than we felt were likely necessary to ensure that the study met the target confidence and precision levels.

[4] In PY5, the sample retailers sold 76% of all bulbs sold through retailers. As we will show later in the evaluation, the program increased the number of small and independent retailers in PY5 and sold slightly fewer bulbs at the larger retail outlets that were the focus of the in-store customer interviews.

To gain entry to the stores, we first accompanied the program field representative who was conducting a lighting demonstration. The program representative helped the interviewer gain permission to come back and conduct additional interviews on the following two days. In all cases, permission was granted. For each retailer, we selected retail locations with the most program sales and that also had a demonstration day either on the schedule or where one could be added. Our 10 sample stores sold 18% of all bulbs sold through retailers in PY4.[5] Table 4 shows the number of locations, days spent at each, and total number of interviews completed by retailer type.

Table 4. In-Store Interview Retailer Categories

Retailer Type	Stores	Days	Interviews
Do-It-Yourself	6	18	204
Warehouse	2	6	48
Big Box	2	6	91
Total	**10**	**30**	**343**

We conducted interviews across AIC territory.

Figure 1 below shows our intercept locations as well as the number of bulbs sold in each county in AIC territory. Our sample stores are located in counties that sold the most program bulbs.

We conducted interviews on the days of the week and during store hours when residential customers are more likely to shop. The interviews took place on Saturdays, Sundays, and Mondays over the course of four weeks in January 2013. Interviews were conducted during the day between 9 am and 5 pm.[6] We conducted interviews with customers purchasing CFLs and LEDs discounted through the program, CFLs and LEDs that were not discounted, and incandescent and halogen light bulbs.

[5] In PY5, the sample stores sold 13% of all bulbs sold through retailers.

[6] Because travel and overnight stays were required for most locations, we chose to remain in the area through Mondays to get additional completes when a lighting demonstration was not present. We completed fewer interviews on Mondays, but being in the store on a weekday did allow us to conduct interviews with more commercial customers than if we had only conducted interviews on weekends. We use these interviews to estimate the percentage of program bulbs that are installed in a commercial locations.

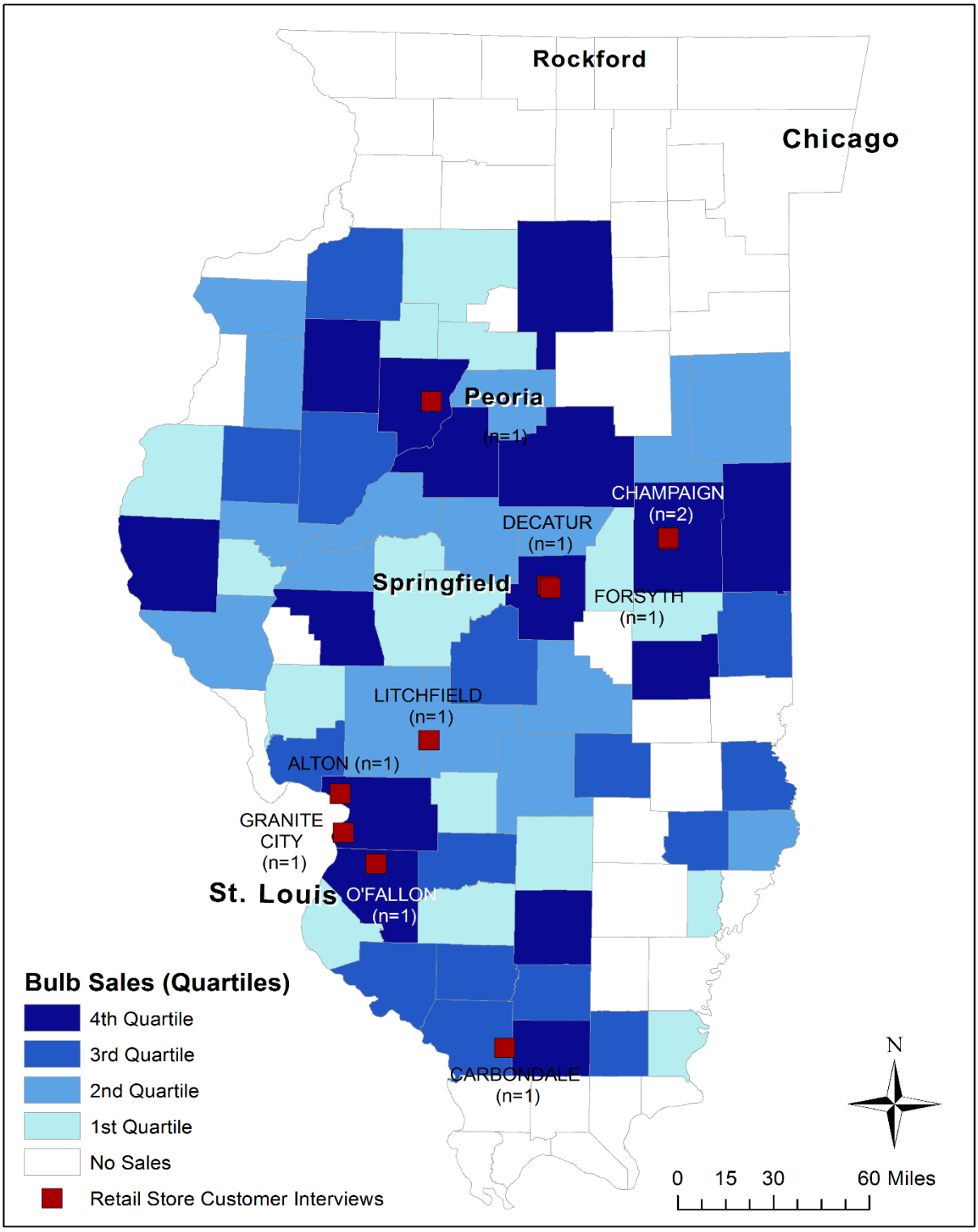


Figure 1. In-Store Customer Interview Locations

We conducted approximately one-quarter (24%) of all interviews while a demonstration was taking place. Because demonstration events impact the shopping environment and may not be typical of most customer purchases throughout the year, we report the results separately for demonstration and non-demonstration hours where appropriate.

We instructed the field interviewers to station themselves in the lighting aisle of the store and approach customers after they had made their purchase decision and were preparing to leave the aisle. Interviewers asked customers to complete a short survey in exchange for a $5 gift card to that particular retail store, which they could use that day. Interviewers recorded customer responses using an electronic tablet. We designed and programmed the survey so interviewers only asked questions that were relevant to the types of bulbs customers were purchasing. The average interview took eight minutes.

We asked questions to assess program free ridership, along with questions to understand the types of customers who are more likely to be free riders. The survey contained questions on the influence of price and marketing materials on the customer's purchase decision. We also asked about reasons for purchasing the type of lighting technology being purchased. Appendix A contains a copy of the survey instrument.

Lighting Shelf Stocking Study

We conducted a lighting shelf stocking study at each of the 10 participating retailers where we conducted customer interviews. For each lighting product discounted through the program or that could be purchased instead of a discounted product, we recorded a number of key characteristics including bulb type, pack size, specialty features, and price. We also collected information on the presence and focus of all lighting marketing materials in the store. Appendix A contains a copy of the shelf stocking instrument.

3.1.1 PROCESS ANALYSIS

For the process analysis, we analyzed data collected during our interviews with program staff, the review of marketing materials and program data, the in-home lighting study, the in-store customer interviews, and the lighting shelf stocking study. We utilize univariate statistics and hypothesis testing in the presentation of results.

3.1.2 IMPACT ANALYSIS

Gross Impacts

The evaluation team calculated the program's gross electric and demand savings using the program-tracking database as well as algorithms and savings assumptions outlined in the 2012 Illinois Statewide Technical Reference Manual (2012 TRM).[7]

[7] State of Illinois Energy Efficiency Technical Reference Manual, Final as of September 14, 2012.

Electric Savings

To calculate program electric savings, we applied the savings algorithm outlined in the 2012 TRM:

$$\Delta \text{ kWh} = ((\text{WattsBase} - \text{WattsEE})/1000) * \text{In Service Rate (ISR)} * \text{HOU (Hours of Use)} * \text{Waste Heat Factor (WHFe)}$$

The savings assumptions vary depending on the customer and bulb type purchased, and are discussed in greater detail in the sections below. The most common situation would be a residential customer purchasing a standard CFL, which would have the following savings assumptions:

$$\text{ISR} = .695$$

$$\text{HOU} = 938$$

$$\text{WHFe} = 1.06^{8}$$

The baseline wattages in the 2012 TRM are based on the lumen output and the year the bulb is installed, as shown in Table 5 below. For example, Energy Independence and Security Act (EISA) compliant halogen bulbs are the baseline wattage for CFLs that produce between 1,490 and 2,600 lumens beginning in June 2012, thus dropping the base wattage from 100 to 72 watts.

Table 5. Baseline Wattages for Calculation of Gross Savings after EISA

Minimum Lumens	Maximum Lumens	Incandescent Equivalent Pre-EISA 2007 ($Watts_{Base}$)	Incandescent Equivalent Post-EISA 2007 ($Watts_{Base}$)	Effective Date from which Post-EISA 2007 Assumption Should Be Used
1490	2600	100	72	June 2012
1050	1489	75	53	June 2013
750	1049	60	43	June 2014
310	749	40	29	June 2014

Because the program-tracking data did not contain the lumens for the products sold through the program, we needed to add this information to the tracking data before calculating program savings. We matched the list of bulbs sold through the AIC program to a list of ENERGY STAR-qualified bulbs located on the ENERGY STAR website.[9]

[8] WHFe for an interior bulb installed within a single family home or within an unknown (but cooled) location.

[9] See http://www.energystar.gov/productfinder/product/certified-light-bulbs/results. One can search for information by bulb type on this page, or download an Excel file that contains information on all products.

Installation Location

The 2012 TRM provides different HOU assumptions and waste heat factors depending on where bulbs are installed. Though the program targets residential customers, it cannot prevent commercial customers from purchasing bulbs at participating stores. To apply the most appropriate savings assumptions, we asked customers during our in-store customer interviews if they intended to install the bulbs in a home or business. If a business, we asked for the type of business, and if the business was a rental property, we inquired as to whether the bulbs would be installed in a common area or a tenant unit. We classified bulbs that would be installed in tenant units as residential installations and the rest as commerical. For customers who said they would install the bulbs in both their home and business, we evenly divided the bulbs between the two locations. We found that 97% of discounted bulbs would be installed in residential locations, and 3% in commercial locations. This result is the same as found in an earlier study and used in previous evaluations.[10]

For 97% of bulbs sold we applied the residential HOU assumptions, and for 3% we applied the commercial HOU assumptions from the 2012 TRM (see Table 6 below). The TRM provides different HOU assumptions for standard and specialty CFLs for residential installations. The TRM only provides hours for standard CFLs for commercial installations, so we applied the standard CFL HOU to all assumed commercial installations. The TRM does not provide HOU for medium screw-based standard LEDs in residential settings, which were the bulbs sold through the AIC program. We use the HOU for standard CFLs for these LEDs.

Table 6. 2012 TRM Hours of Use Assumptions

Bulb Type	HOU
Residential Installations	
Standard CFLs	938
Post Light	1,825
Candelabra	1,328
Globe	1,240
A-Lamp	938
Dimmable	938
Reflector	938
Plant Light	938
Three-Way	897
LEDs (Medium Screw-Based)	938
Commercial Installations	
All CFLs	4,576

[10] The Cadmus Group, *L&A Program Addendum #3*. Prepared for Ameren Illinois Company, May 10, 2011.

Like HOU, the 2012 TRM provides different WHFe for different installation locations (such as single family, multifamily in unit, or multifamily common area). We therefore used a WHFe of 1.06 for the 97% of bulbs installed in residential locations, and 1.24 for the 3% installed in commercial locations[11].

In-Service Rate

The in-service rate is calculated using the carryover savings method outlined in the 2012 TRM. AIC chose to begin use of the method in PY3 to ease the transition to PY5, when the new method must be used. The method assumes that 2% of program CFLs will never be installed, but the remaining 98% will be installed over a three-year period. Installation rates also vary by bulb type, with lower first-year installation rates for standard CFLs compared to specialty CFLs and fixtures. The program sold a small number of medium screw-based LEDs through the web store. The 2012 TRM only contains first-year installation rates for LED downlights ranging from 0.95 to 1.00. Given the high cost of these bulbs, we chose to use an installation rate of 1.00 for the small number of LED bulbs purchased in PY5. Table 7 presents the three-year installation rates by bulb type presented in the TRM and used in this evaluation.

Table 7. 2012 TRM Residential CFL Installation Rates

Bulb Type	First Year	Second Year	Third Year	Final
Standard CFLs	69.5%	15.4%	13.1%	98%
Specialty CFLs	79.5%	10.0%	8.5%	98%
LEDs (Medium Screw-Based)	100%	--	--	100%

Because AIC began using the carryover method in PY3, PY5 savings will include savings from sales made in PY5, PY4, and PY3. For example, total program savings due to the sale of standard CFLs will comprise 69.5% of savings from sales in PY5, 15.4% of savings from sales made in PY4, and 13.1% of sales made in PY3.

Realized PY5 Gross kWh Savings = Δ kWh * (Unit Purchased PY5|Installed in PY5 + Unit Purchased PY4|Installed in PY5 + Unit Purchased PY3|Installed in PY5)

Because of EISA, the evaluation team adjusted the savings for 100 watt bulbs within bulbs carried over from PY3 and PY4 by changing the baseline wattage from 100 watts to 72 watts.

Demand Savings

The evaluation team calculated demand savings using the method outlined in the 2012 TRM:

Per-Unit kW Savings = Delta Watts/1000 * ISR * Waste Heat Demand Factor (WHFd) * Summer Peak Coincidence Factor (CF)

Where:

Delta Watts = Base Wattage – CFL Wattage

[11] As we do not know where the bulbs may be installed=, we followed the TRM guidelines and chose the WHFe for miscellaneous buildings

ISR = 2012 TRM (see Table 7 above)

WHFd = 1.11 (residential), 1.46 (miscellaneous commercial)

CF = 0.081 to 0.184 (residential), 0.66% (miscellaneous commercial)

The waste heat and summer peak coincidence factors vary based on installation location. We apply the residential values for 97% of bulbs sold, and the commercial values for the remaining 3%. In addition, the 2012 TRM provides coincidence factors for different specialty CFL types installed in residential locations (see Table 8 below). Our calculation of demand savings for specialty CFLs applies the value appropriate for each bulb type. The TRM only provides a coincidence factor for standard CFLs installed in commercial locations, so we apply the standard CFL coincidence factor to all commercial installations. Because the TRM does not provide a coincidence factor for medium screw-based standard LEDs in residential settings, which were the bulbs sold through the AIC program, we use the coincidence factor for standard CFLs for these LEDs.

Table 8. 2012 TRM Coincidence Factor Assumptions

Bulb Type	CF
Residential Installations	
Standard CFLs	0.095
Post Light	0.184
Candelabra	0.122
Globe	0.116
A-Lamp	0.095
Dimmable	0.095
Reflector	0.095
Plant Light	0.095
Three-Way	0.081
LEDs (Medium Screw-Based)	0.095
Commercial Installations	
All CFLs	0.660

Table 9 summarizes the sources of the data and assumptions used in the calculation of gross energy and demand savings.

Table 9. Sources Information for *Ex Ante* and *Ex Post* Gross Savings Inputs

Gross Savings Input	*Ex Post* Savings
Program Sales	PY5 Program-Tracking Database
Base Watts	2012 Illinois Statewide TRM and ENERGY STAR Website
CFL Watts	PY5 Program-Tracking Database
Residential vs. Commercial Installations	2013 AIC In-Store Customer Interviews
Hours of Use	2012 Illinois Statewide TRM
Installation Rate	2012 Illinois Statewide TRM
Waste Heat Demand Factor	2012 Illinois Statewide TRM
Summer Peak Coincidence Factor	2012 Illinois Statewide TRM

Net Impacts

We use the PY3 net-to-gross ratio (NTGR) of 0.83 to estimate net program savings. This value is the average of the results from two studies. The multi-state study, using data collected in 2010, used a comparison approach and employed data on CFL usage and purchases from a number of states with varying levels of lighting program maturity, including some states with no programs at all. The results were used to estimate a model-predicting program NTGR. The NTGR from this study was 0.75. The second study was conducted in PY2 and consisted of retailer reports of program influence on CFL sales. The NTGR from this study was 0.91. The PY3 NTGR averages the two study results to produce a final NTGR of 0.83, which was used in PY2, PY3, and PY4.

4. RESULTS AND FINDINGS

This section presents the process and impact findings from the PY5 evaluation of the Residential Lighting Program.

4.1 PROCESS FINDINGS

4.1.1 PROGRAM DESIGN AND IMPLEMENTATION

Based on interviews with program implementation staff, the Residential Lighting Program ran smoothly in PY5. Despite increasing program goals during the year, the program exceeded the final goal for number of bulbs sold. According to implementation staff, the program was able to meet these expanded goals by increasing incentives and employing off-shelf product placement to catch the attention of customers. Implementation staff credited long-running relationships with participating retailers as the key to securing these product placement promotions.

Program design and procedures remained largely the same as PY4, with two notable changes.

- The program increased its quality assurance and quality control procedures regarding the field representatives' work. Staff members conducted additional store visits to ensure that products and promotional materials were in place, and conducted interviews with retailers to ensure their satisfaction with field representatives.

- The program increased the number of independent grocery stores, small hardware stores, and discount stores. According to program staff, some of these retailers started carrying additional efficient lighting products as a result of their participation.

4.1.2 PROGRAM DATA

The program provided tracking data for both retailer and online sales. While the data fields provided were complete and accurate, not all fields necessary to calculate program savings using the method outlined in the 2012 TRM were tracked. For each product sold through the program, the tracking data provided the actual wattage, the base wattage that the program used to calculate energy savings, and the gross and net kWh savings. The 2012 TRM savings method uses bulb lumens to determine base wattages. This method was to be used beginning in PY5. However, the program continued to use the base wattage equivalencies provided in ICC Order Plan 2 Docket 10-0568 filed December 9, 2011. This method identifies a range of CFL wattages that are equivalent to a single incandescent base wattage. To calculate savings, we used an ENERGY STAR database and online research to assign lumens to each of the 410 products sold through the program.

In addition, the program-tracking data did not contain information about CFL type (standard or specialty) or specialty type (e.g., globe, reflector). This information is necessary to calculate savings using the installation rate method established by the 2012 Statewide TRM as well as the 2012 TRM formula for demand savings. Upon request, the program was able to provide CFL type, while the evaluation team determined the type of specialty bulb using product descriptions. Appendix C contains a listing of all bulbs discounted through the program, the bulb type, and the lumens of each bulb.

4.1.3 PROGRAM MARKETING, OUTREACH, AND TRAINING

In PY5, the Residential Lighting Program was promoted primarily through the use of point-of-purchase (POP) sales materials at participating retail stores. Our in-store stocking study found materials promoting the presence of AIC-discounted CFLs at all 10 participating stores we visited. We found additional AIC materials describing the benefits of CFLs at nine of the stores. We visited four different retail chains and found that they differed in how the discount was promoted. At two of the chains, both the regular and discounted price were displayed, while at the other two only the discounted price was displayed.

APT held 78 in-store events at top-selling retailers, aimed at promoting the program (see Appendix D for a listing of all events). These events involved representatives using "light bars" to demonstrate various bulbs, educational materials, and direct customer contact. Our analysis of the in-store customer interviews show that these events increased sales of energy-efficient lighting during the event. Customers who purchased light bulbs while a lighting demonstration was taking place were more likely to purchase efficient lighting than customers who purchased lighting outside of an event. During an event, 54% of customers purchased CFLs compared to 43% of customers when an event was not present (see Table 10). When LEDs are included, close to two-thirds of event customers (64%) purchased an efficient bulb compared to half of non-event customers (49%). Though the events did not promote LEDs, it is possible that the events' emphasis on energy efficient lighting encouraged customers to investigate and purchase other efficient bulbs in addition to CFLs.[12]

Table 10. Comparison of Bulb Purchases with and without Promotional Events

		Event		No Event	
Efficiency	**Bulb Type**	**Number**	**Percentage**	**Number**	**Percentage**
Higher	LEDs	8	10%	17	6%
	CFLs	45	54%	118	43%
	Halogen	6	7%	29	11%
Lower	Incandescent	31	37%	124	46%
	Total	**84**	**107%**	**272**	**106%**

Note: This table presents the number of customers who purchased each type of bulb. Percentages are greater than 100% because some customers purchased more than one type of bulb.

[12] Some of the additional LED purchases that took place during events could be spillover if they were, in fact, due to the information provided during events. Additional research would be required to confirm and quantify the program's influence. The spillover savings would be very small since retail events make up a small proportion of all hours retailers are open.

Customers who purchased program-discounted CFLs during lighting events are also more likely to know that they purchased discounted CFLs (59% compared to 44%), and that AIC is the source of the discount (62% compared to 35%) (see Table 11 below).[13] From our stocking study, we noted that some retailers only displayed the discounted price and not the regular price of the bulbs. This difference does not appear to have impacted customer awareness of the discount. Customers who purchased CFLs at the retailers who displayed both the regular and retail price were not more aware of the discount than those who purchased bulbs at retailers who only displayed the discounted price.

Table 11. Awareness of AIC Lighting Discounts

	Event (n=44)	No Event (n=108)
Aware of Discount	59%	44%
	Among % Aware of Discount (n=26)	**Among % Aware of Discount (n=48)**
Aware AIC Is Discount Sponsor	62%	35%

Program field representatives visit participating retailers on a regular basis to ensure that products and promotional materials are displayed properly. The program employs seven field representatives who are assigned responsibility for specific stores across AIC territory. The number of visits varies by retailers, with many of the warehouse, big box, and DIY stores receiving weekly visits. The discount and grocery stores receive monthly visits. While visiting the stores, the field representatives also typically train store staff on CFLs and how to best promote them, and provide a brief overview of how the program works from the consumer's standpoint.

4.1.4 Retail Stocking and Sales of Energy-Efficient Lighting

The results from our in-store stocking study and customer interviews provide key information on the state of the lighting market in PY5. Both studies show that most retailers in AIC territory continue to stock less-efficient lighting products, and large numbers of AIC customers continue to buy these products. The stocking study shows that both energy-efficient and non-efficient lighting products are widely available, while the customer interviews show that less-efficient bulbs are still the most frequently purchased bulb types. Moreover, without the AIC rebates, CFLs continue to cost more than less-efficient bulbs. The next three sections examine these results in greater detail.

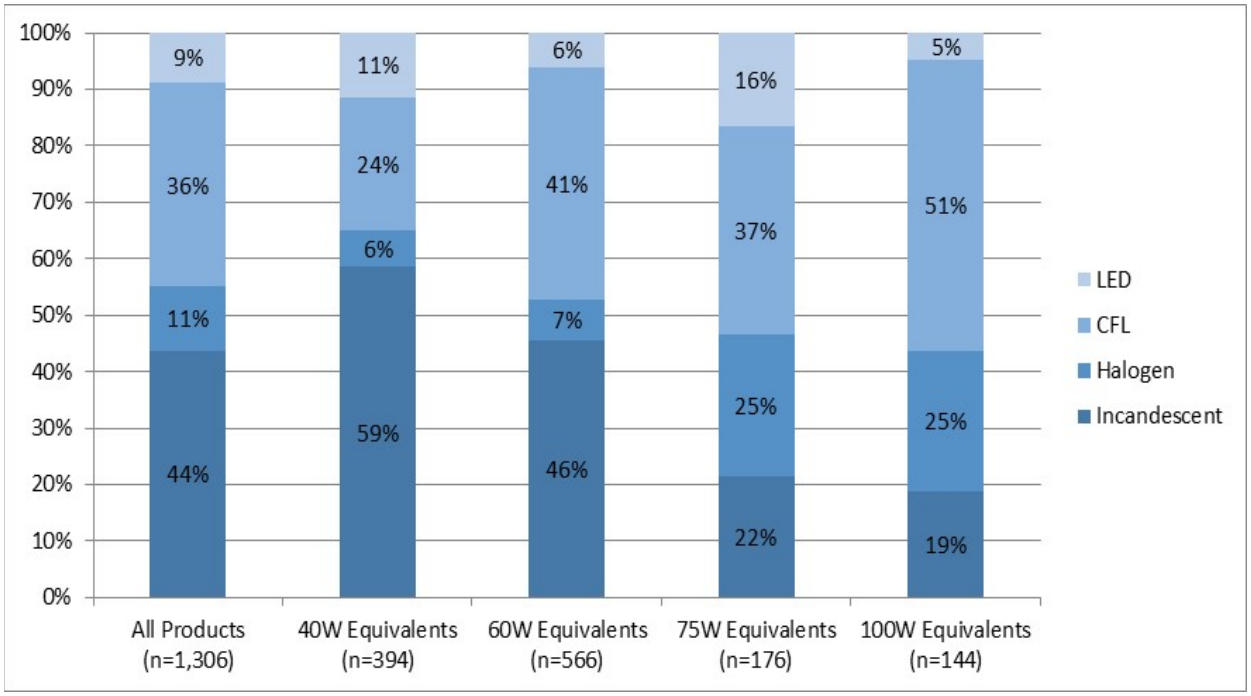
Lighting Product Stocking

We conducted an inventory of the lighting products on the shelves at the 10 participating retailers where we conducted in-store customer interviews in January 2013. This inventory shows that across all wattages and bulb types, the less-efficient bulb types—incandescents and halogens—comprised a slight majority of lighting products on retailers' shelves. Combined, these bulb types accounted for 55%

[13] These results should only be used to assess customer awareness of marketing materials, and not the impact of the discount on purchase behavior. Customers who are unaware of the discount might still not pay full price for the bulbs.

of lighting products stocked (see Figure 2 below). Energy-efficient products were more common among the higher-wattage bulbs. CFLs and LEDs made up a slight majority of 75- and 100-watt products stocked. This result is not surprising given the gradual phase-in of the EISA regulations, starting with the higher-wattage bulbs.[14]

Figure 2. All Lighting Products on Shelves



Note: The numbers ("n") in this figure represent the number of different types of products and not counts of bulbs.

The results in Figure 2 include both standard and specialty bulbs.[15] When we examined only standard bulbs—the type impacted by EISA—CFLs were more common, but we still found that incandescent bulbs were available across all four wattage categories. We found 75-watt incandescent bulbs in eight of the 10 stores, while 100-watt bulbs were in seven of the 10 stores.

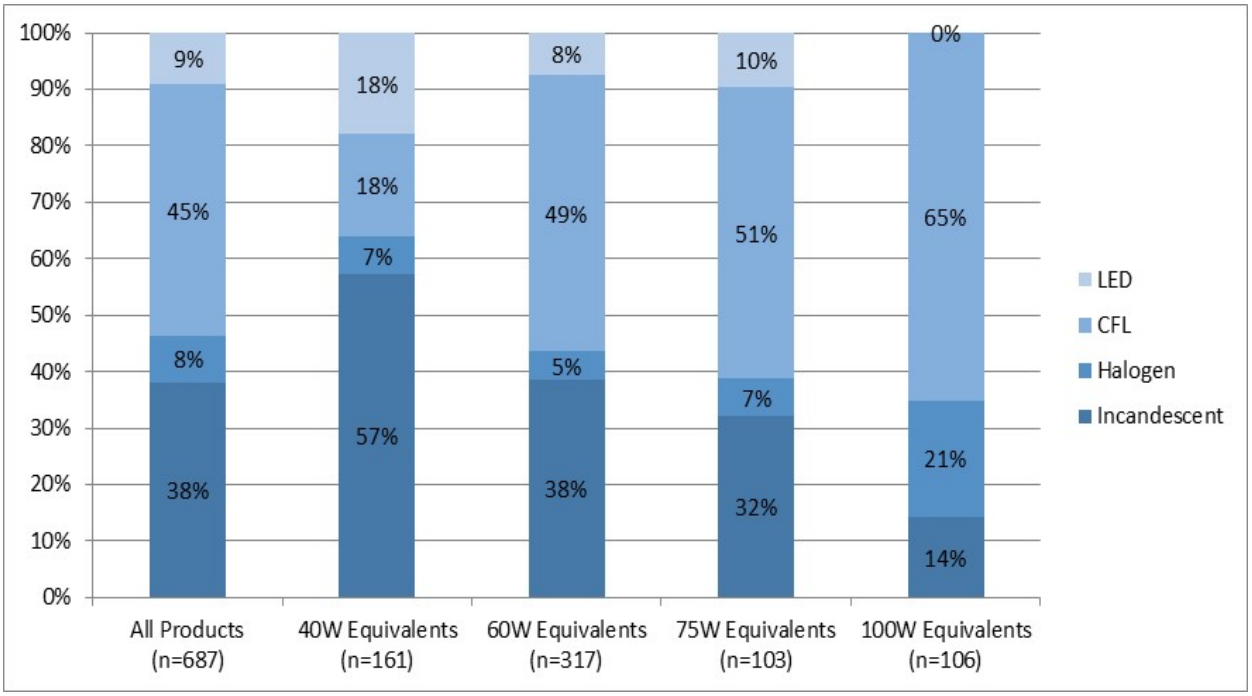
Across all wattages of standard bulbs, the most commonly stocked bulb type in early 2013 was CFLs (45%), followed by incandescents (38%) (see Figure 3 below). Fourteen percent (14%) of 100-watt or equivalent products on shelves were incandescents, while nearly one-third of 75-watt or equivalent products were incandescents. Incandescents are more common among 40- and 60-watt products, which will be impacted by EISA in January 2014.

[14] The stocking numbers reveal what is available for customers to purchase, but they should not be confused with sales data on what customers actually purchase. Because customers likely purchase products at different rates, actual sales data could differ from stocking data. The next section provides the sales results from our in-store customer interviews.

[15] Standard and specialty products are stocked in nearly equal numbers. Just over half of unique products stocked were standard bulbs (53%). The numbers in Figure 2 come nearly equally from both bulb types.

As incandescents phase-out, halogens may be phasing-in. EISA-compliant halogens are more common among 100-watt products than the other wattages. EISA-compliant halogens comprise one in every five 100-watt products stocked (21%), and roughly one in 20 of the other wattages (5% to 7%).

Figure 3. Standard Lighting Products on Shelves (affected by EISA Legislation)

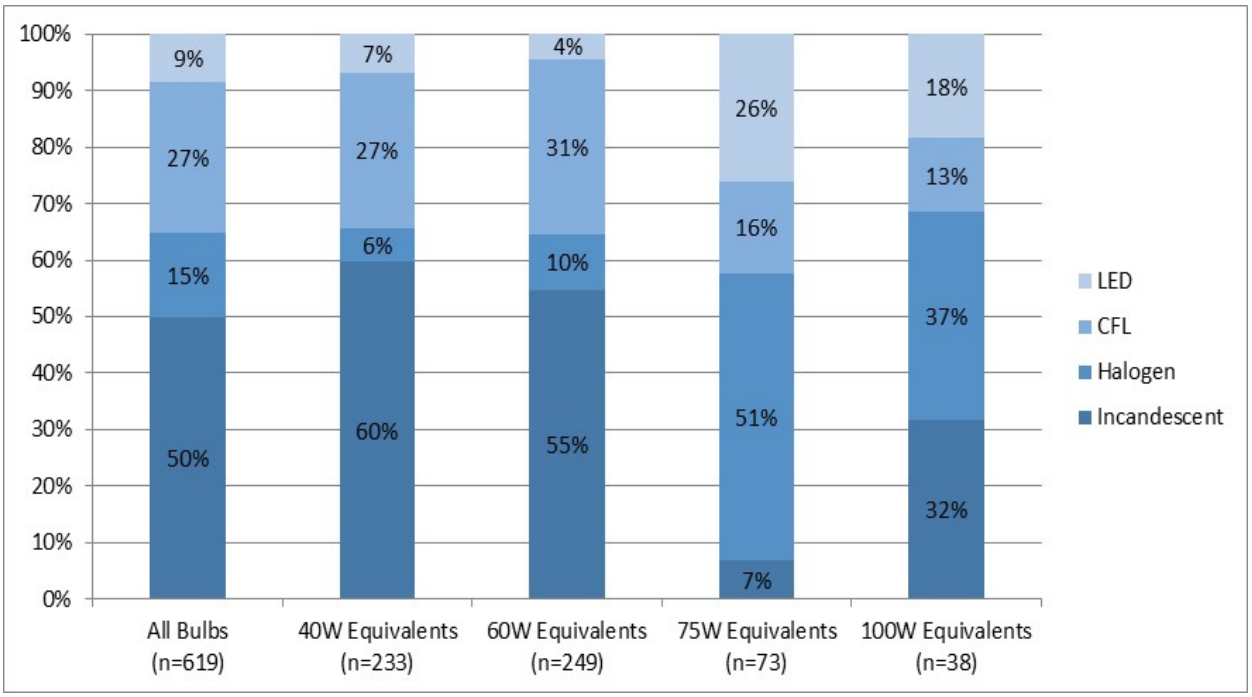


Note: The numbers ("n") in this figure represent the number of different types of products and not counts of bulbs.

We found fewer efficient products in the specialty bulb categories; the most common type of specialty light bulb was an incandescent (see Figure 4 below). Half (50%) of specialty products on shelves were incandescents, while 15% were halogens. CFLs made up slightly over one-quarter of specialty products (27%). Results differ across wattages. Like standard bulbs, incandescents are most common among 40- and 60-watt-equivalent products. We found some unusual differences between 75- and 100-watt products. Incandescent products are more common in the 100-watt category, while halogens are the most common 75-watt product sold. Both wattages have a sizable percentage of LEDs.

However, while we present out data by wattages, comparing the results across wattages is not suggested due to the varied uses of specialty bulbs. There are also fewer higher-wattage specialty products compared to the lower wattages, suggesting some unique functions might exist for these higher-wattage specialty products.

Figure 4. Specialty Lighting Products on Shelves (not affected by EISA Legislation)



Note: The numbers ("n") in this figure represent the number of different types of products and not counts of bulbs.

Lighting Product Pricing

As part of the shelf stocking study, we collected pricing information for all products. For discounted products, we recorded both the regular retail price and discounted pricing when available. We also noted whether the provider of the discounts was AIC or the retailer/manufacturer.

Figure 5 below compares the pricing of standard incandescents, EISA-compliant halogens, and CFLs.[16] For CFLs, Figure 5 provides three average prices. Two of the prices are for the CFLs that AIC discounts; the figure shows the average discounted price of these CFLs and also what these bulbs would cost if they were not discounted by AIC. Most retailers also sell some additional CFLs that are not discounted by AIC. Figure 5 shows the average price of these non-discounted CFLs as well.

Though prices of CFLs have come down, without the AIC-provided discounts, the standard CFLs that AIC discounts would still be more expensive than incandescents. The average CFL costs approximately $1 more than the average incandescent bulb and is equal in price to the average halogen. With the AIC discount, the price of the average standard CFL is essentially equal to that of incandescents, and costs approximately $1 less than the price of the average halogen.

[16] We compare regular and discounted pricing in this section. As a result, the data presented come only from the six stores that had both regular and discounted pricing. These six stores cover all of the retailer types we visited (i.e., DIY, big box, and warehouse).

Figure 5. Average Price of Standard Light Bulbs

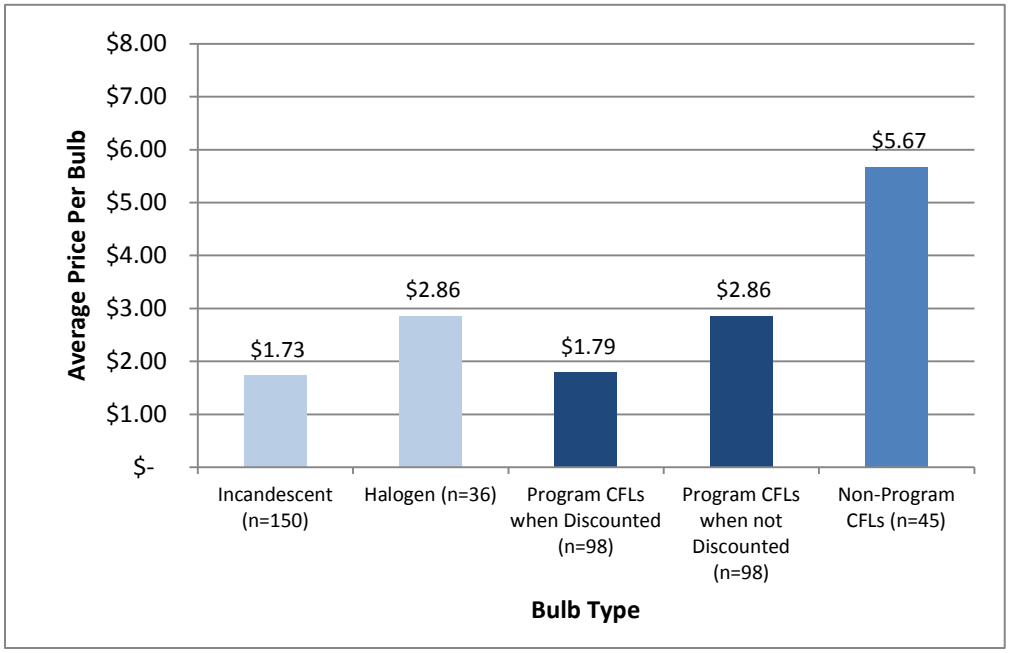
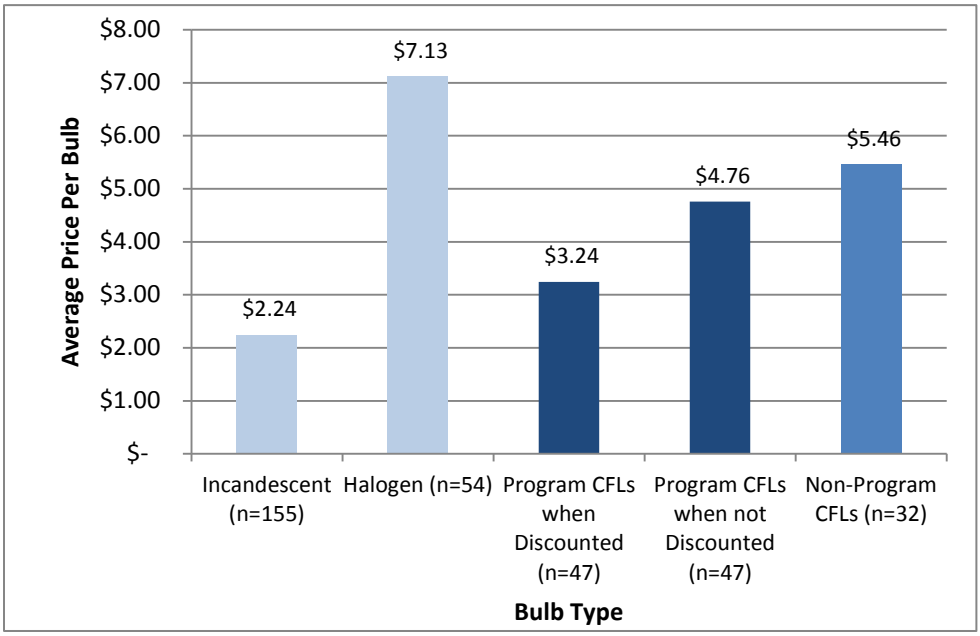


Figure 6 makes the same comparisons of the pricing of specialty bulbs. The average specialty CFL would cost nearly twice as much as the average specialty incandescent if AIC did not provide discounts. Specialty CFLs, both with and without the AIC discount, cost less than specialty halogens.

AIC discounts on specialty CFLs bring their price close to that of incandescents, but CFLs are still more expensive. The average discounted specialty CFL is $1 more on average than the average specialty incandescent.

Figure 6. Average Price of Specialty Light Bulbs



Lighting Purchases

Results from our in-store customer interviews show that not only are stores stocking less-efficient light bulbs, but also that customers are buying them. Despite the presence of AIC-discounted CFLs that are comparable in price to incandescents, just over half (53%) of the standard and specialty bulbs purchased at participating retailers are incandescents or halogens (see Table 12).[17]

Table 12. Purchase of Energy-Efficient Bulbs

Bulb Type*	Bulbs	
	Number	*Percentage*
Energy-Efficient	1,022	47%
Less-Efficient	1,134	53%
Total	**2,156**	**100%**

* CFLs and LEDs = "Energy-Efficient"; Incandescents and Halogens = "Less-Efficient."

With the addition of LEDs and EISA-compliant halogens to the market, consumers now have more than one efficient and less-efficient option. CFLs and incandescents were still the more frequently purchased bulbs of these respective types (see Table 13). Incandescents were the most frequently purchased bulb type across all types.

Table 13. Types of Bulbs Purchased

Efficiency	Bulb Type	Bulbs	
		Number	***Percentage***
Higher	LEDs	75	3%
	CFLs	947	44%
	Halogen	106	5%
Lower	Incandescent	1,028	48%
	Total	**2,156**	**100%**

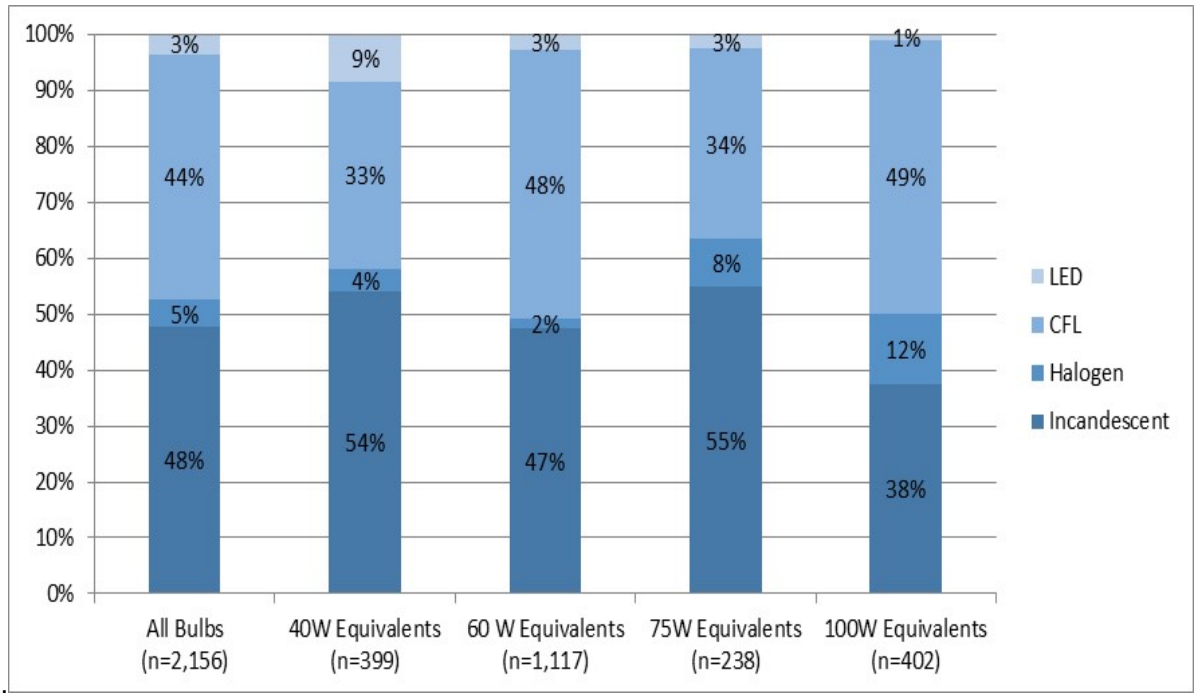
Seventy-five and 100-watt incandescent bulbs continue to be available and customers continue to buy them. One-quarter of 100-watt or equivalent bulbs purchased were incandescents, while nearly half of 75-watt or equivalents were incandescents (see Figure 7 below). These purchase data likely overstate the rate of purchase of 100- and 75-watt standard incandescent bulbs, as it includes purchases of both

[17] Although we conducted interviews with customers purchasing all types of lighting, a main focus of this study was to interview customers purchasing program-discounted CFLs to estimate program impact on these purchases. As a result, we collected less information on purchases of non-program bulbs. We only recorded whether a bulb was a standard or specialty for program-discounted CFLs, and therefore cannot present purchases of less-efficient bulbs by bulb type.

standard and specialty bulbs. However, it is likely that a majority of these purchases are standard bulbs because specialty bulbs comprise a smaller percentage of the market.[18]

Just as we saw with the stocking study results, the market share of halogens may be increasing as that of incandescents decreases.[19] A greater percentage of customers who are purchasing 100- and 75-watt bulbs purchase halogens than those purchasing 60- and 40-watt bulbs (12% and 8% compared to 2% and 4%).

Figure 7. Types of Bulbs Purchased, Standard and Specialty



Barriers to CFL Usage

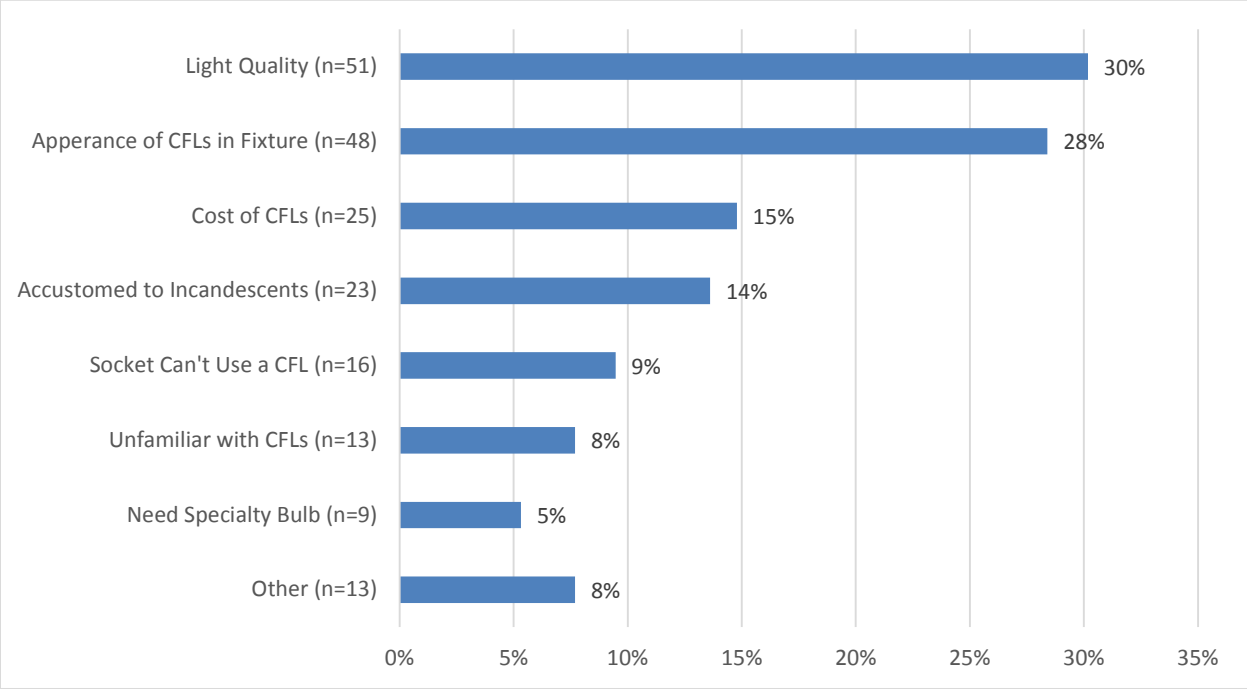
The results from our stocking study and in-store customer interviews show that barriers to CFL usage remain. Despite widespread availability of CFLs and AIC discounts that bring the price of CFLs in line with incandescent bulbs, slightly over half of customers still purchase either an incandescent or halogen. We asked questions of customers who were purchasing these less efficient bulbs that shed light on the remaining barriers and what AIC might do to overcome them.

[18] Our in-home lighting study found that 30% of screw-based sockets in AIC homes were using a specialty bulb. Though nearly half of the unique products on shelves are specialty bulbs, it is unlikely that half of bulbs sold are specialty bulbs, given the socket types in AIC homes. Given the variety of specialty bulb uses, retailers must stock a variety of specialty products, but likely don't sell more of these products.

[19] Lamp shipment data also indicates that EISA-compliant halogens are gaining market share. See, "Incandescent Lamp Shipments Wane During Second Quarter", NEMA, October 8, 2013: http://www.nema.org/News/Pages/Incandescent-Lamp-Shipments-Wane-During-Second-Quarter.aspx

Typical barriers to CFL usage include awareness, light quality and price. On the surface, awareness of CFLs does not seem to be a problem. According to our in-home lighting study, 97% of AIC customers are aware of CFLs and 93% have at least one in use in their homes. In addition, when we asked customers who were purchasing incandescents in the store why they were buying them instead of CFLs, only 8% said it was because they were not familiar with CFLs (see Figure 8). More customers mentioned the light quality of CFLs, the appearance of the bulbs in their light fixtures, and CFLs' high cost as reasons why they were purchasing incandescents.

Figure 8. Reasons for Purchasing Incandescent or Halogen Bulbs Instead of CFLs

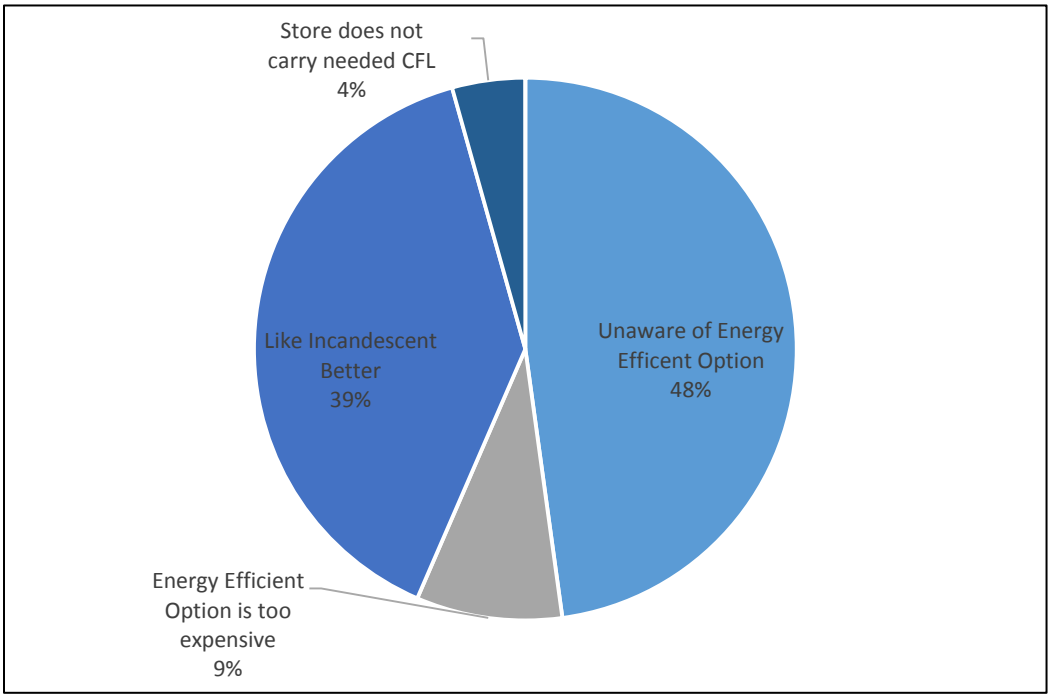


However, lack of awareness may be a greater barrier than these responses suggest. While most customers are aware of CFLs as a general product, some appear to be unaware of the variety of CFLs that exist. Customers who said they were buying incandescents because of the "appearance of CFLs in their light fixture", "the socket can't use a CFL", or "the socket needs a specialty bulb" may not be aware that a specialty CFL exists that would fit and look good in their light socket. Combined, these responses make up 50% of the reasons given for purchasing an incandescent bulb (see Figure 8).

We asked these respondents a follow up question to see if they were aware that a specialty CFL might exist to meet their needs or if there was another reason underlying their response. Of those that could provide an answer, 48% did not know that a specialty CFL existed 39% were aware of the CFLs but simply preferred incandescents. A small percentage (%) cited the high costs of CFLs (see Figure 9 below).

These results suggest that AIC may want to increase their marketing of specialty CFLs to let customers know there is a specialty CFL for nearly every socket. But even with increased awareness of CFL options, some customers still do not like the bulbs. LEDs may be a potential solution to this barrier as they continue to drop in price.

Figure 9. Reasons for Purchasing Incandescent Instead of Specialty CFL



4.2 IMPACT RESULTS

4.2.1 PROGRAM DATA VERIFICATION

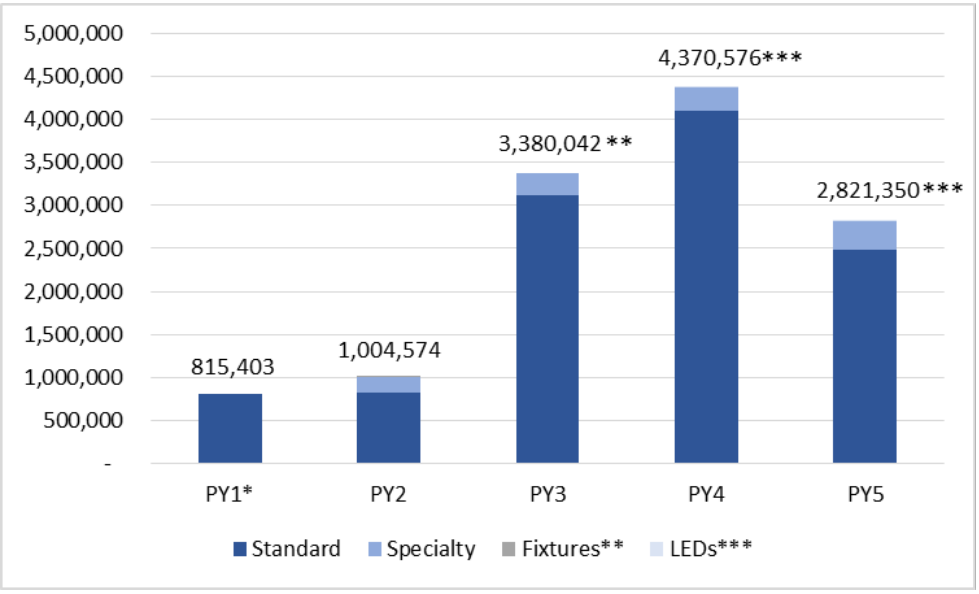
We verified program participation by examining the product sales data for product eligibility and time of sale. Our review of the program-tracking data found that all product sales were made during the eligible time period for eligible products.

We also examined the program data to ensure that the appropriate base wattage was used to calculate program savings for each product. The program continued to use a wattage-equivalency method to calculate savings, rather than the lumens-based approach in the 2012 TRM. Of the 410 different lighting products discounted through the program, the two methods produced the same base wattage for 318 products (78%). For 73 products (18%), the lumens method resulted in a base wattage that was higher, thus resulting in lower savings than the program calculated using wattage-equivalencies. For the remaining 19 products (5%), the lumens method resulted in a lower base wattage/greater savings. Overall, the impact of using the lumens method instead of the wattage-equivalency method on program savings is slight. When we factor in the number of each product that was sold through the program, the lumens method reduces the total program delta watts by 1,895 kW, which (after application of hours of use and waste heat factor) results in a reduction of program kWh savings of roughly 1%.

4.2.2 PROGRAM PARTICIPATION

The program sold a total of 2,821,350 bulbs in PY5, exceeding program goals in terms of bulb sales. PY5 goals were substantially lower than in PY4, which is the first year that the program decreased its goals since it began (the program has met or exceeded its goals every year). Figure 10 below shows program sales from PY1 through PY5, and shows increasing sales of bulbs until PY4.

Figure 10. Total Bulbs Sold PY1-PY5



* We do not have a record of the number of CFLs sold by type for PY1.
** Indicates fixtures were sold but the quantity is too small for the bar to be visible.
*** Indicates LEDs were sold but the quantity is too small for the bar to be visible.

Nearly all bulbs were sold through the markdown program in PY5. The web store sold a very small number of bulbs, though it sold more LEDs than either standard or specialty CFLs (see Table 14 below). Like previous years, the vast majority of bulbs sold in PY5 were standard CFLs (88%). However, the program sold more specialty CFLs in PY5 compared to PY4, in both absolute and percentage terms (see Figure 10 above). The program sold approximately 62,000 more specialty CFLs in PY5 compared to PY4 (12% of all sales in PY5 compared to 6% in PY4).

Table 14. PY5 Bulb Sales by Type and Sales Channel

Bulb Type	Markdown	Web Store	Total
Standard CFL	2,486,588	541	2,487,129
Specialty CFL	332,106	574	332,680
LEDs	914	627	1,541
Total	**2,819,608**	**1,742**	**2,821,350**

Part of the reason the program sells fewer specialty CFLs than standard CFLs is that fewer light sockets need a specialty bulb. However, our 2012 in-home lighting study shows that AIC customers are not purchasing specialty CFLs at a rate that is proportionate to the socket types in their homes. While specialty CFLs made up 12% of PY5 sales, our lighting study found that 30% of screw-based sockets had

a specialty bulb installed. Not surprisingly, CFL saturation in specialty sockets lags behind CFL saturation in standard sockets. Forty-one percent (41%) of standard sockets had a CFL installed, compared to 18% of specialty sockets (see Appendix B for full report).

An examination of the types of incandescent specialty bulbs in use in AIC homes suggests an area for future program emphasis. The most common type of specialty incandescent in AIC homes is candelabra bulbs, while the most common type of specialty CFL discounted and sold through the program is reflectors (see Table 15 below).[20] Approximately half of specialty incandescent bulbs in AIC homes are candelabra bulbs, but only one in five specialty CFLs sold in PY5 was a candelabra bulb. Reflector CFLs made up slightly over half of CFLs purchased in PY5 (55%), but are only 21% of specialty incandescents in homes.

The difference between what is in use and what is being purchased could be due to a number of factors, including customer preference, number of products discounted, or prominence of products in stores. If we examine the individual products that are discounted, the greatest percentage are reflectors, followed by globes (see Table 15). Candelabras made up 20% of all products discounted through the program in PY5. To increase specialty CFL saturation, the program may want to consider working with retailers to discount more candelabras, given the prevalence of these sockets in AIC homes.

Table 15. Specialty Bulbs Installed in AIC Homes Compared to Purchased and Discounted

Specialty Bulb Type	Incandescents	CFLs	
	Bulbs in Homes (n=2,347)	Bulbs Sold (n=253,658)	Discounted Products (n=122)
Candelabra	49%	24%	20%
Globe	29%	21%	23%
Reflector/Flood	21%	55%	57%
Bug/Plant Light	1%	< 1%	1%
Total	**100%**	**100%**	**100%**

In PY5, the program's goal was to increase its presence in grocery stores, drug stores, and independent hardware stores. The majority of program-discounted bulbs were still sold at big box retailers and DIY stores, but an increasing percentage was sold at these smaller retailers (see Table 16 below). The percentage of bulbs sold at big box retailers dropped from 65% in PY4 to 55% in PY5. These sales shifted to smaller retailers, which, according to program staff interviews, began selling some products they were not selling prior to their participation in the program.

Table 16. Bulb Sales by Retailer Type

Retailer Type	PY4	PY5

[20] We excluded A-Lamp, post-lights, three-way and dimmable CFLs from this comparison, though these bulbs are considered specialty bulbs in terms of program sales in Table 14. Customers who switch from incandescents to CFLs for these products often have options and could install a spiral CFL depending on the socket. We limited this analysis to sockets that would likely require the same shape of bulb regardless of its type.

Retailer Type	PY4		PY5	
	Bulbs	% of Sales	Bulbs	% of Sales
Big Box	2,820,055	65%	1,548,276	55%
DIY	1,412,077	32%	957,731	34%
Discount	94,707	2%	143,154	5%
Independent Hardware	31,139	1%	24,885	1%
Grocery Store	10,350	< 1%	72,974	3%
Online Store	1,738	< 1%	1,742	< 1%
Drug Store	510	< 1%	72,588	3%
Total	**4,370,576**	**100%**	**2,821,350**	**100%**

An examination of the bulb wattages sold through the program provides insight into the size and timing of the impact of EISA on program savings. A majority of CFLs sold in PY5 (69%) were in the 750-1,049 lumens range, which is equivalent to a 60-watt incandescent and not currently impacted by EISA. For PY5, the baseline wattage for bulbs in the 1,490-2,600 lumen range dropped from 100 watts to 72 watts due to EISA. These bulbs made up 13% of all program sales, which amounts to a reduction in program savings of 4% compared to pre-EISA.

In PY6, 1,050-1,489 lumens will be impacted, with the baseline wattages dropping from 75-watt to 53-watt-equivalent. If sales remain the same as PY5 with 8% of program sales, program savings will be 2% less compared to pre-EISA. The large majority of program sales will not be affected by EISA baseline adjustments until PY7, when the baseline will drop on 40- and 60-watt-equivalent bulbs to 29 and 43 watts, respectively. These bulbs made up 79% of all program sales in PY5; with a similar rate of sale, program savings would be 22% less under EISA. Across all wattages, program savings will be 28% less by PY7.

Table 17. Program Bulb Sales by Wattage

Lumens	Incandescent/Halogen Equivalent	Number	Percent
Less than 310	25 or less	7,123	< 1%
310-749	40/29	278,627	10%
750-1,049	60/43	1,949,431	69%
1,050-1,489	75/53	223,562	8%
1,490-2,600	100/72	355,484	13%
2,601+	100+	7,123	< 1%
Total		**2,821,350**	**100%**

4.2.3 GROSS IMPACTS

Table 18 outlines the *ex ante* and *ex post* gross savings for the PY5 Residential Lighting Program. Because some bulbs sold are put in storage for later installation, an installation adjustment factor is required to calculate the gross savings achieved in PY5. We used the 2012 Statewide TRM method that banks savings from PY5 sales for application in future years. AIC chose to begin use of this method in

PY3. Therefore, the *ex post* gross savings achieved in PY5 and shown in Table 18 is the result of sales made in PY3 and PY4 but installed in PY5, and sales made in PY5 and installed in PY5. The program-tracking database did not apply an installation rate in its calculations of PY5 savings; *ex ante* savings is based on all bulbs sold in PY5.

Table 18. PY5 Residential Lighting Program Gross Impacts

Sales Year – Install Year	Energy (MWh)		Demand (MW)	
	Ex Ante	***Ex Post***	***Ex Ante***	***Ex Post***
PY3 – Year 3	--	19,628	--	2.00
PY4 – Year 2	--	30,998	--	4.06
PY5 – Year 1	130,392	105,806	13.78	11.56
Total PY5 Gross Savings	**130,392**	**156,432**	**13.78**	**17.68**
PY5 Achieved Gross Realization Rate	*1.20*		*1.28*	

Note: Realization Rate = *Ex Post* Value / *Ex Ante* Value.

The 2012 TRM requires an adjustment in baseline savings for EISA-impacted bulbs. The adjustment begins at the start of the first program year following EISA implementation for a given wattage, because EISA-impacted bulbs are still available for purchase as retailers sell through their existing inventory. EISA impacted 100-watt equivalent CFLs in January 2012. Accordingly, we reduced the baseline for 100-watt-equivalent CFLs to 72 watts for bulbs installed in PY5, which began in June of 2012. In PY6, the baseline wattage for 75-watt-equivalent CFLs drops to 53 watts. We have made the appropriate adjustments to the banked savings for 100-watt-equivalent CFLs that were sold in PY3 and PY4 but were installed in PY5.[21]

Ex post gross savings are different than *ex ante* gross savings due to methodological reasons:

- The program savings method assumes that 100% of program sales are installed in residential spaces. Our evaluation assumes that 3% of bulbs are installed in commercial spaces that have greater hours of use and waste heat factors.
- The program savings method uses the same HOU for standard and specialty bulbs. Our evaluation uses the different HOU for standard and specialty bulbs provided in the 2012 TRM, which are higher for some specialty bulb types.
- The program savings method uses a wattage-based approach to estimate the base wattage for each bulb. Our evaluation used the lumen-based method outlined in the 2012 TRM. The lumen-based method reduces savings by approximately 1%.

[21] The PY3 carryover savings reported here do not match the savings reported in PY3. The PY3 carryover savings were calculated in PY3 in anticipation of the new statewide TRM. That TRM eventually also included the adjustment to the baseline due to EISA, which was not used in the PY3 report. We made the appropriate adjustments to the PY3 savings for this report.

- The 2012 TRM banked savings method resulted in greater savings because the program sold more bulbs in both PY3 and PY4 than in PY5, which resulted in more savings added to PY5 from past sales than were taken from PY5 for future installations.

Table 19 below provides the savings values from sales made in PY5 that are realized in PY5, and the savings that will carry over to PY6 and PY7 due to their later installation. As discussed earlier, the 2012 TRM method assumes that 98% of CFLs will be installed within three years, and 2% of bulbs will never be installed. When calculating carry over savings of PY5 bulb sales, we used post-EISA baseline wattages for PY6 installations of 100 and 75-watt-equivalent CFLs and PY7 installations of all wattages.

Table 19. PY5 Residential Lighting Sales Yearly Gross Impacts

Measure	Energy (MWh)			Demand (MW)		
	PY5	PY6	PY7	PY5	PY6	PY7
Standard CFLs	90,690	19,344	11,707	9.93	2.12	1.79
Specialty CFLs	15,035	1,891	1,608	1.67	0.21	0.13
LEDs	0.80	0	0	0.00009	0	0
Total	**105,806**	**21,235**	**13,325**	**11.61**	**2.33**	**1.46**

4.2.4 NET IMPACTS

We applied a NTGR of 0.83 to the gross ex post MWh and MW estimates in Table 18 to calculate PY5 *ex post* net savings. As discussed earlier, the NTGR was estimated in PY2 and has been used in the evaluation of PY2 through PY4 sales. Program-tracked net savings used the same NTGR.

Table 20. PY5 Residential Lighting Program Net Energy Impacts

Net Energy Impacts	Net Energy (MWh)		Net Demand (MW)	
	Ex Ante	*Ex Post*	*Ex Ante*	*Ex Post*
Residential Lighting Program	108,226	129,839	11.44	14.67
PY5 Net Savings Realization Rate	*1.20*		*1.28*	

Note: Realization Rate = *Ex Post* Value / *Ex Ante* Value.

The Residential Lighting Program's realization rate for net energy savings is 1.20, and its realization rate for net demand savings is 1.28. The differences between *ex ante* and *ex post* net savings are due to the reasons cited above in the discussion of gross savings.

- We recommend an updated first year in-service rate based on bulb type. The current first year ISR is 69.5% for time of sale CFLs. Our research supports a first year value of 76% for standard bulbs and 88% for specialty bulbs.

- PY5 research indicates a NTGR of 0.47.

Details on the research around these two points is shown in Appendix E.

APPENDIX A. DATA COLLECTION INSTRUMENTS

In-Home Audit Recruiter, Auditor Instrument, Home Owner Survey, In-Store Intercept Survey, Store Shelf Survey Instrument


AIU Lighting Study Recruiter FINAL 0515


AIU Home Study Auditor Instrument Fl


AIU Home Study Home Owner Survey


Ameren Lighting In-Store Survey FINA


Shelf Survey Instrument FINAL 20

APPENDIX B. IN-HOME LIGHTING ASSESSMENT

February 2013 Memo Providing Results of In-Home Lighting Assessment.

AIC PY4_PY5
Residential Lighting

APPENDIX C. PROGRAM BULB DETAILS

The attached document contains a listing of all bulbs discounted through the program, the bulb type, and lumen output.

AIC Residential Lighting PY5 Prograı

APPENDIX D. IN-STORE LIGHTING DEMONSTRATIONS

The attached file contains the dates and locations of all the in-store lighting demonstrations conducted by the program in PY5.

AIC Residential Lighting PY5 Events.

APPENDIX E. DETAILS ON FUTURE PLANNING INPUTS

As part of our in-home lighting study and in-store customer interviews, we conducted research to update key inputs to the algorithm for lighting program savings. These include program leakage, in-service rate, and attribution.

Program Leakage

As an upstream program that discounts products at the point of purchase, there is no way for the program to require customers to show proof that they are AIC customers. As a result, some of the bulbs sold through the program are likely purchased by non-AIC customers. We used questions asked during our in-store customer interviews to estimate program leakage. We asked all customers purchasing program-discounted CFLs for the name of the utility that provides electricity to their home or business (depending on where they said they would install the bulbs).

We found that 10% of program-discounted bulbs were purchased by customers of another utility. Table 21 below provides a list of the electric providers of customers who purchased program bulbs. The percentages represent the percentage of program bulbs purchased by these customers, so the overall leakage rate is the percentage of discounted bulbs that leaked out of AIC territory. AIC has a number of municipal utilities (muni) within its territory, and most bulbs that were purchased by non-AIC customers were purchased by customers of a muni. Of the 898 bulbs that leaked out of AIC service territory, less than 1% of bulbs (1 out of 898 bulbs) were purchased by a non-muni customer (Ameren Missouri). We interviewed customers from additional utilities, but these customers purchased other types of bulbs and therefore were not included in our calculation of leakage.[22]

Table 21. Program Bulbs Purchased by Electric Utility Provider

Utility	Percent
AIC	90%
Clay Electric	3%
Tri County Electric	2%
Clinton County Electric	1%
Coles Moultrie	1%
Illinois Rural Electric	1%
Village of Rantoul	< 1%
Cornbelt Energy	< 1%
MJM	< 1%
Shelbyville Electric	< 1%

[22] These utilities included Clinton County Electric, Com Ed, Direct Energy, Eastern Illini, Eastern Illinois Cooperative, Egyptian Co-Op, EIEC, and Electric Co-Op.

Utility	Percent
Ameren Missouri	< 1%
Total	**100%**

The location of the retailer relative to other utility territories should impact the leakage rate. Table 22 provides the leakage rates by retailer location. Retailers located in O'Fallon, Alton, and Champaign all had higher leakage rates. No bulbs purchased at retailers in Carbondale, Forsyth, Granite City, and Peoria were purchased by non-AIC customers.

Table 22. Leakage Rate by Retailer Location

Utility	Percent
O'Fallon	18%
Alton	13%
Champaign	10%
Decatur	6%
Litchfield	1%
Carbondale	0%
Forsyth	0%
Granite City	0%
Peoria	0%

We do not recommend reducing gross savings or making adjustments to the TRM based on these results. The in-store intercept sample design was not designed to estimate leakage. To accurately estimate leakage, the geographic location of the stores that are included in the sample must be similar to the overall population of stores. To gain entry into stores, we had to make use of a convenience sample and conduct interviews where existing lighting demonstrations were already scheduled or could easily be scheduled. We did not consider the proximity of stores to the AIC borders when selecting stores. We recommend further research in which store location is a criterion for sample inclusion to accurately estimate program leakage.

In-Service Rate

We calculated an updated in-service rate for AIC as part of the in-home lighting study that we conducted in PY4 and PY5. The estimate is based on the number of bulbs we found that were installed, compared to the total number of bulbs we found in the home, which included bulbs installed and in storage.

Seventy-four percent (74%) of homes have bulbs of any type in storage, with an average of 13 bulbs stored.[23] In the average home, incandescents (49%) and CFLs (47%) make up nearly all bulbs in storage. Of the CFLs in storage, nearly all are standard CFLs (95%); few are specialty (5%).

[23] The median number of bulbs in storage is eight.

Out of the total number of incandescent light bulbs in our study, 85% were in use, while the remaining 15% were in storage (see Table 23). The overall in-service rate for CFLs is slightly lower, at 78%. CFL in-service rates vary by bulb type. Specialty CFLs have a higher in-service rate than standard CFLs (88% compared to 76%).

Table 23. In-Service Rates

Bulb Type	In-Service Rate
Incandescent	85%
CFL	78%
–Standard CFL	76%
–Specialty CFL	88%

Based on these results, we recommend a first year installation rate of 76% for standard CFLs and 88% for specialty CFLs. Based on the carryover method outlined in the 2012 Illinois Statewide TRM, we assume that 98% of all bulbs will be installed three years after purchase, with 55% of the remaining bulbs installed in year two and 45% installed in year three. Using these assumptions, see Table 24**.** provides the recommended installation rate over a three-year period for standard and specialty CFLs. Given the high price of LEDs and lack of available data, we recommend a 100% first year installation rate for LEDs until more research can be conducted.

Table 24. Recommended Installation Rates for AIC

Bulb Type	First Year	Second Year	Third Year	Final
Standard CFLs	76%	12%	10%	98%
Specialty CFLs	88%	6%	4%	98%
LEDs (Medium Screw-Based)	100%	--	--	100%

Net-to-Gross Ratio (NTGR)

As part of our in-store customer interviews and in-home lighting study, we conducted research to update the program NTGR to be used in PY6. We used the in-store interviews to estimate program free ridership, and the in-home study to estimate program spillover. We describe the methods used for free ridership and spillover below, and provide results for both.

In addition to in-store customer interviews, the evaluation team also proposed to estimate free ridership using the Revenue Neutral Sales Model (RNSM). We felt the RNSM would have provided a good comparison estimate because some of the weaknesses of intercept approach are strengths of the RNSM. An advantage of the RNSM is that the results are based on all program sales so the results represent the entire program year, all retailers, and can be reported by bulb type. The evaluation team conducted interviews during different days of the week, at the stores that sold the most program bulbs, and across AIC territory. However, due to the high cost of conducting in-store customer interviews, we could only conduct interviews during a relatively small number of days and at a small number of stores compared to all days during PY5 and all program stores. Due to the difficulty of obtaining retailer permission to conduct the interviews, we also had to use a convenience sample of stores, which does not allow the use of sampling theory to estimate standard errors. The evaluation team felt it would have been valuable to compare the results from the customer interviews and RNSM method, and potentially, provide a combined result. ICC staff did not approve the use of the RNSM because it has not been sufficiently established within the evaluation community.

Free Ridership

The AIC Residential Lighting Program encourages customers to purchase energy-efficient lighting by discounting the purchase price so it is closer to that of less-efficient alternatives. The program also educates consumers about the benefits of efficient lighting. The in-store intercept survey was designed to measure the influence of both program components, the discount and the information. For each respondent, the free ridership score ranges from 0 to 1. A score of 0 means the participant would not have purchased any CFLs without the program, while a score of 1 means the participant would have purchased all of the CFLs without the help of the program. The questions and algorithm allow for partial free riders—customers who would have purchased some but not all of the bulbs, or were partially influenced by program information. The development of these separate scores is outlined below, followed by the methodology used to combine them into one overall free ridership estimate.

Program Discount Score

The program discount score is based on questions that measure the impact of the program discount on the quantity and efficiency of light bulbs purchased. In asking about the discount, we ask what customers would have purchased if the CFLs were more expensive, and reference the average per-bulb discount. We ask separate questions for standard and specialty CFLs because the size of the discount and average regular price per bulb is higher for specialty bulbs.

The discount score is comprised of two scores: (1) a quantity score, and (2) an efficiency score. To determine the effect that the discount had on the quantity of bulbs purchased, we first asked customers if they would have purchased all of the bulbs, some of them, or none of them if the CFLs had cost more. Customers who stated that they would have purchased some of the bulbs were asked how many bulbs they would have purchased if they cost more. Using these two questions and the quantity of program CFLs the customer did purchase, we calculated a quantity score that is the proportion of the bulbs that the customer would have purchased at full price. The score ranges from 0 to 1, with 0 being not a free rider and 1 a full free rider. Table 25. further outlines this scoring method.

Table 25. Program Discount Free Ridership Score: Quantity

Question	Response	Program Discount Free Ridership Score
(QH24/29) I see you are buying X standard CFLs that are discounted by Ameren. If the Ameren discount had not been offered, and this/these CFLs had instead cost $1.00/$1.50 more PER BULB, would you still have purchased all of these CFLs, some of them, or none of them?	All	1.0
	Some	Go onto Question 25
	None	0.0
(QH25/30) How many of the CFLs would you have purchased if they had cost $1.00/$1.50 or more per bulb? *(Only for Respondents who answered "Some" to question above)*	Record Number	Divide the proportion of the bulbs the customer would purchase at full price by the total number of discounted bulbs the customer purchased

The efficiency score is designed to give the program additional credit if it prevents the sale of incandescent or halogen bulbs and causes the customer to purchase CFLs instead. Customers who would have purchased some or none of the bulbs could have either purchased fewer CFLs and no other bulb type, or purchased less-efficient bulbs instead of the CFLs. The discount's impact on the number of CFLs purchased is already accounted for by the quantity score. The efficiency score gives the program additional credit for preventing the sale of incandescents. Customers who would have purchased incandescents instead of CFLs are given a score of 0. Customers who would have purchased less-efficient bulbs if the CFLs cost more are given a value of 0. Customers who would have not purchased a less-efficient bulb are given a value of 1. Table 26. further outlines this scoring method.

Table 26. Program Discount Free Ridership Score: Efficiency

Question	Response	Program Discount Free Ridership Score
(QH26,27/QH31,32) If the CFL(s) had cost $1.00/$1.50 more per bulb, would you have purchased a different type of light bulb instead of the CFL(s)?	Yes	Go to QH28 or QH33
	No	1
(QH28/QH33). What type of light bulbs would you have purchased instead of CFLs? Would you have purchased…	Incandescents Halogens	0
	LEDs	1

We calculate an overall program discount score by multiplying the discount quantity score by the discount efficiency score:

Program Discount = Discount Quantity * Discount Efficiency

Program Information Score

To determine the influence of program education and outreach, we asked customers who recalled seeing in-store information or displays on the benefits of CFLs about the influence of these materials on their purchase decision. The question asks customers to rate the program on a 0 to 10 scale where 0 means no influence and 10 means an extreme amount of influence. We convert this scale so it ranges from 0 to 1, and reverse the order so 0 means the program information had extreme influence and 1 means the information had no influence. Customers who did not recall seeing any program information do not have a program information score; their overall free ridership score is based solely on their program discount score. Table 27 details how the program information score is calculated.

Table 27. Program Information Free Ridership Score

Question	Response	Program Information Free Ridership Score
(QH36) Using a scale of 0 to 10 where 0 means not at all influential and 10 means extremely influential, how influential was the in-store information sponsored by Ameren in your decision to buy CFL(s) today?	0 to 10	1 – (Response/10)

Overall Free Ridership Score

The overall free ridership score is the minimum of the program discount score and the program information score. We take the minimum of the two components to ensure that the program receives credit for whichever avenue of program influence mattered most to the customer. Averaging the components would penalize the program if it did not influence both. For example, a customer may already understand the benefits of CFLs, but still would not buy them at full price. Averaging the two components would reduce overall program influence because the customer said the informational materials did not influence the purchase.

Overall Free Ridership Score = Min [(Program Discount Score), (Program Information Score)]

We calculated an overall free ridership score for each customer and for each bulb type the customer purchased. If the customer purchased both standard and specialty bulbs, the customer has two free ridership scores. The overall free ridership score for these customers is a weighted average based on the number of each type of bulb purchased.

We conducted two stages of weighting to calculate the final program free ridership score. We first weighted the sample estimates of standard and specialty free ridership by the number of each type of bulb each customer purchased. This weighting gives more weight to customers who purchased more bulbs.

For the second stage, we weighted the sample results by PY5 program sales to produce an overall free ridership score that represents all bulbs sold through the program. We combined the standard and specialty free ridership scores by calculating a weighted average based on the number of each type of bulb purchased in PY5 based on program sales data.

Free Ridership Results

As we discussed in the methodology section, to gain entry to the stores to conduct the customer interviews, the first day of data collection at each store was done in conjunction with a program lighting demonstration. We conducted interviews for an additional two days at each store when there was no demonstration. Using the method outlined above, the free ridership estimate for all days was 0.53. We compared the free ridership of purchases made during the hours that the demonstration was taking place to other hours and found that the free ridership rate of customers who purchased lighting during the demonstration was 0.50, compared to 0.54 for those who purchased lighting without the demonstration present (see Table 28). Because the intercept interviews make use of a convenience sample, sampling theory based on probability samples does not apply and it is not technically correct to test whether two results are statistically different using sampling theory. However, it is still commonly done with in-store intercepts; in this case, when we conducted a difference of means test, the two free ridership estimates are not statistically different. Due to the small size of the difference, we use the free ridership estimate from interviews conducted during all the hours we were in the store to calculate the program NTGR.[24]

[24] Our free ridership estimate is based on interviews with 150 customers who purchased a total of 893 CFLs, after excluding interviews conducted with non-AIC customers.

Table 28. Program Free Ridership

Day Type	Free Ridership
All Hours[a]	0.53
Demonstration Hours	0.50
Non-Demonstration Hours	0.54

[a] We use this estimate in the calculation of overall lighting program NTGR.

Spillover

We used the results from two in-home lighting audits conducted in AIC customers' homes to estimate potential program spillover. The first study was conducted in 2010, and the second study in 2012. The method involves estimating the number of CFLs in AIC homes in both years, and comparing the growth in CFL usage to the number of CFLs distributed by AIC. Any CFLs in excess of AIC program distribution, either through upstream sales or other programs, are potential spillover.

Our analysis did not find evidence of spillover. This finding does not mean that spillover does not exist. The 2010 study had a smaller sample size than the 2012 study, so the precision of the 2010 estimate was large. It is possible that if we were to conduct a similar study in the future with a larger sample size, we would have enough statistical power to detect spillover. CFLs have also been in the marketplace long enough that some could be burning out, and customers are starting to replace CFLs with CFLs. We recommend conducting future research to explore this possibility.

Net-to-Gross Ratio

Given the lack of spillover, the final program NTGR is calculated as:

$$NTG = 1 - \text{Free Ridership}$$

With a free ridership rate of 0.53, overall program NTGR is 0.47.

Table 29. Residential Lighting Program NTGR

Concept	Ratio
Free Ridership	0.53
NTGR	0.47