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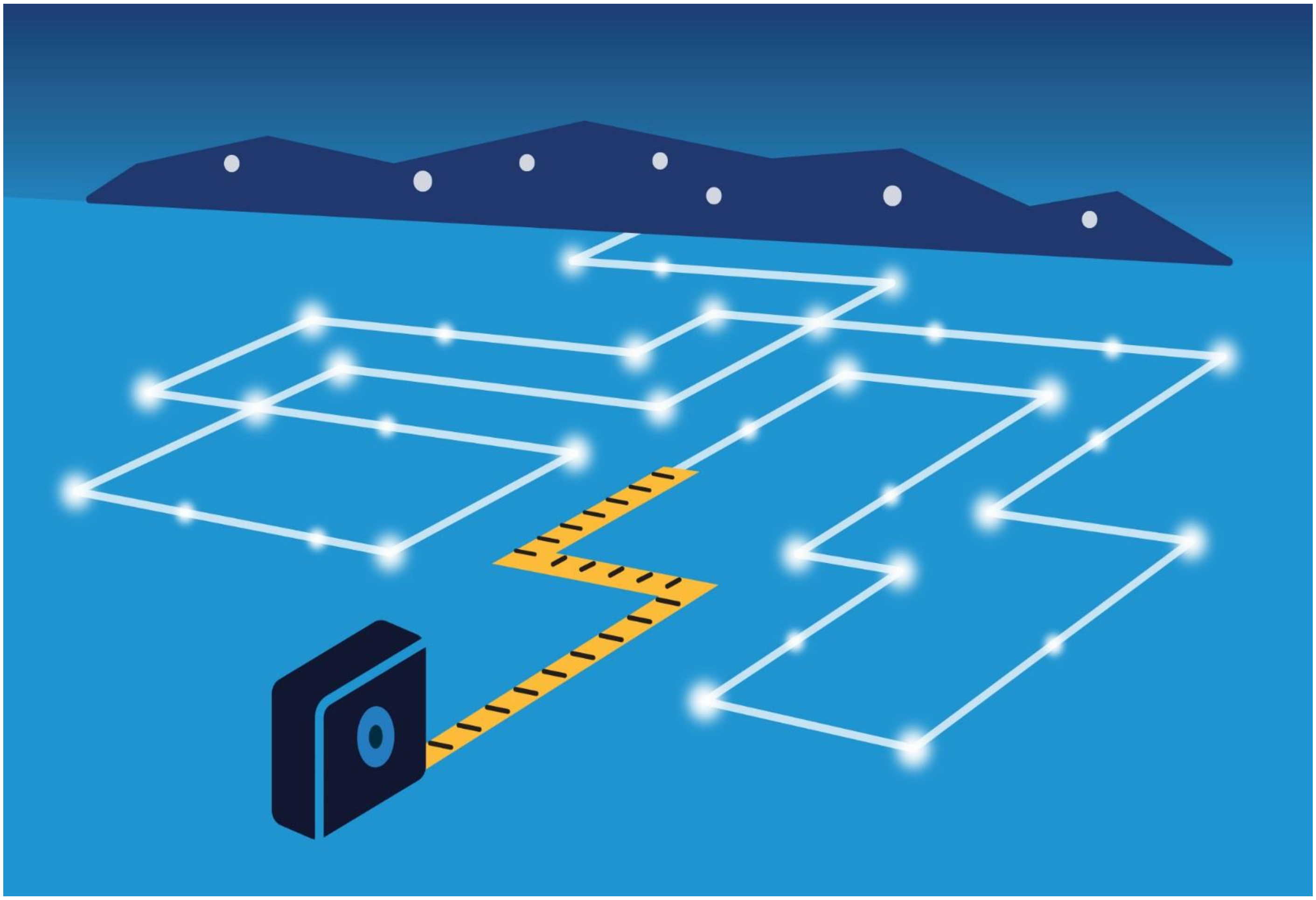

Impact and Process Evaluation of the 2013 (PY6) Ameren Illinois Company Residential Lighting Program

Final

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1. Executive Summary

This report presents the results of Opinion Dynamics' evaluation of Ameren Illinois Company's (AIC's) Residential Lighting Program during its sixth year of operation (program year 6, or PY6), from June 2013 to May 2014. The expected savings from this program represent 20% of AIC's portfolio of electric savings and 0% of portfolio therm savings (including residential and commercial customers).[1]

Launched in August 2008, the program has as its aim the eventual transformation of the residential lighting market in AIC territory. It works to increase residential customers' awareness and use of ENERGY STAR® (ES) lighting products by providing discounts and by undertaking marketing and outreach efforts at participating retailers, community events, and on the AIC website. The discounts offered by the program and its retail and manufacturing partners bring the cost of ES lighting closer to that of less-efficient options. They encourage customers who are reluctant to pay full price for ES lighting to choose energy-efficient over standard lighting. During its six years, the program has discounted 17,051,292 energy efficient light bulbs and fixtures.

The Residential Lighting Program is implemented by Conservation Services Group (CSG) and subcontractors Applied Proactive Technologies (APT) and Energy Federation, Incorporated (EFI). It is part of the 8-103/IPA expansion.

To evaluate the program's performance, we conducted in-depth interviews with program staff, reviewed program data and program materials, interviewed customers who were purchasing lighting at participating retailers, and undertook a stocking study of lighting products at participating retailers. We also conducted an in-home lighting audit, and consumer preferences survey.

1.1 Impact Results

The Residential Lighting Program sold a total of 4,659,601 bulbs in PY6, which is a 65% increase from PY5. 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 (82%), the program sold a greater percentage of specialty CFLs in PY6 (18%) than it did in PY5 (13%).[2] LEDs were not a focus of the program and were only sold through the on-line store. They accounted for less than 1% of program sales. The Web store sold less than 1% of all bulbs sold through the program (see Table 1).

[1] Note that the percentage of expected savings here and through the plan is calculated based on the AIC Filing dated January 20, 2011, which includes non-residential new construction.

[2] Throughout this report, we use the program definition of standard versus specialty CFLs. A standard CFL is a spiral bulb that does not have any special functions. A specialty CFL either has glass covering the spiral, can be dimmed, can function as a 3-way bulb, or has other special functions.

Table 1. Bulb Sales by Type and Sales Channel

Bulb Type	Markdown	Web Store	Total
Standard CFL	3,808,116	323	3,808,439
Specialty CFL	850,195	250	850,445
LEDs	0	717	717
Total	4,658,311	1,290	4,659,601

The carryover savings method outlined in the Illinois Statewide TRM for Energy Efficiency Version 2.0 (June 7, 2013) spreads program savings across the three years customers take to install all of the bulbs they purchase. For evaluation purposes, AIC chose to begin using this method in PY4. As a result, PY6 savings come from bulbs *installed* in PY6 but that could have been *purchased* in PY4, PY5, or PY6. As shown in Table 2, the program achieved a net energy impact of 100,064 MWh and a net demand impact of 12.39 MW.

Table 2. PY6 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	82,621	91,493	8.72	11.32
PY6 Net Savings Realization Rate	1.11		1.30	

Note: Realization Rate = Ex post Value / Ex ante Value.

The Residential Lighting Program's realization rate for PY6 net demand savings is 1.30, and the realization rate for net energy savings is 1.11.

Ex-post savings is different than ex ante savings due to the following methodological reasons:

- The program savings method assumes that 100% of program sales are installed in residential spaces. Our evaluation determined that 4% of bulbs are installed in commercial spaces, which have greater hours of use and different waste heat factors. As a result, ex post gross savings are 11.6% higher than ex ante gross savings for both energy (MWh) and demand (MW).
- The program savings method uses an In-Service-Rate (ISR) of 1.00, which assumes that 100% of bulbs purchased in PY6 are installed in PY6. Our evaluation uses the carryover method outlined in the Statewide TRM Version 2 and assumes a first year ISR value of 0.695 and includes savings from a portion of sales made in PY4 and PY5 but not installed until PY6. For sales of PY6 bulbs, ex post energy savings (MWh) are 29.2% lower and ex post demand savings (MW) are 4.2% lower than ex ante energy and demand savings as a result of the first year ISR. For sales of PY4 and PY5 bulbs installed in PY6, ex post energy savings (MWh) are 25.1% higher and ex post demand savings (MW) are 28.9%. Combined, ex post gross energy savings (MWh) are 4.1% lower and ex post gross demand savings (MW) are 24.7% higher than ex ante gross savings due to the application of the carry over savings method.
- The program savings method uses different hours of use (HOU) than the Statewide TRM Version 2 recommends. Our evaluation uses the HOU provided in the Statewide TRM Version 2, which are higher for standard bulb types and, in most cases, lower for specialty bulb types. As a result, ex post gross energy savings (MWh) are 14.3% higher than ex ante gross savings.

- The program savings method uses lumens to determine base wattages, but used a different conversion than that provided in the Statewide TRM Version 2. Some program base wattages were too high and some too low so that across all sales the impact was small. In addition, our audit of lumen values identified incorrect values for two products, resulting in different base wattages for less than 0.01% of bulbs sold. Combined, ex post gross savings are 1.1% higher than ex ante gross savings for both energy (MWh) and demand (MW).
- The program savings method does not use waste heat factors in the ex ante savings calculations. The evaluation team applied the waste heat factors recommended in the Statewide TRM Version 2 to calculate ex post energy and demand savings. As a result, ex post gross energy savings (MWh) are 6.2% higher and ex post gross demand savings (MW) 11.5% higher than ex ante gross savings.
- The program savings method uses different summer peak coincidence factors than the Statewide TRM Version 2 recommends. Our evaluation team applied the TRM-recommended values to the evaluated demand savings. As a result, ex post gross demand savings (MW) are 23.2% higher than ex ante gross savings.
- The program used a net-to-gross ration (NTGR) of 0.44 to estimate net saving whereas the evaluation team used the PY5 net-to-gross ratio (NTGR) of 0.47 to estimate net ex-post savings. Both values are from the PY5 Lighting Impacts evaluation. The lower value was from a draft early results memo, which the the evaluation team revised slightly for the final report after applying weights based on final PY5 sales data.
- The program savings methods does not account for bulbs sold to non-AIC customers. We applied an overall leakage rate of 11%, which accounts for AIC-discounted bulbs sold to non-AIC customers as well as bulbs discounted by other utilities but purchased by AIC customers. As a result, ex post gross energy (MWh) and demand (MW) savings are 11% lower than ex ante savings.

1.2 Process Results

The Residential Lighting Program ran smoothly in PY6. The program met its goals in terms of bulbs sold and exceeded the sales of any previous program year, and PY5 in particular by 65%. A program objective was to increase sales of specialty CFLs. To meet this goal, program administrators increased the incentive on specialty CFLs and saw the sale of specialty CFLs increase from 13% of all bulb sales in PY5 to 18% in PY6.

In PY6, a key marketing tactic used by the Residential Lighting Program was 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 seven of the eight participating stores we visited and found additional AIC materials describing the benefits of CFLs at seven of the stores.

The program employs seven field representatives who are assigned responsibility for specific stores across AIC territory. Field representatives visit participating retailers on a regular basis to ensure that products and promotional materials are displayed properly and provide retailer training. Field representatives also held 147 in-store lighting demonstrations to promote the program and educate customers about CFLs. 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, 73% of customers who purchased bulbs purchased CFLs compared to 56% of customers when an event was not present.

We conducted a number of research studies to gain information on the state of the lighting market in AIC territory. Combined, these studies show that customer use of standard CFLs is increasing. However, despite the increase in sales of program-discounted specialty CFLs in PY6, significant barriers remain to CFL use for specialty lighting needs. The following paragraphs provide key findings from these studies.

EISA is having an impact on stocking practices with fewer stores carrying 100 and 75-watt standard incandescent bulbs. Energy-efficient bulb types—CFLs and LEDs—comprised a majority of the lighting products on retailers' shelves, but we found large differences in product availability by lumen output. While energy-efficient bulbs make up the majority of bulbs stocked, incandescent bulbs are still available across lower lumen ranges. At the eight participating retailers where we performed inventories, no 100- or 75-watt equivalent standard incandescents were available, but incandescents still made up 13% of 60-watt equivalent products and 32% of 40-watt equivalent products stocked. We found 100 and 75-watt incandescents at 22% of the 139 retailers we called as part of the mystery shopper survey, but we believe this may be an overestimate due the similarity in appearance of incandescents and EISA-compliant halogens.

The stocking of specialty bulbs, which is not impacted by EISA, is different than that of standard products. Incandescents and halogens comprised a slight majority (51%) of specialty products stocked in stores. Incandescents were the most common specialty product making up over one-third (35%) of the products on retailers' shelves and CFLs were next most common comprising over a quarter (28%) of the products.

Across all retailers where we conducted customer interviews, almost two-thirds of customers purchased at least one energy efficient bulb (64%). Approximately half of customers purchased program-discounted CFLs (56%) while a very small percentage (3%) purchased CFLs that were not discounted by the AIC program. LEDs do not yet have a large market share; only 5% of customers purchased LEDs. A sizable percentage of customers still purchased a less efficient bulb—either incandescents (29%) or EISA compliant halogens (12%).

The type of bulbs purchased varies depending on whether the customer is purchasing a standard versus specialty bulb. When purchasing a specialty bulb, nearly two-thirds of customers purchased incandescents or halogens (65%) compared to one-quarter of customers when purchasing standard bulbs (25%).

Some retailers only stock CFLs and LEDs. If we exclude those retailers from the analysis, we find that a sizable percentage of bulbs purchased were less efficient products, even in the presence of program discounts. Thirty-nine percent of standard bulbs purchased were a less efficient bulb while 70% of specialty bulbs purchased were less efficient.

Results from our in-home lighting audit confirm these findings. Overall CFL saturation increased from 33% in 2012 to 38% in 2014. This increase is due entirely to an increase in CFL saturation in standard light sockets. CFL saturation in standard sockets increased from 40% in 2012 to 49% in 2014 but remained essentially the same in specialty sockets (18% in 2012 compared 16% in 2014 – a change that is not statistically significant).

The consumer preference study provides further evidence that AIC customers are willing to purchase standard CFLs at wide range of price points but not specialty CFLs. Even at higher price points, customers prefer standard CFLs to incandescents, halogens, and LEDs. LEDs are not a substitute for standard CFLs at current market prices for LEDs. Even at less than $3 a bulb for an LED, customers prefer CFLs.

The results are quite different for specialty CFLs. Customers are only willing to purchase specialty CFLs at low price points. Customers are far more discriminating when it comes to specialty bulb purchases and prefer less efficient technologies. However, specialty LEDs may be an effective substitute. Our results show that as the price for specialty LEDs decreases, the market share of specialty CFLs steadily declines while the share for halogens and incandescents remains relatively flat.

We looked closely at the consumer preferences of customers with below median CFL saturation to better understand what the program could do to encourage these customers to purchase more efficient lighting. These customers tend to be older and have a higher percentage of specialty sockets in their homes. We found that lower prices on CFLs are unlikely to cause them to purchase CFLs, but they are not averse to efficient lighting. Reduced pricing on LEDs, particularly specialty products, could increase the efficiency of lighting in their homes.

1.3 Recommendations

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

- **For standard bulbs, keep incenting standard CFLs and do not make the switch to standard LEDs.** AIC Customers are satisfied with standard CFLs and most are not willing to switch to LEDs unless prices drop much lower than current market prices. The program would need to discount standard LEDs heavily to encourage customers to purchase the bulbs at the rates they purchase standard CFLs. At this discount level, the program is not likely to be cost-effective.
- **Keep incentives for standard CFLs at their current level.** Incentives for CFLs are still important. Because AIC customers purchase incandescents and halogens at higher rates when they are stocked alongside program-discounted CFLs, removing incentives from standard CFLs would likely cause many customers to switch to a less efficient product. Without discounts, our stocking study showed that CFLs cost more than EISA-compliant halogens. Because incandescents are still available in the most commonly purchased wattage (i.e. 60 watts), it is too soon to say if customers will purchase CFLs if they cost more than halogens when incandescents are no longer available.
- **For specialty bulbs, consider switching incentives from CFLs to LEDs.** Our research shows that specialty CFLs are a hard sell but LEDs are a viable alternative. Between the drop in market prices and the longer life of LEDs, specialty LEDs could be a cost-effective alternative to specialty CFLs. Our consumer preference study showed that more consumers prefer LEDs to CFLs when LED prices reach $10 a bulb. Our in-store stocking study found that the average price for specialty LEDs was much higher than $10, but this price was across a range of bulb types. There may be some LED types, such as reflectors, that are more common and have lower market prices. Prices are also dropping rapidly. AIC could continue to provide increased incentives for specialty CFLs as well as increased education on the specialty CFL options available and sales would likely continue at the PY6 improved rate. Yet there is a risk that customers who purchase these bulbs will be dissatisfied and resist future purchases of efficient specialty bulbs, including LEDs. If market pricing allows, our research suggests that the program would benefit by switching these incentives to specialty LEDs.
- **Consider some changes to participating store selection to reduce program leakage.** The evaluation found that 15% of program-discounted bulbs are being purchased by non-AIC customers. Much of AIC's leakage is due to customers of municipal utilities purchasing AIC-discounted bulbs. Given the location of these utilities, this problem could be challenging to address. We recommend conducting additional research with more rigorous methods in PY8 to confirm the leakage rate found in PY6. This research will also identify the store locations that have the greatest impact on leakage so that program administrators can consider whether they should continue to keep these locations in the program.
- **Use the methods outlined in the approved Statewide TRM to calculate program savings.** Program administrators improved the program tracking systems between PY5 and PY6 and began tracking all of the necessary information to calculate savings using the method outlined in the Statewide TRM Version 2. However, the program did not follow the method outlined in the TRM and used different

savings assumptions. Using the methods outlined in the TRM approved for the program year will aid in program tracking and routine reporting.

2. Introduction

2.1 Program Description

The Residential Lighting Program aims to transform the residential lighting market in AIC territory by increasing customers' awareness and use of ENERGY STAR (ES) lighting. The program employs marketing and outreach efforts at participating retailers and community events and on the AIC website. It also 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. These 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 throughout the AIC territory. Discounted standard and specialty CFLs can also be purchased on the AIC website, which, beginning in PY6, also sells two types of LEDs.

Launched in August 2008, the program is implemented by the Conservation Services Group (CSG) and its subcontractors Applied Proactive Technologies (APT) and Energy Federation, Incorporated (EFI). During the program's six years of operation, it has discounted 17,051,292 energy-efficient light bulbs and fixtures. This evaluation reviews the program's performance in PY6, which began in June 2013 and ended in May 2014.

2.2 Research Objectives

The results of our PY4 and PY5 evaluations indicate the market for residential lighting products is changing. CFL penetration and saturation have increased in AIC territory over the past few years, and more consumers are aware of the variety of technologies available to meet their lighting needs. The implementation of the Energy Independence Security Act (EISA) is also beginning to change the marketplace. Fewer retailers' stock 100- and 75-watt incandescent light bulbs, but many are selling EISA-compliant halogens in their place. LEDs, another new technology, have come down considerably in price and are available in a greater number of wattages and bulb styles.

Our PY5 in-store interviews found many customers who were still purchasing less-efficient bulbs rather than CFLs or LEDs. Just over half of all customers we interviewed (53%) purchased a less-efficient (incandescent or halogen) bulb despite the availability of discounted CFLs at the retailer. We found that lack of awareness of efficient bulb options, light quality, and price were barriers to purchases of efficient bulbs.

Almost more than any other type of program, the Residential Lighting Program benefits from a thorough understanding of the market. We consider a market to be an economic system that brings together the forces of supply and demand for a particular good or service. A market consists of customers, suppliers, channels of distribution, and transactions.[3] The research tasks we conducted for the PY6 evaluation build on those we conducted in PY4 and PY5. Our central objectives were to assess the performance of the Residential Lighting Program, the current state of the lighting market in AIC territory, and the impact of the program on that market, as well as to provide information to help the program determine where future efforts will have the most impact.

Below we describe the details and logic behind our PY6 evaluation tasks. We designed the tasks to answer the following impact-related research questions:

[3] Partially taken from Barron's Business Guides. Dictionary of Marketing Terms. Third Edition.

1. What are the estimated program gross energy and demand savings?
2. What are the estimated program net energy and demand savings?
3. What is the estimated impact of the program on CFL purchases? How many customers would have purchased less-efficient bulbs if the program had not discounted CFLs?
4. What is potential spillover from the program? How many CFLs have been added to the market since 2012, compared to the number of CFLs discounted by the program?

We also examined the following process-related research questions:

1. Did the program change its design in PY6? If so, how, why, and were those changes advantageous?
2. Was program implementation effective and smooth?
3. Are customers satisfied with the program, the products, and the process for participation?
4. What is the format of customer outreach? How often does the outreach occur?
5. In what areas could the program improve to increase its overall effectiveness? What could the program do to help customers understand energy-efficient lighting options and how to save more energy?

A larger portion of our evaluation research focused on the different parts of the residential lighting market and addressed the following questions:

1. What screw-in lighting products are available for AIC customers to purchase? How has this changed over time? What impact is EISA having on the availability of less-efficient lighting products (i.e., incandescent and EISA-compliant halogen bulbs)?
2. What has been the program's impact on the residential lighting market in terms of CFL penetration and saturation? How has CFL use changed since 2012, when we last conducted a lighting audit for AIC?
3. What is the penetration and saturation by bulb type and room type? Is the program causing more customers to consider efficient light bulbs for every light socket in their homes, including specialty sockets? Does efficient lighting saturation lag behind for some uses compared to others?
4. What is the profile of AIC customers whose homes have high CFL saturation rates compared to those whose homes do not? Has that profile changed in the past few years? Is the program reaching new users of energy-efficient lighting products?
5. What are the barriers to purchasing efficient lighting? What factors are most important to customers when they purchase light bulbs? How can the program market efficient lighting to address the barriers? Are customers aware of EISA? What is the likely impact of EISA on future lighting purchases?

3. Evaluation Methods

Table 3 summarizes the evaluation tasks that we conducted for PY6.

Table 3. Summary of AIC Residential Lighting Evaluation Activities for PY6

Activity	PY6 Impact	PY6 Process	Forward Looking	Details
Program Data Review	X			Verified program-reported savings
Program Materials Review		X		Reviewed program implementation plan and marketing and outreach materials.
In-Store Customer Intercept Interviews	X	X	X	Interviewed 1,001 customers at 24 participating retail stores. Asked questions used to estimate program free ridership, residential versus commercial usage of program lighting, and leakage rate. Also used the interviews to assess barriers to ES lighting purchases and program processes.
Lighting Shelf Stocking Study	X	X		Conducted a stocking study of lighting products on shelves at 8 participating retail stores to gain information on the availability and pricing of ES lighting and less-efficient products, including the continued presence of EISA-regulated incandescent bulbs. Also collected information on the presence and type of marketing materials in stores.
Mystery Shopper Survey	X	X		Interviewed 139 participating and non-participating retailers to assess the availability of standard incandescent light bulbs in stores.
In-Home Lighting Study	X	X	X	Completed 225 lighting audits. Collected information on the quantity and type of lighting in use and in storage in customer's homes.
Consumer Preference Survey		X		Conducted a conjoint survey with 223 in-home audit participants. Used the results of the survey to assess customer preferences for different lighting features and to predict future lighting purchase behavior.

3.1 Data Collection

The following activities informed the PY6 evaluation of the Residential Lighting Program.

3.1.1 Review of Program Materials and Data

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

3.1.2 In-Store Customer Intercept Interviews

Opinion Dynamics interviewed 1,001 customers purchasing lighting at 24 participating retail locations between March and May 2014. The interviews took place at do-it-yourself (DIY), warehouse, and big box stores.[4] We had to use a convenience sample of stores for budgetary reasons and because not all retailers allow in-store customer research. Selection of which customers to interview was also not random. Despite these constraints, we selected a sample of stores that represented a large percentage of program sales and customers across AIC territory.

To gain access to the stores, we accompanied the program field representative who was conducting a lighting demonstration. The program representative helped the interviewer obtain permission to return and conduct additional interviews on the following two days. We conducted approximately one-fifth (18%) of all interviews while a lighting demonstration was taking place. Because such demonstrations alter the shopping environment and purchases made then may not be typical of most customer purchases throughout the year, we report the results separately for demonstration and non-demonstration hours, where appropriate.

Table 4 shows, by retailer type, the number of locations, days spent at each site, and the total number of interviews completed. We selected stores throughout AIC territory that had the most program sales and a demonstration day already scheduled or where one could be conducted.[5] The 24 stores chosen sold 27% of all program bulbs sold at participating retailers during PY6.[6] We weighted the sample results by PY6 program sales so the results represent all bulbs sold through the program.

Table 4. In-Store Interview Retailer Categories

Retailer Type	Stores	Days	Interviews
Do-It-Yourself	11	33	471
Warehouse	4	12	236
Big Box	9	27	294
Total	**24**	**72**	**1,001**

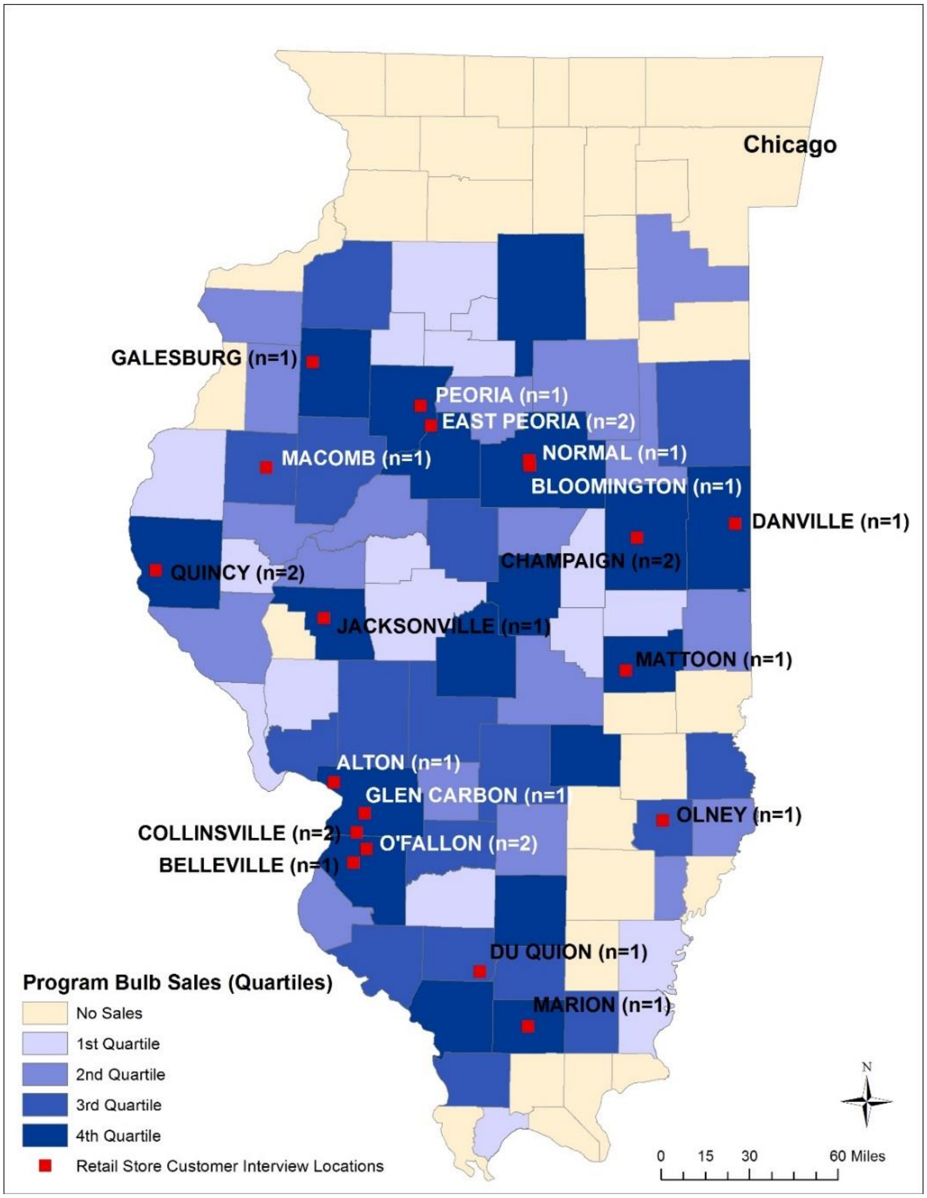
Figure 1 shows our intercept locations and the number of bulbs sold in each county in AIC territory. Our sample stores are located in counties where the most program bulbs were sold.

[4] These three retailer types sold 84% of all program-discounted bulbs during PY6.

[5] We used partial-year program sales data to select the retail locations.

[6] If we look just at the sales made at do-it-yourself, warehouse, and big box retailers, the 24 stores where we conducted intercepts sold 32% of the program bulbs sold at those three retailer types during PY6.

Figure 1. In-Store Customer Interview Locations



One of the study's objectives was to estimate the percentage of program-discounted bulbs sold to non-AIC customers, so location was an important factor in selecting stores to include in our study. We considered the stores' location relative to the border of AIC territory and attempted to select stores whose location was representative of the locations of the population of participating stores.[7] Table 5 compares the locations of the 24 stores where we conducted intercepts with all participating stores. Because we had to consider multiple factors when selecting stores, the locations of those in the final sample are somewhat different from those of

[7] AIC has a number of municipal utilities scattered throughout its territory. Our store selection process considered the location of stores relative to these municipal utilities as well as larger utilities with longer borders such as ComEd and Ameren Missouri.

the overall population. To account for this difference, we applied a location-based weight to our survey results when estimating leakage.

Table 5. Retailer Locations

Distance from AIC Territory Boundary	Intercept Stores		All Participating Retailers	
	Stores	Percent	Stores	Percent
<1 mile	1	4%	34	5%
1-3 miles	5	21%	146	21%
3-5 miles	6	25%	108	15%
5-10 miles	6	25%	234	33%
10-15 miles	5	21%	99	14%
15-20 miles	0	0%	64	9%
>20 miles	1	4%	25	4%
Total	24	100%	710	100%

So that our results reflected a wide range of customers, we conducted interviews on Fridays, Saturdays, Sundays, and Mondays between 9 a.m. and 5 p.m.[8] We attempted to interview all customers purchasing lighting, including CFLs discounted through the program, CFLs that were not discounted, and incandescent, halogen, and LED light bulbs.

We instructed the field interviewers to station themselves in the store's lighting aisle and approach customers after they had made their purchase decision and were preparing to leave the aisle. The interviewers asked customers to complete a short survey in exchange for a $10 gift card to that particular retail store, which they could use that day. Interviewers asked predetermined questions and entered customers' answers into an electronic tablet. Only questions pertaining to the types of bulbs a customer was purchasing were asked. Appendix F contains a copy of the intercept survey instrument.

3.1.3 Lighting Shelf Stocking Study

We conducted a lighting shelf stocking study at eight of the 24 stores where we interviewed customers. We conducted interviews at four different retailers and conducted shelf surveys at two locations per retailer. We also conducted a mystery shopper survey that collected some of the same information (described below). So that we could compare the results of the two studies, we conducted them at the same eight stores. We selected the eight stores whose field dates for the shelf stocking studies would be closest to the dates when

8 Because travel and overnight stays were required for most locations, we chose to conduct interviews for three days at each store, two weekend days and one weekday. This strategy also gave us two days to complete additional interviews when a lighting demonstration was not conducted. We completed fewer interviews on weekdays; however, being in a store on a weekday did allow us to interview more commercial customers than if we had conducted interviews on weekends only, which was necessary to estimate the percentage of program bulbs installed in commercial locations.

we conducted the mystery shopper study. The mystery shopper survey was fielded for a shorter length of time than the in-store customer intercepts.

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 F contains a copy of the shelf stocking instrument.

3.1.4 Mystery Shopper Study

We conducted a mystery shopper telephone survey to assess the availability of 100- and 75-watt incandescent light bulbs in AIC territory across a wider range of stores. Posing as a customer, we called 139 stores (69 stores participating in the program and 70 that were not) and asked whether they stocked 100- or 75-watt incandescent bulbs.

Ideally, our sample of retailers for this study would be representative of all retailers where AIC customers purchase light bulbs and each retailer would be represented in proportion to its light bulb sales. Although we did not have sales data for all light bulbs, we did have data on sales of program bulbs by participating retailers, which should be a good indicator of bulb sales in general given the large number of retailers that participate in the program. We used mid-year program sales to select participating retailers and retail locations. We included the 21 top-selling retailers participating in the program, with the number of stores proportionate to program sales.[9] We called the top-selling locations for each retailer.

For the sample of non-participating stores, we identified major retailers in AIC territory that sold light bulbs but did not participate in the program during PY6. Because we did not have sales data for non-participating stores, we used the sales data for participating retailers to determine the number of stores to include for each non-participating retailer type. For retailer types that sold more bulbs through the program or that had a large number of locations, we selected more stores to include in our sample. We classified each non-participating retailer by type and randomly selected stores for each retailer. Finally, we constructed a weight to use in the analysis of the survey results. We calculated the average sales for each store type using program sales data and used these averages to construct a weight for each non-participating retailer.

We present the survey results for participating and non-participating retailers separately as well as combined. We did not attempt to weight the combined results to reflect the relative contribution of participating and non-participating retailers to the overall sales of light bulbs in AIC territory. We do not have the necessary sales data and felt that any weight we could create might bias the results. Therefore, the combined results should be used with caution.

Appendix F contains a copy of the mystery shopper survey instrument.

3.1.5 In-Home Lighting Study

The evaluation team conducted in-home audits of the lighting installed and stored in 225 AIC customers' homes. We drew a stratified simple random sample from the AIC residential customer database in which we grouped customers into eight geographic regions. The regional grouping made conducting the study easier from a logistical standpoint and ensures that the study participants were representative of the entire AIC

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[9] The program had 24 participating retailers. We chose to exclude three because their sales were less than 1% of all program sales.

service territory. The number of target visits in each region was proportionate to the region's share of the AIC customer population so that sample weights were unnecessary.

For each of the eight regions, we drew a simple random sample of twice as many customers as we needed to complete the target number of visits. We over-recruited because, when customers are called back a few days after initially agreeing to participate, approximately half typically agree to the site visit. For this study, we recruited 430 customers for visits and eventually completed 225 audits.[10] The number of interviews completed by region was proportionate to each region's share of the overall AIC population. The target sample was sufficient to ensure 90% confidence and 10% precision for estimates of CFL penetration and saturation. We recruited audit participants via telephone in June and completed the visits in June and July 2014.

We calculated the survey response rate for in-home recruitment survey using the standards and formulas set forth by the American Association for Public Opinion Research (AAPOR).[11] We chose to use AAPOR Response Rate 3 (RR3), which includes an estimate of eligibility for these unknown sample units (e). The formulas used to calculate RR3 are presented below. The definitions of the letters used in the formulas are displayed in Table 6.

RR3 = I / ((I + P) + (R+NC+O) + e(UH)

We also calculated a cooperation rate, which is the number of completed interviews divided by the total number of eligible sample units actually contacted. In essence, the cooperation rate gives the percentage of participants who completed an interview out of all of the participants with whom we actually spoke. We used AAPOR Cooperation Rate 1 (COOP1), which is calculated as:

COOP1 = I / ((I + P)+R))

[10] The evaluation team compared the observable characteristics of those that received an in-home audit to those that were recruited but ultimately did not participate in the study. We found no statistically significant differences between these two groups across a number of observable characteristics, including household type, house size, the total number of rooms, the total number of household members, the proportion of retirees, education levels, and household income.

[11] *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, AAPOR, 2011. http://www.aapor.org/AAPORKentico/AAPOR_Main/media/MainSiteFiles/StandardDefinitions2011_1.pdf

Table 6. In-Home Audit Recruiter Call Disposition

Disposition	n
Completed Interviews (I)	**457**
Eligible Non-Interviews	6,341
Partial interviews (P)	6
Refusals (R)	2,343
Break off (R)	73
Respondent never available (NC)	3,901
Language Problem (O)	24
Not Eligible	**2,524**
Fax/Data Line	63
Non-Working	1,744
Wrong Number	159
Business/Government	246
No Eligible Respondent	285
Duplicate Number	9
Unknown Eligibility Non-Interview (UH)	**5,413**
Not dialed/worked	1,766
No Answer/Answering Machine	3,562
Busy	65
Call Blocking	20
Total Customers in Sample	17,342
Response Rate (RR3)	**4.5%**
Cooperation Rate (COOP1)	**15.9%**

During each home visit, the auditor recorded the quantity and type of lighting installed in each room inside the home and in the exterior garage. The auditor also recorded lighting found in storage but not in use. Upon completion of the audit, customers received a $50 American Express gift card for their time.

The evaluation team conducted similar studies in 2010 and 2012, and we make comparisons to these studies where appropriate.

3.1.6 Consumer Preferences Study

In addition to tracking the number, type, and location of residential lighting products installed in homes, the evaluation team asked in-home study participants to complete a short survey addressing past and future lighting purchasing behaviors and their awareness of lighting market-related factors such as EISA. We used a conjoint survey to assess consumer preferences for standard and specialty bulbs.[12] Respondents were asked to choose between different hypothetical product options, which required them to make tradeoffs between price and non-price attributes. By having respondents assess the attributes of different products simultaneously in a process that mimics the actual shopping experience, conjoint surveys provide insights into how consumers make decisions. In this way, researchers can examine the relative importance of different product attributes by observing how consumers make choices, rather than ask them directly what factors are most important for their purchasing decision. This approach helps avoid potential social desirability bias or respondents saying that every attribute is important. Moreover, it allows for a more reliable calculation of relative importance for each product attribute since respondents must compare products side-by-side.

In total, 223 of the 225 audit study participants completed the conjoint survey. Since we administered the conjoint survey to all in-home audit participants, the sample strategy and design are identical to those of the in-home lighting study.

The in-home lighting study we conducted in PY4 suggested that consumers use different considerations when purchasing standard versus specialty bulbs. To help understand the decision making process for these two different bulb types, we used two versions of the conjoint survey. In one version, we showed respondents a picture of a desk lamp and asked them what replacement bulb they would purchase for this fixture. For the specialty bulb survey, we showed respondents a picture of a recessed can and asked them to select a replacement bulb for this fixture. By having separate surveys for standard and specialty bulbs, we were able assess whether the relative importance of product attributes varies by socket type. In the section below, we provide details of the design of each version of our conjoint survey.

For the standard bulb survey, we presented respondents with a “choice set” of four bulbs: an incandescent, a halogen, a CFL, and an LED. We varied the product attributes 10 times and asked respondents what they would purchase each time. With the exception of incandescents,[13] we varied the features of each type of light bulb across five different dimensions or attributes: purchase price,[14] estimated yearly energy cost,[15] bulb life,[16] turn-on functionality, and light color. Each attribute took on a range of values. In other words, the product profiles for CFL, LED, and Halogen bulbs presented to respondents varied on all five of the attributes listed above. Table 7 displays the product attributes and their associated “levels” for standard bulbs. We randomly assigned a level for each of the attributes for CFLs, LEDs, and halogens, while the incandescent option is fixed at the levels specified in the table.[17]

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[12] The median length of the consumer preferences survey was 11 minutes.

[13] It is important to note that we held the attribute levels constant for incandescents. We did so in order to assess customer conversion to more efficient lighting technology relative to the typical incandescents they are most accustomed to using and that are still available in many stores.

[14] The range of price levels derive from a lighting shelf-survey that we had already completed for the PY6 evaluation. This helps to provide an accurate depiction of typical prices for light bulbs in Ameren territory.

[15] The range of values for yearly energy cost are taken from the 2014 Illinois TRM Version 3.0.

[16] The range of values for bulb life are taken from the 2014 Illinois TRM Version 3.0.

[17] By randomizing the attribute levels, our experimental design can produce product profiles that are less realistic (i.e. a CFL that costs $13). However, the evaluation team chose not to prohibit product pairs that are less realistic since losses to statistical efficiency would significantly decrease the validity of our models. Given the small sample size of this study, significantly deviating from an orthogonal design (i.e. truly random) would greatly reduce the precision of model point estimates. In future studies, with larger sample sizes, the evaluation team can prohibit the creation of unrealistic product profiles.

Table 7. Product Attributes and Levels for Standard Bulb Survey

Attributes	Randomized Products	Fixed Product
Bulb Technology	CFL, LED, Halogen	Incandescent
Price	$1.50, $2.00, $2.50, $10, $13	$0.75
Estimated Yearly Energy Cost	$1.75, $2.50, $6.50, $7	$10
Bulb Life	1 year, 3 years, 5 years, 10 years, 20 years	1 year
Turn On	Dim at first; Full brightness	Full brightness
Light Color	Warm White, Cool White, Natural light	Warm white

The design of the specialty bulb survey mirrors that of the standard bulb survey with one major exception. In the survey instructions for the specialty bulb survey, we asked respondents what bulb they would purchase for a specialty socket and provided a picture of a recessed can. We administered this specialty bulb survey only to respondents that had a recessed can light socket in their home. We did this to set up a more realistic decision-making environment for respondents (i.e., asking about lighting products they have in their home) and so improve our ability to generalize our findings beyond the sample.

Similar to the standard bulb survey, we presented respondents with a choice of four different reflector bulbs: an incandescent, a halogen, a CFL, and an LED. We varied the product attributes 10 times and asked respondents what they would purchase each time. Table 8 lists each of the product attributes and their associated levels for the specialty bulb survey.

Table 8. Product Attributes and Levels for Specialty Bulb Survey

Attributes	Randomized Products	Fixed Product
Bulb Technology	CFL, LED, Halogen	Incandescent
Price	$5.00, $6.50, $8.50, $10, $20	$4.00
Estimated Yearly Energy Cost	$1.75, $2.50, $3, $7.50	$11
Bulb Life	1 year, 3 years, 5 years, 10 years, 20 years	1 year
Turn On	Dim at first; Full brightness	Full brightness
Light Color	Warm White, Cool White, Natural light	Warm white

Appendix E contains the actual conjoint surveys that we administered along with screen shot examples.

3.2 Analytical Methods

3.2.1 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 in the Illinois Statewide TRM Version 2.0.

This section first presents the savings algorithm and formulas for calculating ex post evaluated bulb savings. We then highlight the savings inputs (such as base wattage, in-service rate, hours of use, and coincidence factors) used in our calculations.

Electric Savings

As noted above, to calculate program electric savings, we applied the savings algorithm in the Statewide TRM Version 2. The TRM outlines a carryover savings method to account for bulbs that are purchased and stored for later use. The method assumes that 2% of program CFLs will never be installed, but the remaining 98% will be installed over three years. Because AIC began using the carryover method in PY3, PY6 savings will include savings from sales made in PY6, PY5, and PY4:

$$\text{Realized PY6 Gross kWh Savings } = \Delta \text{ kWh} \times (\text{Units Purchased PY6}|\text{Installed in PY6} + \text{Units Purchased PY5}|\text{Installed in PY6} + \text{Units Purchased PY4}|\text{Installed in PY6})$$ [18]

First-year installation rates vary by bulb type, with lower installation rates for standard CFLs compared to specialty CFLs (see Table 9). For LEDs, we use the first-year installation rate for LED downlights of 95% because it is the only installation rate for LEDs provided in the Statewide TRM Version 2. Given the high cost of these bulbs, we assume that customers will eventually install all LED bulbs. We also assumed the 5% of LEDs not installed in the first year would be installed in the second and third years based on the same installation criteria as CFLs.

Table 9. Residential CFL Installation Rates

Bulb Type	First Year	Second Year	Third Year	Final
Standard CFLs	69.5%	15.4%	13.1%	98.0%
Specialty CFLs	79.5%	10.0%	8.5%	98.0%
LEDs (Medium Screw-Based)	95.0%	2.8%*	2.3%*	100.0%

*LED Second and Third Year ISR values are not listed in the Statewide TRM Version 2, so we used the same assumptions for LEDs as for CFLs. Thus, 55% of the remaining bulbs will be installed in the second year and 45% of the remaining bulbs will be installed in the third year.

The savings assumptions in the Statewide TRM Version 2 vary depending on the customer and bulb type purchased. Based on our in-store customer intercept interviews, the evaluation team determined that 4% of program-discounted bulbs are installed in commercial spaces, which have greater hours of use and different waste heat factors (see Appendix B for more details on this intercept study result). To estimate energy savings, the evaluation team weighted the savings by the number of bulbs installed in residential homes and commercial spaces.

Due to the upstream nature of the program, AIC cannot limit the sales of program-discounted bulbs to AIC customers. At the same time, AIC customers can go to retailers in neighboring jurisdictions and purchase utility-discounted bulbs. Through our in-store customer research, the evaluation team estimated that 15% of AIC-discounted bulbs were sold to non-AIC customers. Through secondary research, we estimated that AIC purchased and installed the equivalent 4% of AIC PY6 sales from other utility programs in Illinois, Indiana, and

[18] Because of EISA, the evaluation team adjusted the baseline savings for standard CFLs purchased in PY4 and PY5 but installed in PY6. The baseline changes include reducing 100 watts to 72 watts and 75 watts to 53 watts.

Missouri We recommended an overall leakage rate that combines leakage out as well as leakage in. Based on our estimates of both factors, we applied an overall leakage rate of 11% to gross savings. Appendix C contains additional details about the methods we used to estimate leakage.

To calculate weighted program electric savings, we applied both the residential and commercial savings algorithms outlined in the Statewide TRM Version 2:

$$Year\ 1\ \Delta\ kWh = 0.11 \times\ 0.96 \times \left[\frac{(Base\ Watt_{2013} - Bulb\ Watt)}{1000} \times ISR_{res,yr1} \times HOU_{res} \times WHFe_{res}\right]$$

$$+ 0.11 \times 0.04 \times \left[\frac{(Base\ Watt_{2013} - Bulb\ Watt)}{1000} \times ISR_{com,yr1} \times HOU_{com} \times WHFe_{com}\right]$$

Where:

Base Watt = EISA complaint base wattage in 2013
Bulb Watt = Actual wattage of installed CFL bulb
ISR = First year In-Service Rate
HOU = Hours of Use
WHFe = Waste Heat Factor for energy savings
Res = Residential values
Com = Commercial values

We provide more detail on the savings assumptions for each quantity in Appendix A.

Similarly, to calculate savings for PY6 purchases that will be installed during the next two years we simply apply the in-service rate (ISR) for year 2 and year 3 and modify the base wattage for the bulbs to be EISA complaint:

$$Year\ 2\ \Delta\ kWh = \ 0.11 \times\ \ 0.96 \times \left[\frac{(Base\ Watt_{2014} - Bulb\ Watt)}{1000} \times ISR_{res,yr2} \times HOU_{res} \times WHFe_{res}\right]$$
$$+ 0.11 \times\ 0.04 \times \left[\frac{(Base\ Watt_{2014} - Bulb\ Watt)}{1000} \times ISR_{com,yr2} \times HOU_{com} \times WHFe_{com}\right]$$

$$Year\ 3\ \Delta\ kWh = 0.11 \times\ 0.96 \times \left[\frac{(Base\ Watt_{2015} - Bulb\ Watt)}{1000} \times ISR_{res,yr3} \times HOU_{res} \times WHFe_{res}\right]$$

$$+ 0.11 \times\ 0.04 \times \left[\frac{(Base\ Watt_{2015} - Bulb\ Watt)}{1000} \times ISR_{com,yr3} \times HOU_{com} \times WHFe_{com}\right]$$

Demand Savings

As we did for electric savings, we calculate PY6 realized savings using bulbs purchased across three years, but installed in PY6:

$$\text{Realized PY5 Gross kW Savings } = \Delta \text{ kW} \times (\text{Units Purchased PY6}|\text{Installed in PY6} + \text{Units Purchased PY5}|\text{Installed in PY6} + \text{Units Purchased PY4}|\text{Installed in PY6})$$ [19]

The evaluation team calculated demand savings using the method outlined in the Statewide TRM Version 2. We applied the appropriate savings assumptions based on installation location and assumed that 96% of bulbs purchased are installed in residential locations and 4% in commercial locations. Our weighted savings equation is as follows:

$$Year\ 1\ \Delta\ kW = 0.11 \times\ 0.96 \times \left[\frac{(Base\ Watt_{2013} - Bulb\ Watt)}{1000} \times ISR_{res,yr1} \times WHFd_{res} \times CF_{res}\right] + 0.11 \times 0.04 \times \left[\frac{(Base\ Watt_{2013} - Bulb\ Watt)}{1000} \times ISR_{com,yr1} \times WHFd_{com} \times CF_{com}\right]$$

Where:

Base Watt = EISA complaint base wattage in 2013
Bulb Watt = Actual wattage of installed CFL bulb
ISR = First year In-Service Rate
WHFd = Waste Heat Factor for energy savings
CF = Coincidence Factor
Res = Residential values
Com = Commercial values

We provide more detail on the savings assumptions for each quantity in Appendix A.

Similarly, to calculate savings for PY6 purchases that will be installed during the next two years we simply apply the ISR for year 2 and year 3 and modify the base wattage for the bulb to be EISA complaint:

$$Year\ 2\ \Delta\ kW = 0.11 \times\ 0.96 \times \left[\frac{(Base\ Watt_{2014} - Bulb\ Watt)}{1000} \times ISR_{res,yr2} \times WHFd_{res} \times CF_{res}\right] + 0.11 \times 0.04 \times \left[\frac{(Base\ Watt_{2014} - Bulb\ Watt)}{1000} \times ISR_{com,yr2} \times WHFd_{com} \times CF_{com}\right]$$

$$Year\ 3\ \Delta\ kW = 0.11 \times\ 0.96 \times \left[\frac{(Base\ Watt_{2015} - Bulb\ Watt)}{1000} \times ISR_{res,yr3} \times WHFd_{res} \times CF_{res}\right] + 0.11 \times 0.04 \times \left[\frac{(Base\ Watt_{2015} - Bulb\ Watt)}{1000} \times ISR_{com,yr3} \times WHFd_{com} \times CF_{com}\right]$$

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[19] Because of EISA, the evaluation team adjusted the baseline savings for standard CFLs purchased in PY4 and PY5, but installed in PY6. The baseline changes include reducing 100 watts to 72 watts and 75 watts to 53 watts.

Summary of Input Sources

Table 10 summarizes the sources of the data and assumptions used in the calculation of ex post gross energy and demand savings. We also provide information on any changes we made to the program-tracking database or different savings assumptions that would cause ex post savings to differ from ex ante savings and the percentage increase or decrease in savings as a result.

Table 10. Sources Information for Ex ante and Ex post Gross Savings Inputs

Gross Savings Input	Ex Post Savings	Notes/Adjustments/ Corrections	Percent Change in Savings
Program Sales	PY6 Program-Tracking Database	For some products in the program-tracking database, the count of bulbs sold was based on the number of packs sold instead of the number of bulbs sold, which undercounts bulbs sold in multi-packs. We adjusted the sales to reflect total bulb sales.	<0.01%*
Base Watts	Statewide TRM Version 2 and ENERGY STAR Website	The program used lumens to assign base wattages, but used a different conversion than provided in the Statewide TRM Version 2 to calculate savings. Some base wattages were too high and some were too low so that across all sales, the impact on savings was small. We also corrected the lumen values for two products, which resulted in a different base wattage.	1.1%
CFL Watts	PY6 Program-Tracking Database	All accurate. No changes.	0.0%
Residential vs. Commercial Installations	2014 (PY6) AIC In-Store Customer Interviews	Program ex ante gross savings calculations assumed all bulbs were installed in residential locations.	11.6%
Hours of Use	Statewide TRM Version 2	Statewide TRM Version 2 HOU values are different from the HOU used in calculating the ex ante values.	14.3%

Gross Savings Input	Ex Post Savings	Notes/Adjustments/ Corrections	Percent Change in Savings
Installation Rate/Carry Over Savings	Statewide TRM Version 2	The program did not apply an ISR when calculating ex ante gross savings, but instead applied the full ISR to net ex ante savings. Applying the ISR to gross savings results in a savings reduction of 29.2%. The evaluation also used the carry over method to credit the program for bulbs purchased in PY4 and PY5, but not installed until PY6. This results in an increase in gross savings of 25.1%. The combined impact on gross savings is a reduction of 4.1%.	-4.1%
Waste Heat Energy Factor	Statewide TRM Version 2	Waste heat factors are not used in the ex ante savings calculations	6.2%
Waste Heat Demand Factor	Statewide TRM Version 2	Waste heat factors are not used in the ex ante savings calculations	10.2%
Summer Peak Coincidence Factor	Statewide TRM Version 2	Statewide TRM Version 2 CF values are different from the CF used in calculating the ex ante values.	23.2%
Leakage	2014 (PY6) AIC In-Store Customer Interviews and Secondary Research	The program savings methods does not account for bulbs sold to non-AIC customers. We applied an overall leakage rate of 11%, which accounts for AIC-discounted bulbs sold to non-AIC customers as well as bulbs discounted by other utilities but purchased by AIC customers.	-11%

*This is the percentage of bulbs that were affected by this change. Due to the very small number of bulbs affected, the impact on savings would be very small as well.

3.2.2 Net Impacts

The evaluation team used the PY5 net-to-gross ratio (NTGR) of 0.47 to estimate net program savings. This value is the result of the PY5 Lighting Impacts evaluation. The PY6 program tracking used a draft (PY5) value of 0.44. The evaluation team revised this value for the final report and updated it to 0.47.

3.3 Sources and Mitigation of Error

Table 11 provides a summary of the possible sources of error associated with data collection conducted for the AIC Residential Lighting Program evaluation. We discuss each item in detail below.

Table 11. Possible Sources of Error

Research Task	Possible Survey Error		Non-Survey Error
	Sampling	Non-Sampling	
In-store Customer Intercepts	• No	• Measurement error • Non-response and self-selection bias • External validity	• Data processing error
Lighting Shelf Stocking Study	• No		
Mystery Shopper Study	• Yes	•	•
In-Home Audit Survey	• Yes	•	•
Consumer Preferences Study	• Yes	•	• Modeler error • Heteroskedasticity
Gross Savings Calculations	• No	• N/A	• Data processing error
Net Savings Calculations	• No	• N/A	• Data processing error

The evaluation team took a number of steps to mitigate potential sources of error throughout the planning and implementation of the PY6 evaluation.

Survey Error

- **Sampling Error**
  - The evaluation team designed the in-home audit and consumer preferences sample to achieve 90% confidence and +/-10% relative precision. We surveyed 225 customers out of a population of 1,039,330 residential electric customers. At the 90% confidence level, we achieved a precision of +/- 5% assuming a coefficient of variation of 0.50. The actual precision of each survey question depends on the variance of the responses to each question.
  - For the in-store customer intercepts, lighting shelf stocking survey, and mystery shopper survey, the evaluation team had to use a convenience sample. Because a convenience sample is a non-probability based sample, traditional sampling theory does not apply. For this reason, the evaluation team did not estimate a precision level for these results or conduct tests of statistical

significance. However, the team did attempt to address potential coverage bias by selecting stores that reflect the overall population of participating stores. For the estimate of program leakage in which the location of the store relative to the AIC border is a critical factor, we weighted the survey results by store location. For survey estimates that represent all program sales (e.g., free ridership), we applied a sales-based weight so that customers who purchased more bulbs and stores that sold more bulbs had a greater weight.

- Non-Sampling Error

  Measurement Error: We addressed the validity and reliability of customer survey data through multiple strategies. First, we relied on the experience of the evaluation team to create questions that, at face value, appear to measure the idea or construct that they are intended to measure. We reviewed the questions to ensure that we did not ask double-barrelled questions (i.e., questions that ask about two subjects, but with only one response) or loaded questions (i.e., questions that are slanted one way or the other). We also checked the logical flow of the questions so as not to confuse respondents, which would decrease reliability. Key members of the evaluation team, as well as AIC and ICC staff, reviewed all survey instruments.

  We also used well-trained and experienced field staff to minimize interviewer error during the in-store customer intercept interviews. We have worked with the same staff on several in-store lighting customer interview projects. They understand the purpose of the study and the lighting technologies involved and are experienced interviewing customers in a retail environment. The auditing team we used for the in-home lighting audit study is the same auditing team we used on numerous home audit projects, including the 2012 AIC study. Throughout the field period we downloaded the data for each study and checked for errors so that we could correct any problems in real time rather than at the end of the study.

  - Non-Response Bias: The field staff we used for the in-store customer interviews are not temporary employees but have years of experience conducting these types of interviews and encouraging customers to complete them. We also gave customers a $10 gift card to the retail store where they were shopping to encourage their participation. For the in-home audit study, the evaluation team attempted to mitigate possible non-response bias by calling each potential respondent at least five times or until a firm refusal was received and by calling at different times of day. We provided a $50 incentive to encourage participation in the study and minimize non-response bias.

  - Data Processing Error: The evaluation team addressed processing error by using established data cleaning and analysis quality control processes and procedures. Experienced project managers oversee the work of analytic staff and conduct checks on their work to catch any data processing errors. We also have analytic code for many data cleaning and processing tasks that flag errors.

  - External Validity: We addressed external validity (the ability to generalize any findings to the population of interest) through the development of an appropriate research design. As such, the degree of external validity varies by study and by the budget and other resources available to the evaluation team. For example, the in-store intercepts had to use a convenience sample, which affects the generalizability of the results. Given the high costs of such a study, it is not possible to conduct interviews throughout the entire program year and at all participating retailers. Faced with these limitations, we employed other strategies to increase the external validity of the results. We conducted interviews at several types of retailers and on weekends and weekdays to capture a variety of customer types. We also conducted interviews at retailers and locations that sold the most bulbs through the program so that the results applied to a large proportion of program sales.

Non-Survey Error

- Data Processing Error
  - Gross Impact Calculations: We applied the Statewide TRM Version 2 calculations to the participant data in the tracking database to calculate gross impacts. To minimize data processing error, the evaluation team had a separate team member review all calculations to verify they were performed accurately.
  - Net Impact Calculations: We applied the prospective deemed NTGR to estimate the program's net impacts. To minimize data processing error, the evaluation team had a separate team member review all calculations to verify they were performed accurately.
- Modeling error
  - For the statistical models used in the consumer preferences study, the evaluation team addressed modeling error in several ways. First, the use of a choice-based conjoint research design enabled us to produce unbiased estimates because product attribute levels are randomized across respondents. Second, to produce group-level estimates of attribute importance and price sensitivity, we used a hierarchical Bayes Regression model (Sawtooth Software Technical Paper, 2009), which leverages Markov Chain Monte Carlo simulations to ensure convergence on stable coefficient estimates.

4. Evaluation Findings

4.1 Process Assessment

4.1.1 Program Design and Implementation

The Residential Lighting Program ran smoothly in PY6. The program met its goals for bulbs sold and exceeded the sales of any previous program year. To meet the objective of increasing sales of specialty CFLs, program administrators increased the incentive on these bulbs. As a result, the program sold more specialty CFLs in both absolute and percentage terms during PY6 than it had in any previous year.

4.1.2 Program Data

Program administrators improved the program tracking systems between PY5 and PY6 and began tracking all of the necessary information to calculate savings using the method in the Statewide TRM Version 2. However, the program did not actually use the TRM method and instead used different savings assumptions to calculate program savings. In the Impact Assessment, we provide greater detail on the specific assumptions that were incorrect and their impact on ex ante savings.

4.1.3 Program Marketing, Outreach, and Training

The program employs seven field representatives who are responsible for specific stores across AIC territory. They visit participating retailers regularly to ensure that products and promotional materials are displayed properly. During these visits, they also typically train store staff on CFLs and how to best promote them. And they provide a brief overview of how the program works from the consumer’s standpoint. The frequency of visits varies by retailer type; many warehouse, big box, and DIY stores are visited weekly, while discount and grocery stores receive less frequent visits,

In PY6, 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 availability of AIC-discounted CFLs at seven of the eight participating stores we visited. We found additional AIC materials describing the benefits of CFLs at seven of the stores. In addition, all the retailers where we performed shelf inventories also displayed CFLs off the shelf such as at the end of aisles on endcaps, in the aisles on wingstacks, or displays near the cash registers. Table 12 shows the other types of informational materials present at the retailers we visited.

Table 12. In-Store Informational Materials Present

Informational Materials Present	Number of Retailers (n=8)
Information on CFL Bulbs	7
Information on CFL Discounts	7
Information on LED Bulbs	6
Information on Proper CFL Disposal	5
Explanation of Lumens	5
Information on EISA Regulations	3

APT held 147 events at retailers to promote the program. These events included representatives using "light bars" to demonstrate various bulbs, the distribution of educational materials, and direct customer contact. Our analysis of the in-store customer interviews shows that sales of CFLs increased during these events. Customers who purchased light bulbs during a lighting demonstration were more likely to purchase CFLs than were customers who purchased lighting at other times. During an event, 73% of customers purchased CFLs compared to 56% of customers when an event was not taking place (see Table 13).

Table 13. Comparison of Bulb Purchases with and without Promotional Events

		Event		No Event	
Efficiency	Bulb Type	Number	Percentage	Number	Percentage
Higher	LEDs	5	3%	43	5%
	CFLs	138	73%	456	56%
	Halogen	14	7%	108	13%
Lower	Incandescent	39	21%	250	31%
	Total	**189**	**104%**	**812**	**106%**

Note: The 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.

Customers who purchased program-discounted CFLs during lighting events were somewhat more likely to know that they purchased discounted CFLs (82% compared to 76%) and that AIC was the source of the discount (66% compared to 54%) (see Table 14).[20] Our stocking study found that some retailers displayed only the discounted price and not the regular price of the bulbs, which may have affected customer awareness of the discount. Customers who bought CFLs at retailers who displayed both the regular retail price and the discounted price were more aware of the discount than those who purchased bulbs at retailers who displayed only the discounted price. However, we conducted a relatively small number of interviews with customers of retailers who displayed only the discounted pricing, so the results could change if we had a larger sample of these customers.

[20] 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.

Table 14. Awareness of AIC Lighting Discounts

	Event (n=125)	No Event (n=414)
Aware of Discount	82%	76%
	Among % Aware of Discount (n=103)	Among % Aware of Discount (n=315)
Aware AIC Is Discount Sponsor	66%	54%

Compared to customers in PY5, more customers who purchased bulbs in PY6 were aware that they were purchasing discounted bulbs (76% of customers during non-event times in PY6 compared to 44% of in PY5). This difference was apparently due to a special promotion at warehouse retailers while we were conducting intercept interviews. (The program was selling CFL 8-packs for $0.99 and had them displayed at each store's front entrance.) Nearly every warehouse customer we interviewed knew they were purchasing discounted bulbs, compared to two-thirds of the customers we interviewed at big box or DIY stores (see Table 15). However, more big box and DIY customers were aware of the discount in PY6 than in PY5. In addition, warehouse customers were somewhat less likely than big box and DIY customers to know that AIC sponsored the discount.

Table 15. Awareness of AIC Lighting Discounts by Retailer Type

Aware of Discount	**Event (n=125)**	**No Event (n=414)**
Do-It-Yourself	68%	64%
Big Box	73%	63%
Warehouse	97%	93%
Total	82%	76%
Aware AIC Is Discount Sponsor	**Among % Aware of Discount (n=103)**	**Among % Aware of Discount (n=315)**
Do-It-Yourself	68%	67%
Big Box	79%	60%
Warehouse	61%	44%
Total	66%	54%

4.1.4 Retail Stocking and Sales of Energy-Efficient Lighting

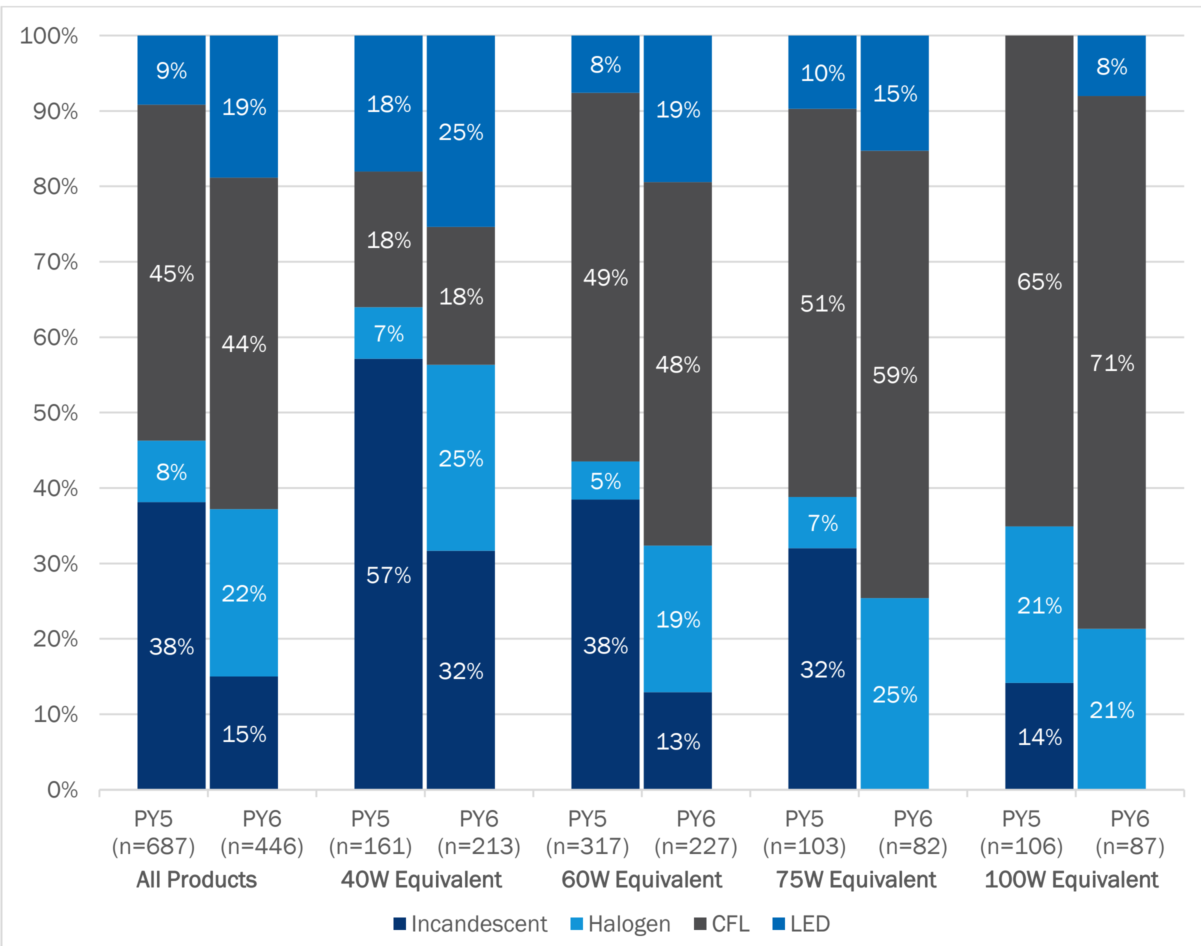
The results of our shelf inventory, mystery shopper survey, and in-store intercepts suggest that the market share of incandescent light bulbs is decreasing, especially for standard lighting products affected by EISA. While a majority of customers purchase energy-efficient lighting products for their standard lighting needs, without the AIC discounts, CFLs would be, on average, more expensive than incandescent and halogen bulbs. The majority of specialty lighting purchases are less-efficient products.

Lighting Product Stocking

The evaluation team conducted an inventory of the lighting products on the shelves at eight of the participating retailers where we conducted in-store intercepts from March to May 2014. We compared the results with a similar inventory that we conducted in PY5. The results show that LEDs and EISA-compliant halogens make up an increasing percentage of standard lighting products on retailers' shelves and are taking shelf space that was once occupied by incandescents (see Figure 2). The share of CFL products has remained relatively stable.

We found large differences in the availability of less efficient bulbs by lumen output. At the eight participating retailers where we performed inventories in PY6, no 100- or 75-watt equivalent standard incandescents were available, but incandescents still made up 13% of 60-watt equivalent products and 32% of 40-watt equivalent products stocked. Incandescents were available across all wattages in PY5 though to varying degrees depending on the wattage. Retailers are replacing incandescents with halogens. We found tremendous growth in the availability of halogens across all wattages except the 100-watt equivalent bulbs. LEDs are increasingly available across all wattages, but particularly in the lower wattage ranges. In fact, we found more LED products at the 40-watt equivalent category than CFLs in PY6.

Figure 2. Standard Lighting Products on Shelves (Affected by EISA Legislation)

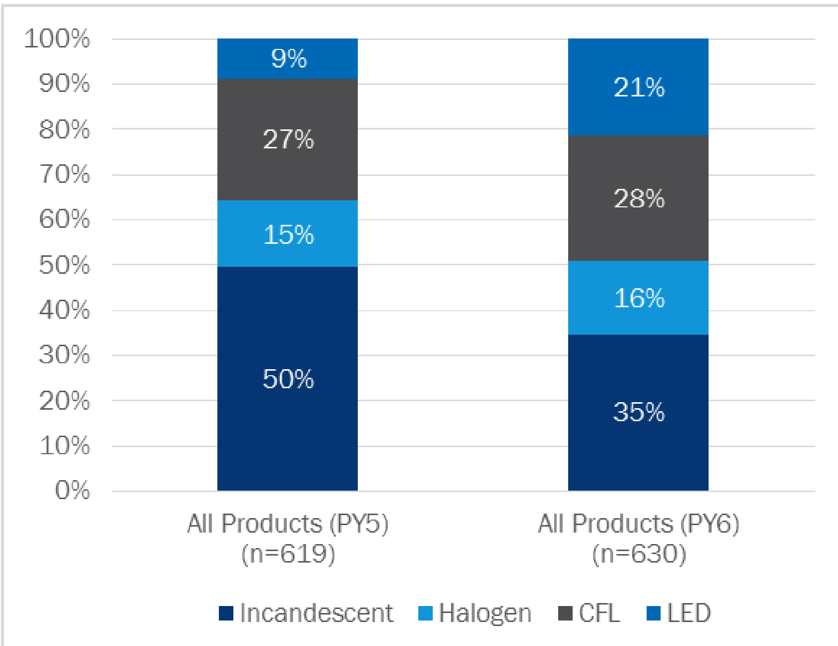


Note: The numbers ("n") in this figure represent the number of different types of products and not counts of bulbs. We completed shelf studies at 10 retailers in PY5 and 8 in PY6. While the overall number of products differs as a result, the types of retailers included in the two studies were similar so that the relative distribution of product types can be compared.

The results from our lighting inventory are consistent with lighting shipping data from the National Electric Manufacturers Association (NEMA) that show shipments of A-line incandescents dropping but still making up approximately one-third of shipments during the second quarter of 2014. Shipments of LEDs and halogens increased the most while shipments of CFLs held relatively stable.[21]

The stocking of specialty bulbs is not affected by EISA, and less-energy-efficient bulb types—incandescents and halogens—constituted a slight majority of the specialty bulb products stocked in stores in PY6. But as we found with standard bulbs, the percentage of incandescent specialty products is less than in PY5 dropping from 50% to 35%. Retailers filled this shelf space with specialty LEDs while the share of CFL and halogen products remained relatively constant.[22] Still, incandescents remain the most common specialty product stocked.

Figure 3. Specialty Lighting Products on Shelves



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

We also conducted a mystery shopper telephone survey to assess the availability of 100- and 75-watt incandescent light bulbs across a wider range of participating and non-participating stores in the AIC service territory. We called 139 stores (half were participating and half were non-participating retailers) and, posing as a customer, asked whether they stocked 100- or 75-watt incandescent bulbs. As shown in Table 16, just

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[21] http://www.nema.org/news/pages/incandescent-a-line-lamps-decline-sharply-in-second-quarter.aspx

[22] While we recorded the lumens and wattage of all specialty products, it is difficult to present the results by lumen range for specialty bulbs as we did for standard bulbs. The baseline wattages vary by bulb type (globe, reflector, candelabra, etc.) for different lumen ranges. We could provide these results for each specialty bulb type, but there is no meaningful way to group all specialty products by lumen range.

over two-thirds of stores (68%) had neither wattage in stock.[23] Over a quarter of the sales staff (27%) said they had 100-watt incandescents in stock, and a similar proportion of stores (26%) had 75-watt incandescents in stock.

Table 16. Availability of 100- and 75-Watt Incandescents (based on Mystery Shoppers Data Collection)

	All Stores (n=139)	Participating Stores (n=69)	Non-participating Stores (n=70)
Have both	22%	24%	14%
Have Only 100W	5%	6%	2%
Have Only 75W	4%	5%	2%
Have neither	68%	65%	81%

As part of our mystery shopper survey, we called all eight of the stores where we conducted in-store shelf stocking studies to confirm that sales staff were not confusing incandescent bulbs with EISA-compliant halogens. If sales associates told us they had either 100- or 75-watt incandescents in stock, we asked them to confirm the bulbs were not halogens, which, we noted, can look similar to incandescent bulbs. We found contradictory results between the two studies for two of the eight stores. One staff member we spoke with said the store carried 75-watt incandescents. The staff member in the other store said both 100- and 75-watt incandescent light bulbs were in stock. Our shelf stocking study, which we conducted at roughly the same time as the mystery shopper survey, found that neither store carried 100- or 75-watt incandescents.

The comparison of the mystery shopper and shelf stocking results suggests there is still some error associated with the mystery shopper survey results. It is very difficult to tell the difference between standard incandescents and EISA-compliant halogens, and not all sales staff will know the difference or take the time to check. Each method has its strengths and weaknesses. The mystery shopper survey allows us to gather data on a wider range of retailers than we can with the shelf stocking study, but there is likely some error in the results.

Lighting Product Pricing

The shelf stocking study collected pricing information for all products. For discounted products, we recorded the regular retail price, where available, and the discounted price. We also noted whether AIC or the retailer/manufacturer provided the discounts.

Figure 4 compares the pricing of standard incandescents, EISA-compliant halogens, CFLs, and LEDs.[24] For CFLs, Figure 4 provides three average prices. Two of the prices are for the CFLs that AIC discounts; the figure

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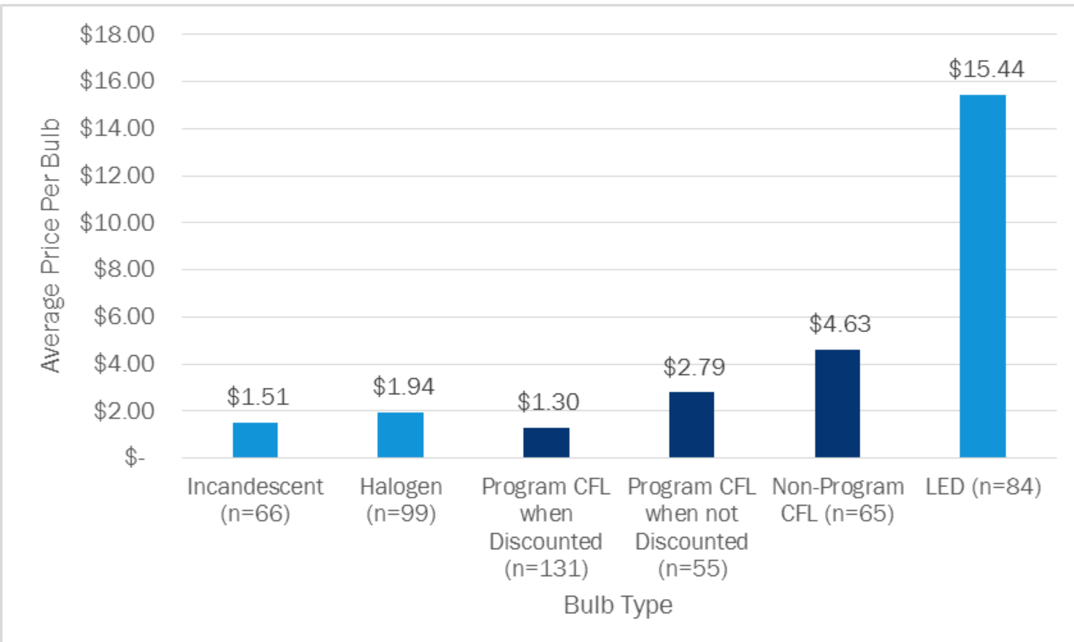
[23] So that the results reflect the stores where most customers purchase light bulbs, we weighted the data so that the stores we believe sell the most bulbs are weighted more heavily in the results. For participating stores, we weighted the results by program sales. Since we did not have access to sales data for non-participating stores, we generated a weight for these stores using participating store data. Each store was categorized by type (DIY, warehouse, big box, grocery, discount, drug, and small hardware). We calculated the average sales by store type using program sales data and used these averages to construct a weight for non-participating retailers.

[24] We compare regular and discounted pricing in this section. The data presented come from all eight stores where we conducted shelf stocking studies as part of our in-store customer interviews. However, some of these stores only present the discounted price, so data was not available for the regular price of some products.

shows the average discounted price of these CFLs and what these bulbs would cost if they were not discounted by AIC. Also available at these retailers are CFLs that are not discounted by AIC, and the average price of these non-discounted CFLs is presented as well.

AIC discounts on standard CFLs reduce their average cost below the cost per bulb for less-efficient lighting products. The standard CFLs that AIC discounts cost about $0.20 less per bulb than incandescents, on average, and more than $0.60 less per bulb than halogens. Without the AIC discount, the average price of program CFLs would be $1.28 more than the average price per bulb of an incandescent and $0.85 more than an EISA-compliant halogen bulb. Standard LEDs cost significantly more than all bulb types, with an average price of over $15 per bulb.

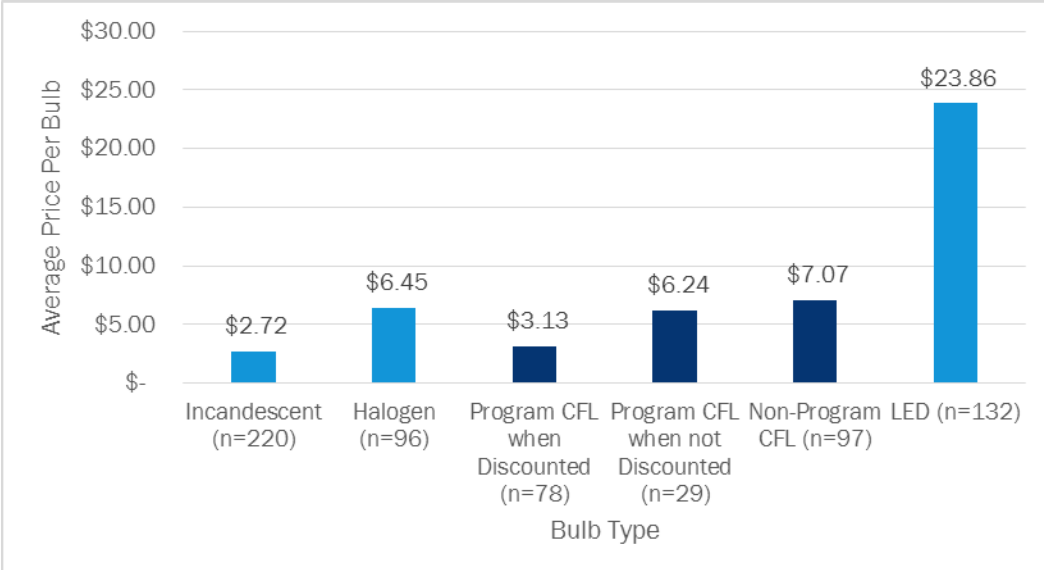
Figure 4. Average Price of Standard Light Bulbs



Note: The non-discounted price for program CFLs was not available for all products in stores so the number of products used to estimate the discounted price is not the same as the number of products used to estimate the non-discounted price. If we limit the comparison to the 55 products for which we have both the discounted and non-discounted prices, the average standard program CFL discounted price is $0.95.

Figure 5 makes the same comparisons for the pricing of specialty bulbs. The average price of a program specialty CFL without the discount would be approximately $3.50 more than a specialty incandescent and about $0.20 less than a specialty halogen bulb. With the program discount, specialty CFLs cost about $0.40 more per bulb, on average, than a specialty incandescent bulb. However, the program discount makes program specialty CFLs over $3 less expensive than specialty halogen bulbs. Once again, the price of LEDs is significantly higher than other bulb types at almost $24 per bulb, on average.

Figure 5. Average Price of Specialty Light Bulbs



Note: The non-discounted price for program CFLs was not available for all products in stores so the number of products used to estimate the discounted price is not the same as the number of products used to estimate the non-discounted price. If we limit the comparison to the 29 products for which we have both the discounted and non-discounted prices, the average specialty program CFL discounted price is $2.97.

Lighting Purchases

The in-store interviews provided information about the types of bulbs customers purchased at participating retailers in PY6.[25] Almost two-thirds of customers (64%) purchased at least one energy-efficient bulb. Approximately half of customers (56%) purchased program-discounted CFLs, while a very small percentage (3%) purchased CFLs that were not discounted by the AIC program. LEDs do not yet have a large market share; only 5% of customers purchased LEDs. A sizable percentage of customers still purchased a less efficient bulb—either incandescents (29%) or EISA-compliant halogens (12%). The average customer purchased 10 bulbs. Customers purchased more program CFLs, on average, than any other type of bulb (see Table 17).

[25] The types of bulbs that customers purchase varies by retailer type. Because our sample of stores over-represents some retailers and under-represents others, we weighted the data by retailer sales so the results would reflect the total sales made at the retailers in our sample.

Table 17. Bulb Types Purchased

Bulb Type	Customers		Bulbs		
	Number	Percentage	Number	Percentage	Average[a]
LEDs	48	5%	186	2%	3.9
Program CFLs	565	56%	6,183	62%	10.9
Non-Program CFLs	30	3%	131	1%	4.4
Halogens	122	12%	876	9%	7.2
Incandescents	288	29%	2,657	26%	9.2
Total	1,001	105%	10,033	100%	10.0

[a] This represents the average number of bulbs purchased by a customer purchasing that type of bulb, not all customers.

As shown in Table 18, the type of bulbs that customers purchased varied significantly by retailer type. The warehouse retailer where we conducted intercepts sells mainly CFLs, with a limited number of halogens and LEDs. The program was running a promotion—an 8-pack of CFLs for $0.99—at this retailer while we were conducting intercepts. Nearly every customer we interviewed at the warehouse stores (98%) purchased program CFLs, and many purchased a large number of the bulbs.[26] Sales at DIY and big box stores show that when less-efficient bulbs are stocked, customers purchase them. At the big box stores, 58% of customers purchased either an incandescent or halogen, while 45% of customers purchased the bulbs at DIY stores. More customers purchased LEDs at DIY stores than at big box stores.

Table 18. Bulb Types Purchased by Retailer Type

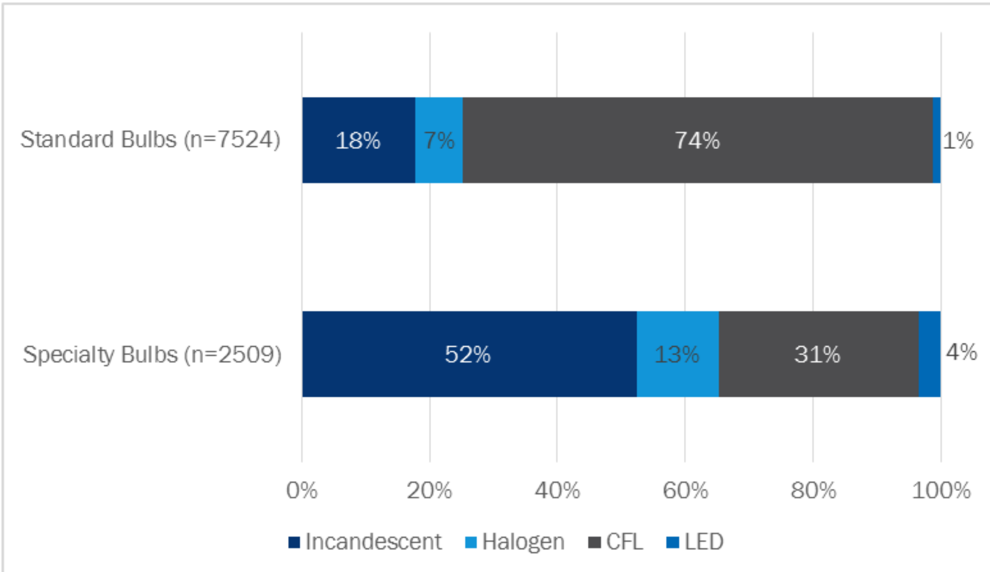
Bulb Type	DIY		Big Box		Warehouse	
	Customers	Bulbs	Customers	Bulbs	Customers	Bulbs
LEDs	13%	6%	2%	<1%	2%	<1%
Program CFLs	38%	50%	37%	44%	98%	100%
Non-Program CFLs	5%	3%	3%	1%	0%	0%
Halogens	15%	9%	16%	14%	<1%	<1%
Incandescents	30%	32%	42%	40%	na	na

The type of bulbs purchased also depends on whether the customer is purchasing a standard or a specialty bulb. Customers generally bought CFLs for their standard bulb needs and incandescents for their specialty

[26] Because of the promotion, we interviewed many more customers at the warehouse stores than we expected. This caused the warehouse stores to be over-represented in our sample. It was critical to weight the results presented in this memo by retailer so the results are representative of the larger population of program sales.

bulb needs. As shown in Figure 6, nearly two-thirds of specialty bulbs purchased were incandescents or halogens (65%), compared to one-quarter of standard bulbs (25%).[27]

Figure 6. Standard and Specialty Bulbs Purchased by Type



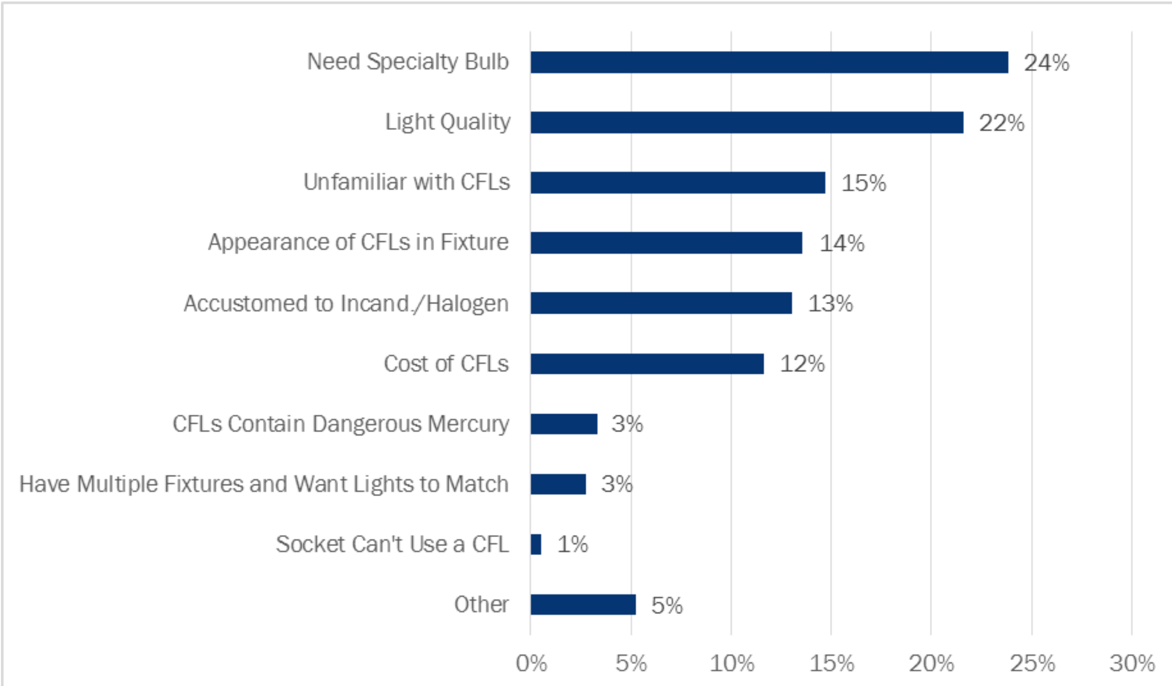
Barriers to CFL Usage

The results of the shelf stocking study and in-store customer interviews confirm that barriers to CFL usage remain. Despite widespread availability of CFLs and AIC discounts that bring their price in line with incandescents and halogens, many customers still purchase less-efficient lighting. We asked questions of customers who were purchasing less-efficient bulbs to understand the remaining barriers and what AIC might do to overcome them.

The main barriers to CFL usage reported by respondents were the need for a specialty bulb and the light quality of CFLs. Almost a quarter of respondents (24%) said they needed specialty bulbs and so were purchasing an incandescent or halogen, while 22% reported they did not like the light quality of CFLs. As shown in Figure 7, other common responses were lack of familiarity with CFLs (15%), the appearance of CFLs in their fixture (14%), being accustomed to incandescents or halogens (13%), and the cost of CFLs (12%).

[27] Some retailers only sell CFLs or LEDs. If we limit the analysis to customers who purchased bulbs at retailers that sold less efficient bulbs as well, we find that incandscents and halogens make up an even greater percentage – 39% of standard bulbs and 70% of specialty bulbs sold.

Figure 7. Reasons for Purchasing Incandescent or Halogen Bulbs Instead of CFLs

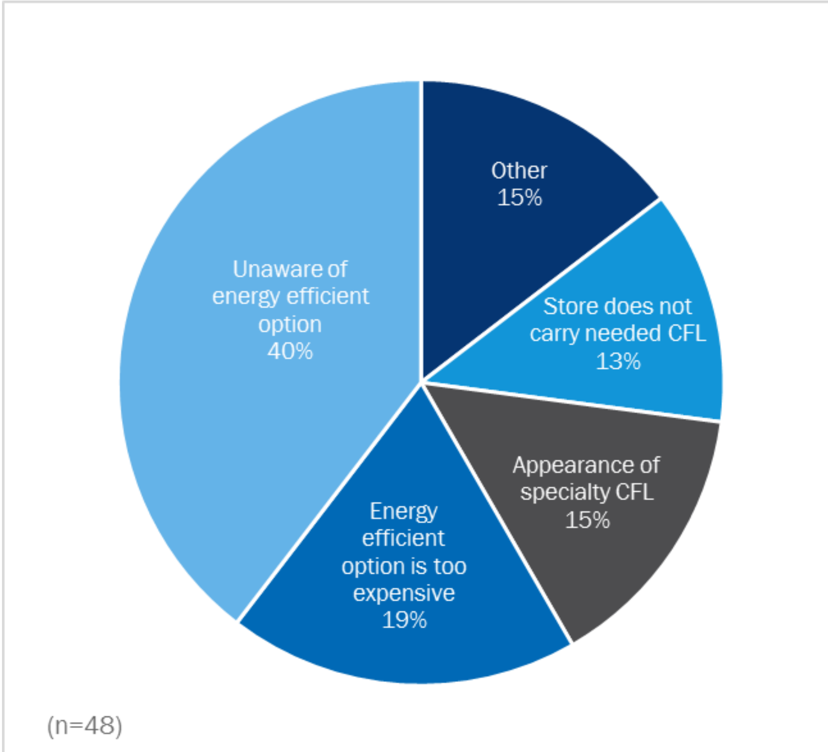


Note: Percentages sum to greater than 100% because this is a multiple response question.

Although only 15% of customers said they were purchasing an incandescent or halogen because they were not familiar with CFLs, this barrier may be greater than it appears. Most customers may be aware of CFLs as a product, but they seem to be unaware of the variety of types of CFL products that exist. Customers who said they were buying incandescents or halogens because they needed a specialty bulb, because they did not like how CFLs looked in their fixtures, or because the socket could not use a CFL may not know that thee is a variety of specialty CFLs that would fulfill their light bulb needs. These responses, along with lack of familiarity with CFLs, make up 54% of customer's reasons for purchasing an incandescent or halogen.

We asked these customers a follow-up question to determine why they did not purchase specialty CFLs instead of incandescent or halogen bulbs. Forty percent were unaware that an energy-efficient option existed for the light bulb they were looking for, while 19% said the energy-efficient option is too expensive. As shown in Figure 8, other reasons cited by respondents were the appearance of the specialty CFL (15%) and the fact that the store does not have the CFL they need in stock (13%).

Figure 8. Reasons for Purchasing Incandescent or Halogen Instead of Specialty CFL



Note: Percentages sum to greater than 100% because this is a multiple response question.

These results suggest that a key barrier to purchasing specialty CFLs remains customers' lack of awareness about the types of specialty CFLs available. We found similar results in PY5. CFLs make up the majority of standard lighting purchases, but less than one-third of specialty bulb purchases. AIC made good progress in PY6 by selling more specialty CFLs than in previous years; however, many customers could still benefit from increased information about energy-efficient options for their specialty lighting needs. These results also suggest that more information and reduced CFL pricing may not be enough. Some customers still may not buy specialty CFLs because of their appearance. The alternative energy-efficient solution may be LEDs as their market share increases and prices drop in the coming years.

4.1.5 In-Home Lighting Study

Awareness and Purchase Behavior

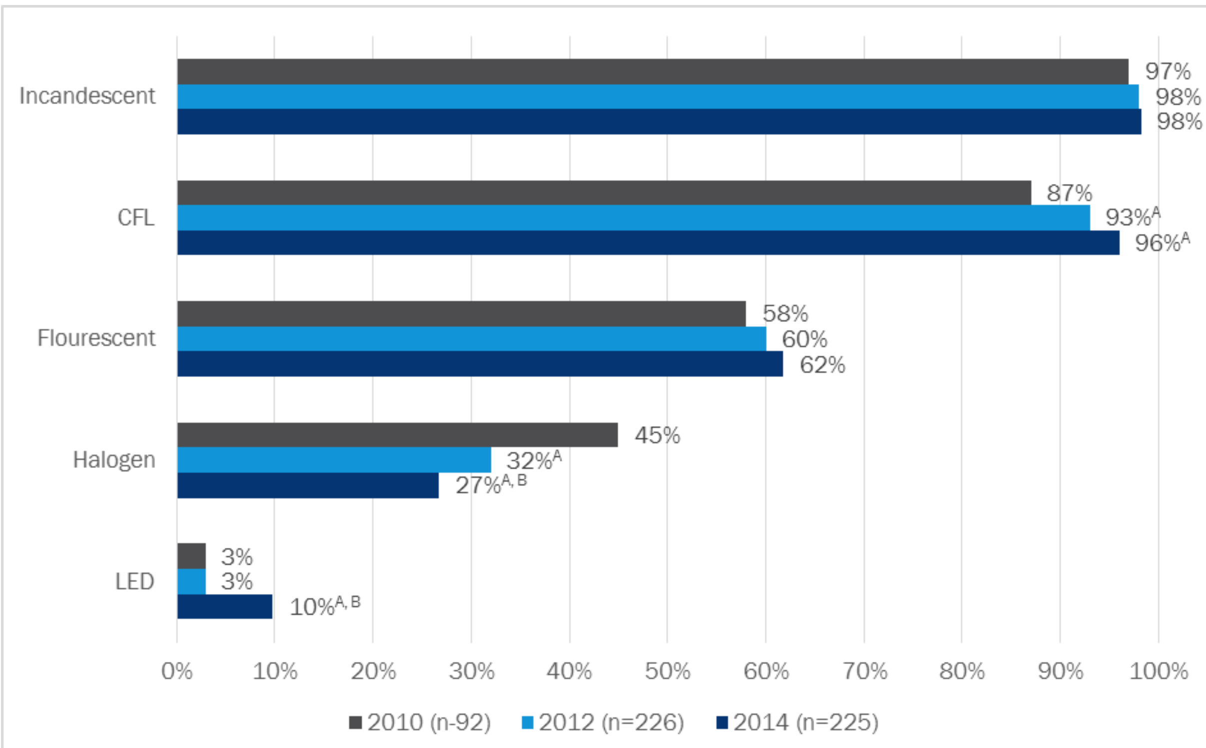
Nearly all AIC customers are aware of CFLs, and most are aware of LEDs. As part of our recruiting for the on-site visits, we asked respondents about their awareness of CFLs and LEDs. Most respondents (94%) reported having heard of CFLs. Over three-quarters (77%) of customers were aware of LEDs.

Penetration

Nearly all AIC customers (96%) had at least one CFL installed in their homes (see Figure 9), which is similar to the CFL penetration rate in 2012 (93%). As in 2010 and 2012, we found a handful of customers (2%) who did not have any incandescents installed. Twenty-seven percent of homes had at least one halogen bulb installed, a significant decline from 45% in 2010.

The number of homes with LEDs installed has increased dramatically, from 3% in both 2010 and 2012 to 10% in 2014. Much of this growth in LED penetration is due to the increased use of medium-screw-based LEDs, which have become more widely available at lower cost. Of the 134 LEDs installed in the homes we visited, 57% were medium-screw-based LEDs. In 2012, we found only 38 LEDs installed across 226 homes, of which 37% were medium screw based.

Figure 9. Lighting Penetration Rates

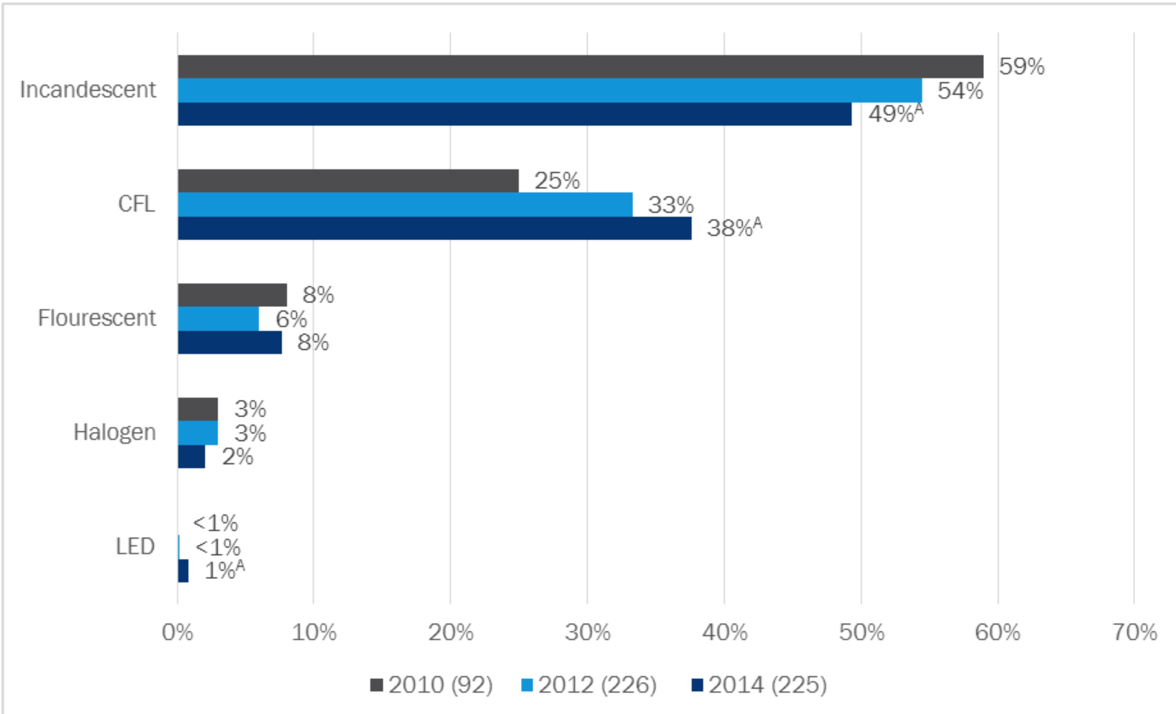


[A] Difference between that year and 2010 is significant at the 0.1 alpha level
[B] Difference between that year and 2012 is significant at the 0.1 alpha level

Saturation

Although nearly every home has at least one CFL installed, the majority of light sockets do not contain the most efficient bulb possible (either a CFL or LED). CFLs comprise 38% of the bulbs installed in the average home in AIC service territory and LEDs are 1% (see Figure 10). Just under half of the bulbs installed are incandescents (49%), and fewer than one in ten is a linear fluorescent (8%). The remaining 2% of bulbs are halogens. CFL saturation has increased significantly since 2012 while incandescent saturation has decreased.

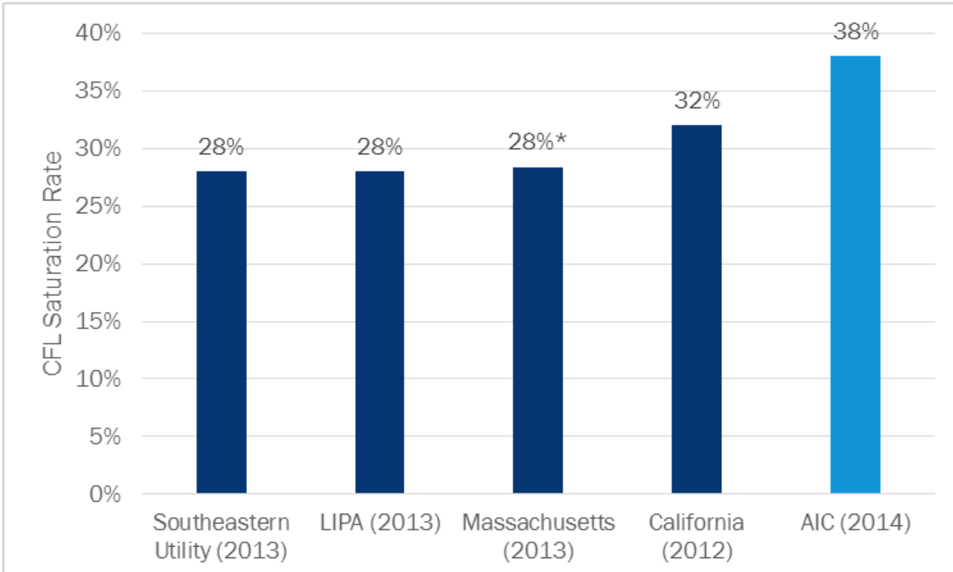
Figure 10. Lighting Saturation Rates



A Difference between 2014 and 2012 is significant at the 0.1 alpha level. Statistical significance could not be determined for 2010 because standard deviations for saturation rates were not reported.

In 2012, we compared CFL saturation rates in AIC territory to those of programs across the country and found the rates in AIC territory to be among the highest. The evaluation team updated this analysis for 2013-2014 and found that AIC's CFL saturation rate remains among the highest of programs that have had recent evaluations that estimated CFL saturation, as shown in Figure 11.

Figure 11. CFL Saturation in Different Areas of the United States



* In Massachusetts, saturation rates were calculated across all sockets, while the other studies report the average CFL saturation rate per household. The method used for the Massachusetts study typically yields a slightly lower saturation rate. For a direct comparison, the median CFL saturation for Massachusetts in 2013 was 31%, while it was 35% for AIC in 2014.
Source: Home Audits conducted by Opinion Dynamics and publicly available reports[28]

Standard Versus Specialty CFLs

The program provides incentives for standard and specialty CFLs alike, although CFLs are installed more frequently in standard sockets than in specialty sockets. The in-home audits collected data on a socket-by-socket basis so that we can examine CFL saturation by socket type.[29] The average AIC home has nearly three times as many standard light sockets as specialty sockets (66% of all sockets are standard, 23% specialty, and 10% pin-based).

[28] LIPA: Opinion Dynamics. May 28, 2014. Long Island Power Authority Efficiency Long Island and Renewable Energy Portfolio. Massachusetts: NMR Group, Inc. June 7, 2013. Final Results of the Massachusetts Onsite Lighting Inventory submitted to Cape Light Compact, NSTAR, National Grid, Unitil, Western Massachusetts Electric, and Energy Efficiency Advisory Council Consultants. California: KEMA, Inc. January 31, 2104. Draft Final Report. WO21: Residential On-Site Study: California Lighting and Appliance Saturation Study (CLASS 2012).

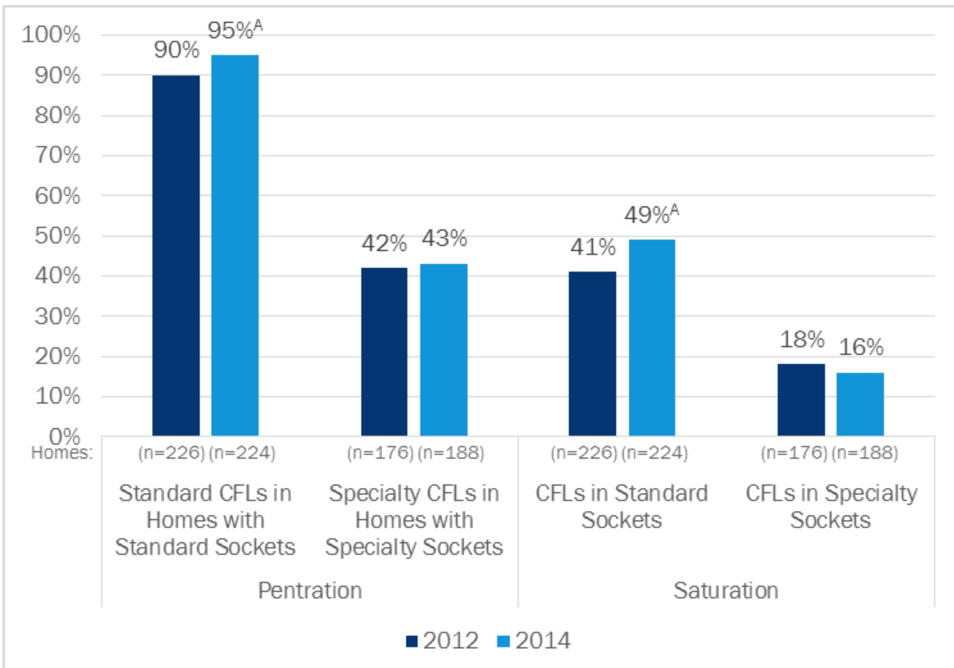
[29] Our definition of specialty CFLs matches that of the program. A specialty CFL is any CFL with a glass covering, or a spiral CFL that is dimmable or 3-way. A specialty socket is one that had a specialty bulb of any technology installed (i.e., incandescent, CFL, etc.). A standard socket is one that had a standard bulb of any technology installed. Alhough a resident could, in the future, install a standard bulb in a specialty socket and vice versa, our analysis assumes the resident has chosen the most appropriate bulb for the socket and will continue to use that same type of bulb.

The program is doing well in terms of CFL usage in standard sockets. All but one home surveyed has at least one standard light socket, and 96% have at least one standard CFL installed. The average home has CFLs in nearly half (49%) of its standard light sockets.

Slightly fewer homes (84%) have at least one specialty light socket. Of these homes, 43% have at least one specialty CFL installed, and the average home has CFLs installed in 16% of these specialty sockets—far less than the 49% of CFLs in standard sockets (see Figure 12).

By comparing these results with our 2012 study, we see that the increase in CFL saturation shown in Figure 10 is due entirely to the increase in CFL saturation in standard light sockets. CFL saturation in standard sockets increased from 40% in 2012 to 49% in 2014, but remained essentially the same in specialty sockets.[30]

Figure 12. CFL Penetration and Saturation by Socket Type*, 2012 and 2014



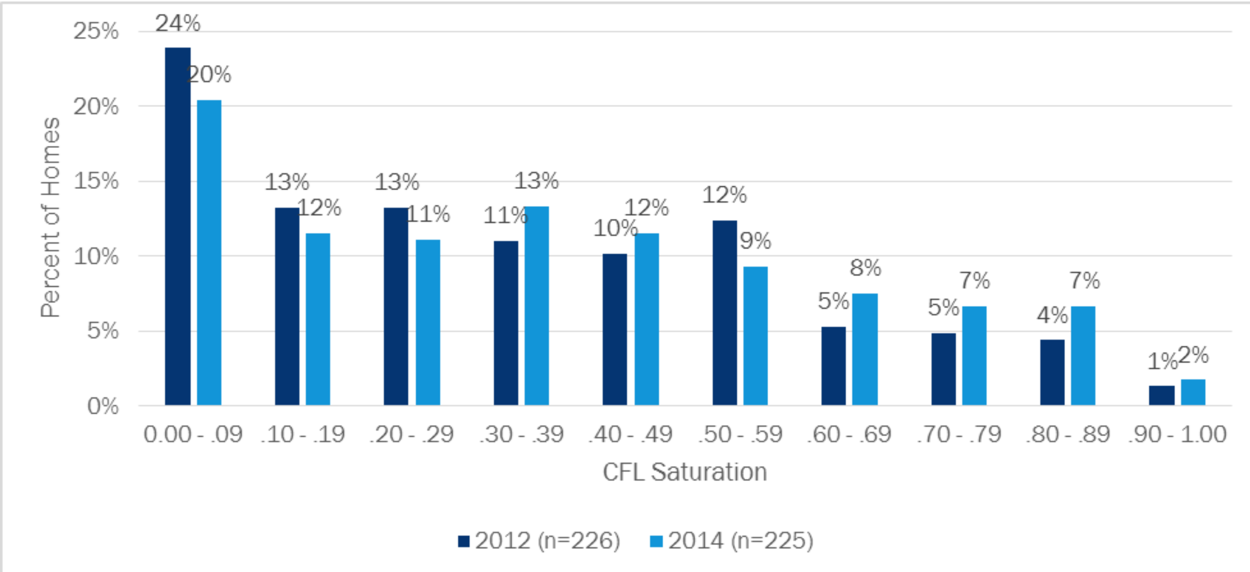
A Difference is significant at the 0.1 alpha level

Customer Differences in CFL Usage

The evaluation team compared the distribution of CFL saturation rates in 2012 and 2014 to better understand the range of CFL usage among AIC customers and how it has changed. CFL usage remains highly varied. We found that more households have saturation rates at the highest levels and fewer have rates at the lowest levels. For example, in 2014, 24% of AIC households had saturation rates above 60% compared to 15% in 2012.

[30] The differences in specialty socket penetration and saturation between 2012 and 2014 are not statistically significant.

Figure 13. Distribution of CFL Saturation, 2012 vs. 2014



Mean Saturation: 2012- 33%; 2014- 38%. Median Saturation: 2012 – 29%; 2014 – 35%.

To help us understand the factors underlying the variation in CFL usage between different households, the evaluation team compared the CFL saturation rates of different demographic groups. We found that homeowners, higher income customers, and older customers have lower CFL saturation rates than other groups. We suspected that some of the differences in CFL saturation might be due to differences in the home sizes of different demographic groups. For example, larger homes, which have more light sockets, tend to cost more and require higher household incomes to purchase. As shown in Table 19, homes with more light sockets have lower CFL saturation rates than other homes. Larger homes also tend to have a greater variety of lighting sockets and a need for more specialty bulbs. We found lower CFL saturation rates in homes that have a greater percentage of sockets that require a specialty bulb.

Table 19 CFL Saturation Rates by Select Demographic Categories

Demographic Characteristic	N	CFL Penetration	CFL Saturation
Home Ownership			
Own (A)	140	96%	33%
Rent (B)	85	95%	45%[A]
Household Income			
Less than $40,000 annually (A)	108	94%	41%
$40,000 – less than $75,000 annually (B)	52	100%[A]	40%
$75,000 or more annually (C)	44	95%	32%[A]
Unreported (D)	21	95%	24%[A,B]
Education			
High School graduate or less (A)	68	96%	36%
Some College (B)	75	96%	40%

Demographic Characteristic	N	CFL Penetration	CFL Saturation
College Grad or More (C)	82	96%	37%
Home Size			
Less than 1,400 sq. ft (A)	88	95%	40%
1,400 – less than 2,000 sq. ft. (B)	65	98%	38%
2,000+ sq. ft. (C)	42	92%	33%
Unknown (D)	30	97%	36%
Age of Respondent			
18-29 years old (A)	41	95%	48%
30 – 49 years old (B)	66	98%	39%[A]
50 – 69 years old (C)	75	100%	39%[A]
70+ years old (D)	40	88%[A,B,C]	22%[A,B,C]
Retirement Status			
No one in household retired (A)	75	97%	41%
Someone in household retired (B)	150	93%[A]	29%[A]
Number of Sockets in Household			
Low (7 to 23 sockets) (A)	54	94%	51%
Medium Low (24 to 38 sockets) (B)	58	97%	36%[A]
Medium High (39 to 63 sockets) (C)	58	98%	36%[A]
High (64 to 146 sockets) (D)	55	95%	28%[A,C]
Percent of Bulbs that are Specialty			
Low (0% to 7.9%) (A)	59	97%	52%
Medium Low (8% to 22.4%) (B)	54	98%	37%[A]
Medium High (22.5% to 35.2%) (C)	56	95%	34%[A]
High (35.3% +) (D)	56	95%	27%[AB]
Total	**225**	**96%**	**38%**

Significant differences at the 0.1 alpha level are noted by superscripts.

To examine these differences even further, we ran a multivariate regression predicting CFL saturation by respondent demographics, the total number of light sockets in the household, and the percentage of light sockets that use a specialty bulb. The model results show that most demographic variables are not significantly related to CFL saturation. The one demographic variable that is significant is age, which has a negative association with CFL saturation rates, even when controlling for income, number of sockets, percentage of bulbs that are specialty, and home size. In addition, the number of light sockets is not significantly related to CFL saturation, but the percentage of specialty sockets is (i.e., the type of sockets in a home matters more for CFL saturation than the number of sockets). In summary, households headed by older adults and that have a higher percentage of specialty light sockets have lower CFL saturation rates than other households.

4.1.6 Consumer Preferences Study

In addition to tracking the number, type, and location of residential lighting products installed in homes, the evaluation team conducted a consumer preference study with audit study participants. We administered a conjoint survey to examine the relative importance of different product attributes and to assess customers' price sensitivity towards energy-efficient lighting products.[31] The results of our consumer preferences study shed further light on the state of the energy efficient lighting market in AIC territory. Our findings inform both program design and implementation by providing information about customer responsiveness to changes in the price of energy-efficient lighting products.

Price Sensitivity and Elasticity Analysis

The evaluation team assessed customer price sensitivity and elasticity of different lighting product configurations by inputting the results from our conjoint survey into a market simulator.

To assess price sensitivity, we varied the price of one product while holding all other products at their current market prices. In addition to examining price sensitivity, the evaluation team calculated the average price elasticity of different product configurations. We define price elasticity as:

$$\frac{\%\Delta\ Quantiy}{\%\Delta\ Price}$$

In the section that follows, we report the results of our price sensitivity and elasticity analysis for standard and specialty CFLs and LEDs. In addition, we segment our results by CFL saturation rates (collected from our in-home audits) to assess whether households with different CFL usage rates respond differently to changes in the price of efficient bulbs.

We included four light bulb types in our market simulations: CFL, LED, halogen, and incandescent. To properly calibrate our market simulator, the evaluation team used data from our PY6 in-store shelf survey to set price levels to reflect the current average price of an LED, halogen, and incandescent bulb in AIC territory.[32] We also calibrated the other product attributes (yearly energy cost, bulb life, turn-on capabilities, and light color) to characterize the typical CFL, LED, halogen, and incandescent bulb found in stores. To assess price sensitivity, we set up our market simulation to vary the price of the CFL, while holding constant all other product configurations. We use the results of our sensitivity analysis as data points to assess average price elasticity. We show price elasticity as a number. For example, a price elasticity equal to 0.50 means that for every 10% drop in price, there will be 5% increase in market share.[33]

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[31] The results of our relative importance calculations are in Appendix E.

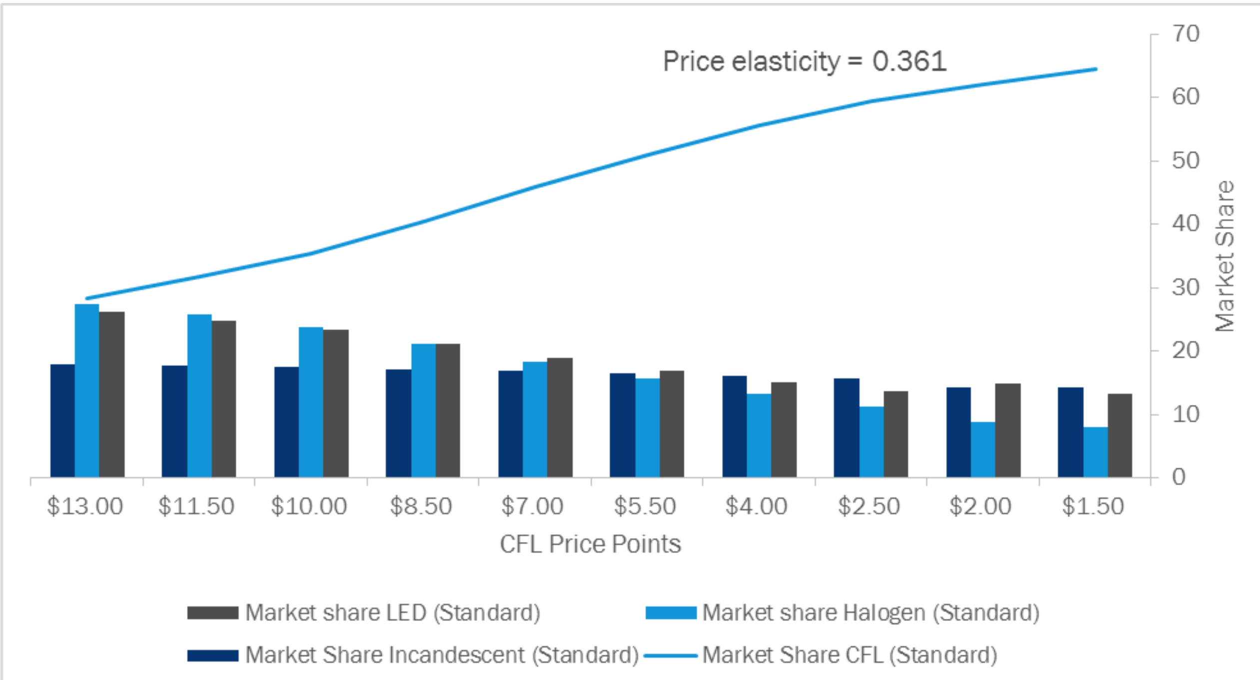
[32] Though lighting prices can change rapidly, we conducted the two studies very close together so the prices used in the consumer preference study should reflect current market prices. We collected pricing data through the shelf stocking study from late March to early May 2014. We conducted the consumer preference study in June and July 2014.

[33] An elasticity (in absolute value) closer to 0 is considered low or relatively inelastic, while an elasticity closer to or greater than 1 is considered high or relatively elastic (Simon and Blume, 1994).

Standard CFLs and LEDs

We display the results of our analysis for standard CFLs in Figure 14. The upward-sloping line reflects the change in CFL market share as the price of a CFL bulb decreases. The bars below the line represent the market shares for an average-priced LED, halogen, and incandescent bulb at each CFL price point.

Figure 14. Price Sensitivity and Average Price Elasticity for Standard CFLs

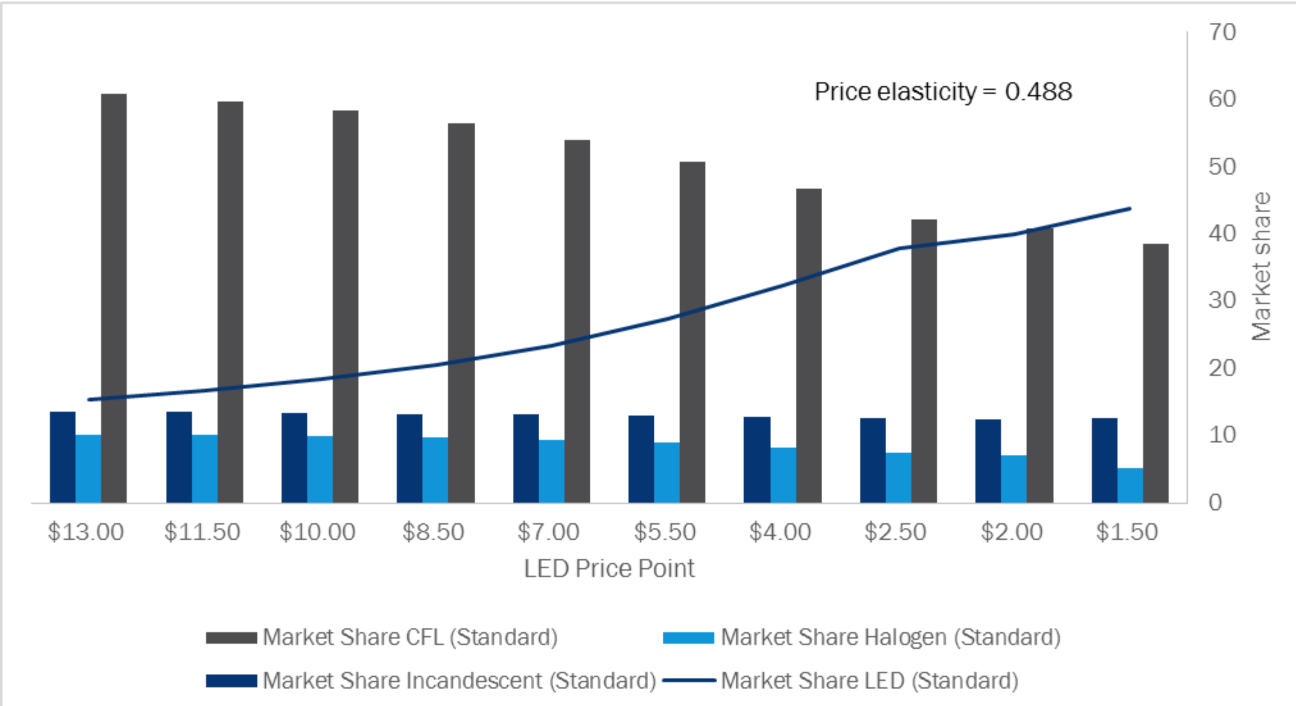


The results of our market simulation show price sensitivity for standard CFLs to be low, with customers preferring standard CFLs to alternative lighting options even at relatively high price points. In fact, CFLs capture a majority market share even when priced above $5 per bulb. Our calculation of the average price elasticity also demonstrates a strong preference for CFLs. We calculate the average price elasticity to be low at 0.361, which indicates that for every 10% increase in bulb price, market share of CFLs will decrease only by 3.6%. These results are consistent with our in-store intercept interviews, which also report a strong preference for standard CFLs among those purchasing bulbs. Our intercept survey results show that more than two-thirds of customers interviewed purchased a CFL for their standard bulb needs.

The results from the market simulation also show what customers would purchase if they chose not to buy a CFL at a given price point. We find that the market share for incandescent bulbs remains relatively flat across different CFL price points, while the share of LEDs and halogens only slightly increases at higher CFL prices. These results indicate that standard LEDs, at current market prices, are not a clear substitute for standard CFLs at higher CFL price points.

The evaluation team further explored the potential market for standard LEDs in AIC territory. Specifically, we used the market simulator to explore a scenario where the AIC lighting program shifted budget from standard CFLs and instead chose to discount standard LEDs. Figure 15 reports the change in market share as the price of standard LEDs decreases, while holding other lighting products at their current market prices.

Figure 15. Price Sensitivity and Average Price Elasticity for Standard LEDs

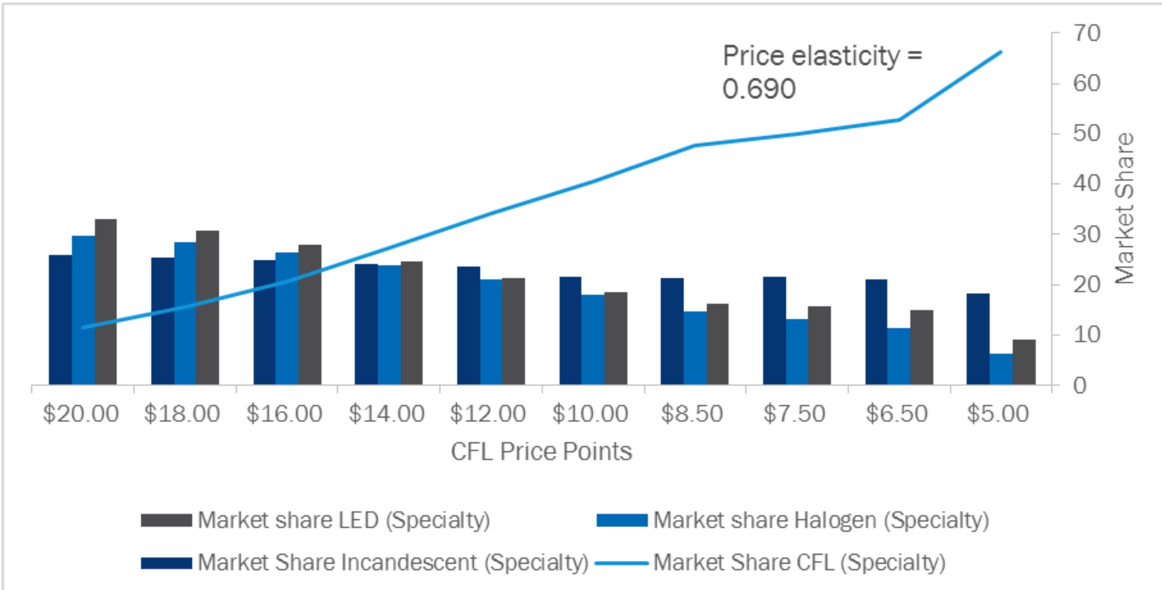


For standard bulbs, we find that LEDs are slow to capture majority market share even at relatively low prices (less than $3). Even at their lowest price point ($1.50), standard LEDs fail to reach 50% market share. In total, these results suggest that AIC customers are generally satisfied with standard CFLs and as a result, they are slower to adopt LEDs.

Specialty CFLs and LEDs

The evaluation team also used the market simulator to examine the market for specialty CFLs and LEDs. Figure 16 provides the results for our market simulation of specialty CFLs.

Figure 16. Price Sensitivity and Average Price Elasticity for Specialty CFLs



In contrast to standard bulbs, we find that specialty CFLs have higher price sensitivity and average price elasticity, indicating that customers are more willing to purchase these bulbs only when they are set at relatively low price points. In other words, AIC customers appear to be far more discriminating when it comes to specialty bulb purchases. The greater price sensitivity and higher average price elasticity for specialty CFLs is consistent with the findings from our in-store intercepts and in-home audits showing that specialty CFLs continue to face barriers to usage among AIC customers. Our market simulation also shows that customers are more likely to prefer less-efficient bulb technologies when replacing a specialty bulb. Specifically, we report higher market shares for both specialty halogens and incandescents (across each CFL price point) when compared to the standard versions of these bulbs. As noted previously in this report, this may reflect a lack of awareness of efficient specialty bulb options or a general dissatisfaction specifically with specialty CFLs (e.g., light quality, bulb appearance). The evaluation team further explored this point by assessing the market for specialty LEDs.

Figure 17 shows the results of a market simulation in which we vary the price of specialty LEDs while holding constant all other lighting products at their current market prices. We see that specialty LEDs capture a majority market share at a much faster rate than standard LEDs, suggesting that customers are more likely to purchase an LED when replacing a specialty bulb. Moreover, we find that even when we price specialty LEDs several dollars above that of the average-priced specialty CFL (i.e., between $7 and $10), LEDs still outpace CFL market share. These results also suggest that LEDs may serve as an effective substitute for CFLs in the specialty bulb market. Our simulations show that as the price for LEDs decrease, the market share of CFLs steadily decline while the share of halogens and incandescents remain relatively flat.

Figure 17. Price Sensitivity and Average Price Elasticity for Specialty LEDs

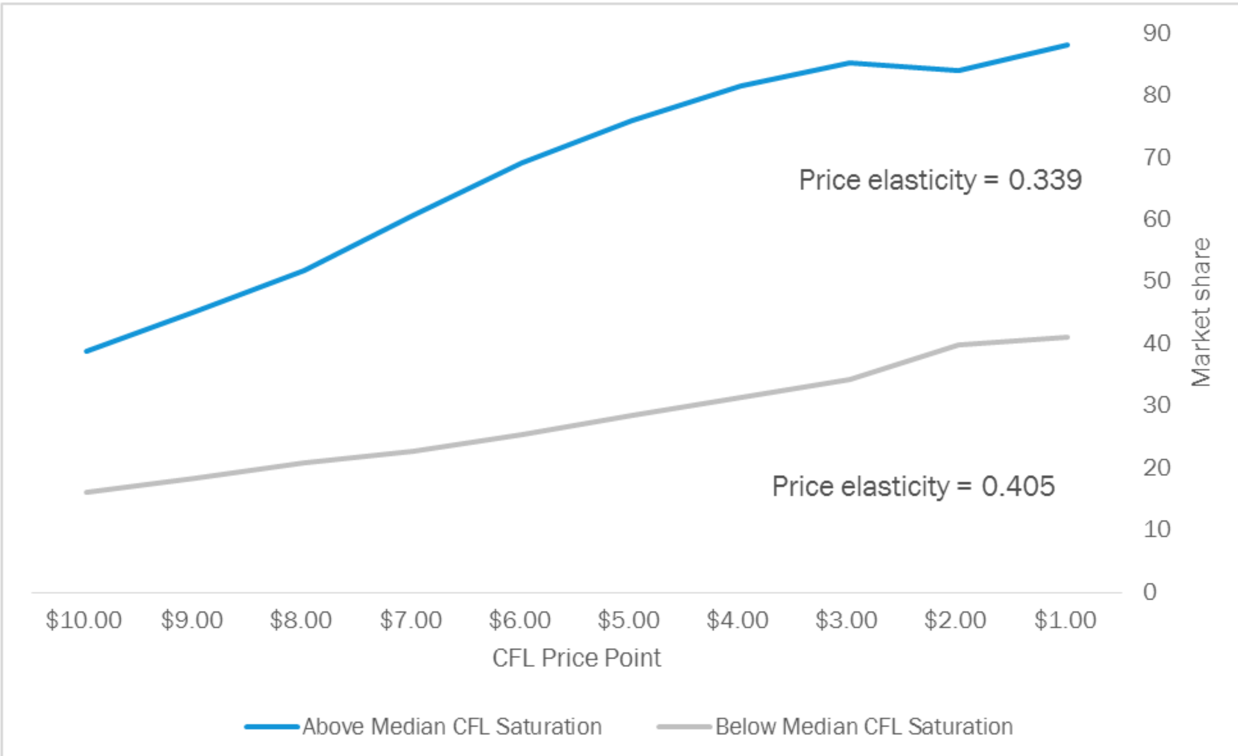
Our in-home audits provide additional evidence that customers seem resistant to specialty CFLs and may be looking for an alternative. We found that only 16% of specialty sockets contained a CFL in 2014, which is unchanged from 2012 when we conducted a similar study.

Segmentation Analysis Based on CFL Household Saturation

The shelf stocking study and in-store customer interviews identified several barriers to CFL usage among AIC customers. To understand how to address these barriers, the evaluation team used data from our market simulations and our in-home lighting audits to assess whether households with low and high CFL saturation levels differ in terms of price sensitivity and average price elasticity. The findings from this analysis can help assess whether changing incentive levels for CFLs will help to capture additional market share for a customer segment that has, to this point, largely failed to adopt CFLs for their home.

To conduct this analysis, the evaluation team leveraged our in-home audit data to conduct separate market simulations for households with above and below median CFL saturation levels. We summarize these results in Figure 18, which shows the price sensitivity and the average price elasticity for standard CFLs for above and below median CFL saturation households.

Figure 18 Price Sensitivity and Average Price Elasticity for Above/Below Median CFL Saturation



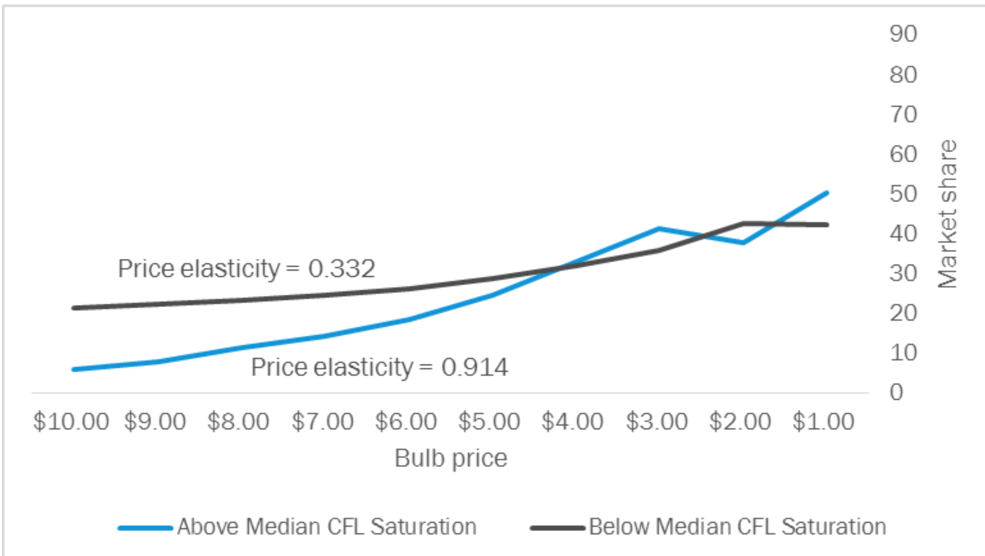
Surprisingly, we find very little difference in the slope (or average price elasticity) of CFL purchases between above and below median CFL saturation households, thus suggesting that both sets of customers maintain similar levels of price sensitivity toward standard CFLs. However, we do see large differences in the willingness-to-pay (WTP) for standard CFLs between these two groups. In other words, we find that at each CFL price level, above median CFL saturation households are much more likely to purchase CFLs compared to those below the median CFL saturation level.

These results indicate that reducing CFL prices further will not encourage a significant increase in CFL purchases among below median CFL saturation households. We see that even at a $1.50 price point, standard CFL market share for below median households is just barely over 40%. As we showed previously when we examined CFL saturation levels by different demographic groups and household characteristics, customers with lower CFL saturation rates tend to skew older and have higher incomes. We also found they tend to be single-family homeowners and live in larger homes. However, once we controlled for the percentage of sockets in the home that required a specialty bulb, only age and the percentage of specialty sockets were associated with CFL saturation.

These differences are somewhat understandable. Older adults may be less comfortable with new technologies and slower to change. In addition, we have seen from across all of our research that customers are slower to use specialty CFLs. However, we have yet to determine whether customers with below median CFL saturation are dissatisfied with CFLs specifically or whether these customers are less likely to purchase energy-efficient bulbs more generally. To explore this question, the evaluation team conducted a second set of market simulations for above and below median CFL saturation households, this time for standard LEDs. To the extent that below median households prefer inefficient bulbs generally, we expect to see our market simulations for standard LEDs yield a similar set of results to that of our CFL simulations above (see Figure 18).

Figure 19 provides the price sensitivity and average price elasticity for standard LEDs for both above and below median CFL saturation households. Our results show that while, there are some differences in the average price elasticity, the WTP for LEDs for below median households is roughly equivalent to (and at times higher than) above median households. Similarly, as the price of LEDs decrease, we see a convergence in LED market share across both segments. These findings suggest that below median CFL saturation households are not less willing to adopt efficient lighting technology in general. Rather, our results point to potentially higher dissatisfaction with CFLs among below median households, which likely accounts for the relatively low WTP values observed in our simulations. As a result, we expect that increased incentive levels for LEDs will help drive efficient lighting purchases for this customer segment.

Figure 19 Price Sensitivity and Average Price Elasticity for Above/Below Median CFL Saturation



In summary, when segmenting the sample by CFL saturation, we found that customers who have CFL saturation below the median (and therefore are a useful segment to target in a future program):

- Are unlikely to significantly increase their CFL purchases even if CFL prices are reduced.
- Are not averse to efficient lighting, but appear to be more dissatisfied with CFLs in general.

Customers with below median CFL saturation are not committed to incandescents or halogens; they simply do not like CFLs. LEDs may be a good alternative for this customer segment as prices continue to drop and LEDs become a cost-effective option for the program.

4.2 Impact Assessment

4.2.1 Program Data Verification

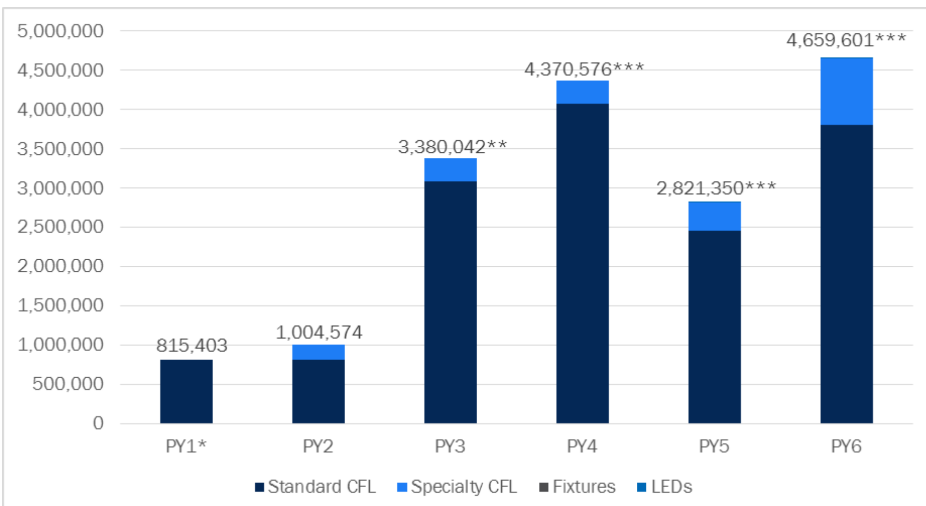
We verified program participation by examining the product sales data for product eligibility and time of sale. Our review of the program-tracking data found that all product sales were made during the eligible time period for eligible products. For a few products, we found that the count of bulbs sold was based on the number of packs sold instead of the total number of bulbs sold, which undercounts bulbs sold in multi-packs. We adjusted the sales to reflect total bulb sales. We also found some inconsistencies between the bulb description and the bulb type classification. For example, we identified several 15-watt standard twist bulbs misclassified as specialty. We corrected these classifications for the final evaluation results.

We also examined the program data to ensure that the appropriate base wattage was used to calculate program savings for each product. The program used a lumens-based approach as recommended by the Statewide TRM Version 2 to calculate savings. However, some of the underlying assumptions regarding hours of use, waste heat factors, baseline wattages and in-service rates did not align with the values provided in the Statewide TRM Version 2. We provided a detailed list of differences between the program-tracked values and the TRM values in the earlier Evaluation Methods section.

4.2.2 Program Participation

The program sold 4,659,601 bulbs in PY6, which is more than any other single program year and 65% more than were sold in PY5. Figure 20 shows program sales from PY1 through PY6. The figure shows increasing sales of bulbs until PY4, a significant drop in PY5 due to a reduction in program goals, and a rebound to the increasing sales trajectory pattern in PY6.

Figure 20. Total Bulbs Sold PY1–PY6



* 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.

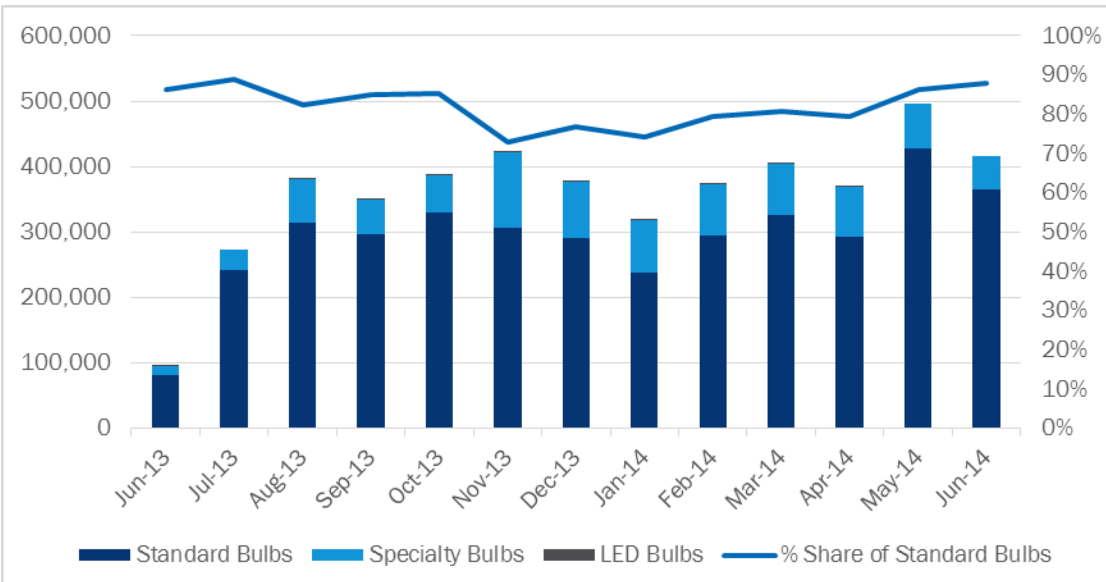
The program sold nearly all bulbs through the markdown program at retailers. The web store sold a very small number of bulbs, though it sold more LEDs than either standard or specialty CFLs (see Table 20). As in previous years, the vast majority of bulbs sold in PY6 were standard CFLs (82%). However, the program sold significantly more specialty CFLs in PY6 compared to any of the previous program years, both in absolute and percentage terms (see Figure 20, above). The program sold approximately 490,000 more specialty CFLs in PY6 compared to PY5 (18% of all sales in PY6 compared to 13% in PY5).

Table 20. PY6 Bulb Sales by Type and Sales Channel

Bulb Type	Markdown	Web Store	Total
Standard CFL	3,808,116	323	3,808,439
Specialty CFL	850,195	250	850,445
LEDs	0	717	717
Total	4,658,311	1,290	4,659,601

Figure 21 shows that the increase in the share of specialty CFLs sold started in November of the PY6 program cycle and continued throughout the rest of the program year.

Figure 21. PY6 Monthly Bulb Sales by Type



Sales by Bulb Type and Shape

Part of the reason the program sells fewer specialty CFLs than standard CFLs is that fewer light sockets need a specialty bulb. However, as we reported previously, specialty CFL saturation lags behind that of standard CFLs and has not increased during the past two years. Table 21 shows program sales by bulb shape. Interior reflector bulbs are the most frequently purchased specialty bulb followed by A-line bulbs.

Table 21. Specialty Bulbs Installed in AIC Homes Compared to Purchased and Discounted

Bulb Type	Total Bulbs Sold	Total Market Share
Standard		
Standard	3,808,439	82%
Specialty		
Interior Reflector	320,323	7%
A-Line	223,866	5%
Globe	154,389	3%
Candelabra	106,364	2%
Three-Way	27,169	< 1%
Exterior Reflector	10,168	< 1%
High Output Spiral	4,252	< 1%
Dimmable Spiral	3,180	< 1%
Post Light	732	< 1%
Bug Light	2	< 1%
LEDs		
A-Line	717	< 1%

Sales by Store Category

As in past years, the majority of program-discounted bulbs were sold at big box retailers and DIY stores. The biggest change in sales over the past two years has been the increase in the sales at discount stores and independent hardware stores, which has been an area of emphasis for the program (see Table 22). Over the past two years, the percentage of bulbs sold at big box retailers has dropped from 65% to 54% while the percentage sold at discount stores has increased from 2% to 10%. According to program staff interviews, the discount stores also began selling some products they were not selling prior to their participation in the program.

Table 22. Bulb Sales by Retailer Type

Program Year	PY4		PY5		PY6	
Store	**Bulbs**	**% of Sales**	**Bulbs**	**% of Sales**	**Bulbs**	**% of Sales**
Big Box*	2,820,055	65%	1,548,276	55%	2,504,400	54%
DIY	1,412,077	32%	957,731	34%	1,377,808	30%
Discount	94,707	2%	143,154	5%	479,644	10%
Independent Hardware	31,139	1%	24,885	1%	155,048	3%
Grocery Store	10,350	< 1%	72,974	3%	77,091	2%
Online Store	1,738	< 1%	1,742	< 1%	1,290	< 1%
Drug Store	510	< 1%	72,588	3%	64,320	1%
Total	4,370,576	100%	2,821,350	100%	4,659,601	100%

*Includes Warehouses

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. In PY6, the baseline wattage for bulbs in the 1,050–1,489 lumen range dropped from 75 watts to 53 watts, but this affected only 7% of bulbs sold (see Table 23). Combined with 100-watt equivalent CFLs, which were first affected in PY5, savings are lower on 21% of bulbs sold through the program.

A majority of standard CFLs sold in PY6 (75%) were in the 750–1,049 lumens range, which is equivalent to a 60-watt incandescent and not currently affected by EISA. In PY7, the program will experience the full impact of EISA when these bulbs along with 40-watt equivalent CFLs must use EISA-compliant halogens to calculate first-year savings. If sales in PY7 are the same as PY6, savings will be 22% lower than in PY6. Across all wattages, savings will be 28% less than pre-EISA levels.

Table 23. Program Bulb Sales by Wattage

Lumens Range	Number of Bulbs Sold	Percent of Bulbs Sold with Each Bulb Category
Standard		
310-749	136,886	4%
750-1,049	2,857,824	75%
1,050-1,489	266,831	7%
1,490-2,599	546,746	14%
2,600+	152	< 1%
Specialty		
Less than 310	540	< 1%
310-749	412,110	48%
750-1,049	384,067	45%
1,050-1,489	18,429	2%
1,490-2,600	31,479	4%
2,601+	2,931	< 1%
2,601+*	889	< 1%
LEDs		
310-749	176	25%
750-1,049	541	75%

*68 Watt Bulbs

4.2.3 Gross Impacts

Table 24 outlines the ex ante and ex post gross savings for the PY6 Residential Lighting Program. Because some bulbs sold are stored for later use, an installation adjustment factor is required to calculate the gross savings achieved in PY6. We used the method outlined in the Statewide TRM Version 2 that banks savings from PY6 sales for application in future years. The ex post gross savings achieved in PY6 and shown in Table 24 are the result of sales made in PY4 and PY5 but installed in PY6 and of sales made in PY6 and installed in PY6. The program tracking database did not apply an installation rate in its calculations of PY6 savings; ex ante savings are based on all bulbs sold in PY6.

Table 24. PY6 Residential Lighting Program Gross Impacts

Sales Year – Install Year	Energy (MWh)		Demand (MW)	
	Ex Ante	Ex Post	Ex Ante	Ex Post
PY4 – Year 3	-	25,828	-	3.39
PY5 – Year 2	-	21,235	-	2.33
PY6 – Year 1	187,776	147,602	19.81	18.37
Total PY6 Gross Savings	187,776	194,665	19.81	24.09
PY6 Achieved Gross Realization Rate	1.04		1.22	

Note: Realization Rate = Ex post Value / Ex ante Value.

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

- The program savings method assumes that 100% of program sales are installed in residential spaces. Our evaluation determined that 4% of bulbs are installed in commercial spaces, which have greater hours of use and different waste heat factors. As a result, ex post gross savings are 11.6% higher than ex ante gross savings for both energy (MWh) and demand (MW).
- The program savings method uses an In-Service-Rate (ISR) of 1.00, which assumes that 100% of bulbs purchased in PY6 are installed in PY6. Our evaluation uses the carryover method outlined in the Statewide TRM Version 2 and assumes a first year ISR value of 0.695 and includes savings from a portion of sales made in PY4 and PY5 but not installed until PY6. For sales of PY6 bulbs, ex post energy savings (MWh) are 29.2% lower and ex post demand savings (MW) are 4.2% lower than ex ante energy and demand savings as a result of the first year ISR. For sales of PY4 and PY5 bulbs installed in PY6, ex post energy savings (MWh) are 25.1% higher and ex post demand savings (MW) are 28.9%. Combined, ex post gross energy savings (MWh) are 4.1% lower and ex post gross demand savings (MW) are 24.7% higher than ex ante gross savings due to the application of the carry over savings method.
- The program savings method uses different hours of use (HOU) than the Statewide TRM Version 2 recommends. Our evaluation uses the HOU provided in the Statewide TRM Version 2, which are higher for standard bulb types and, in most cases, lower for specialty bulb types. As a result, ex post gross energy savings (MWh) are 14.3% higher than ex ante gross savings.
- The program savings method uses lumens to determine base wattages, but used a different conversion than that provided in the Statewide TRM Version 2. Some program base wattages were too high and some too low so that across all sales the impact was small. In addition, our audit of lumen values identified incorrect values for two products, resulting in different base wattages for less than 0.01% of bulbs sold. Combined, ex post gross savings are 1.1% higher than ex ante gross savings for both energy (MWh) and demand (MW).
- For some products in the program-tracking database, the count of bulbs sold was based on the number of packs sold instead of the total number of bulbs sold, which undercounts bulbs sold in multi-packs. The effect on savings was minor; ex post gross savings are approximately 0.01% more than ex ante gross savings for both energy (MWh) and demand (MW).

- The program savings method does not use waste heat factors in the ex ante savings calculations. The evaluation team applied the waste heat factors recommended in the Statewide TRM Version 2 to calculate ex post energy and demand savings. As a result, ex post gross energy savings (MWh) are 6.2% higher and ex post gross demand savings (MW) 11.5% higher than ex ante gross savings.
- The program savings method uses different summer peak coincidence factors than the Statewide TRM Version 2 recommends. Our evaluation team applied the TRM-recommended values to the evaluated demand savings. As a result, ex post gross demand savings (MW) are 23.2% higher than ex ante gross savings.
- The evaluation team also reassigned some bulb categories based on model numbers and descriptions (i.e., standard to specialty, specialty to standard, and specialty types). As a result, we used different values for HOU, base wattages, and waste heat and coincidence factors.
- The program savings methods does not account for bulbs sold to non-AIC customers. We applied an overall leakage rate of 11%, which accounts for AIC-discounted bulbs sold to non-AIC customers as well as bulbs discounted by other utilities but purchased by AIC customers. As a result, ex post gross energy (MWh) and demand (MW) savings are 11% lower than ex ante savings.

Appendix A contains additional details about the savings assumptions we used to calculate program savings. It also contains an attached document that provides, for each product sold through the program, the program tracking data we received and assumptions the program used to calculate ex ante savings compared to the final corrected data and assumptions we used to calculate ex post savings.

Table 25 provides the savings values from sales made in PY6 that are realized in PY6 and the savings that will carry over to PY7 and PY8 due to their later installation. As discussed earlier, the Statewide TRM Version 2 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 PY6 bulb sales, we used post-EISA baseline wattages for PY7 and PY8 installations of 100-, 75-, 60- and 40-watt-equivalent CFLs.

Table 25. PY6 Residential Lighting Sales Yearly Gross Impacts

Measure	Energy (MWh)			Demand (MW)		
	PY6	PY7	PY8	PY6	PY7	PY8
Standard CFLs	119,085	18,745	15,946	14,95	2.35	2.00
Specialty CFLs	28,481	3,583	3,045	3.41	0.43	0.36
LEDs	36.48	0.91	0.74	0.004	0.000089	0.000073
Total	147,602	22,329	21,338	18,37	2.78	2.37

4.2.4 Net Impacts

We applied an NTGR of 0.47 to the gross ex post MWh and MW estimates in Table 26 to calculate PY6 ex post net savings. The NTGR was estimated in PY5, and this is the first year it is being applied to the gross savings. Program tracked net savings used an NTGR of 0.44.[34]

Table 26. PY6 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	82,621	91,493	8.72	11.32
PY6 Net Savings Realization Rate	1.11		1.30	

Note: Realization Rate = Ex post Value / Ex ante Value.

The Residential Lighting Program's realization rate for net energy savings is 1.11, and its realization rate for net demand savings is 1.30. The differences between ex ante and ex post net savings are due to the reasons cited above in the discussion of gross savings.

5. Future Planning

As part of our in-home lighting study and in-store lighting customer interviews, we conducted research to update key inputs to the algorithm used to calculate residential lighting program savings. The inputs include a program in-service rate, bulb installation location breakdown between residential and commercial locations, a program leakage rate, and a program NTG ratio. We provide the results below with additional details in Appendix B.

In-Service Rate

Using 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 (see Table 27). Given the high price of LEDs and the lack of available data, we recommend a 100% first year installation rate for LEDs until more research can be conducted.

Table 27. Recommended Installation Rates for AIC

Bulb Type	First Year	Second Year	Third Year	Final
Standard CFLs	76%	12%	10%	98%
Specialty CFLs	81%	9%	8%	98%
LEDs (medium screw-based)	100%	--	--	100%

[34] The 0.44 NTGR comes from a draft memo reporting results of in-store customer intercepts. In our final PY5 report, we provided an updated and revised NTGR of 0.47.

Residential versus Commercial Installations

As an upstream program run through retailers, both residential and commercial customers can purchase program-discounted CFLs. The Statewide TRM Version 2 provides different savings assumptions for residential versus commercial installations of CFLs but does not provide guidance on the percentage of bulbs sold to different customer types. Based on our in-store customer interviews, we determined that customers install 96% program-discounted bulbs in residential locations and 4% in commercial locations (see Table 28).

Table 28. Bulb Installation Location

Location	Percentage
Residential	96%
Commercial	4%

Program Leakage

We found that 15% of program-discounted bulbs were purchased by customers of another utility. Table 29 lists 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.

Table 29. Program Bulbs Purchased by Electric Utility Provider

Utility	Percent
Ameren Illinois	85%
Illinois Rural Electric	3%
Southwestern Electric	3%
Ameren Missouri	1%
Other[35]	9%
Total	**100%**

It is also necessary to estimate the number of bulbs that are likely leaking into AIC territory so the most accurate overall estimate of leakage is applied to program savings. AIC shares a border with Ameren Missouri, ComEd, and utilities in Indiana, all of which run upstream programs. Using the 2% leakage rate from the evaluation of the ComEd residential lighting program,[36] we estimated that AIC customers purchased 190,317 discounted CFLs from other utility programs, which is equivalent to 4% of PY6 sales.

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[35] These other utilities individually made up less than 1% of program bulb purchases. They are Adams Electric, City of Shelbina, Clinton County Electric, Coles Moultrie, ComEd, Corn Belt Energy, City Water, Light & Power, Dayton Power and Light, Eastern Illini Electric, Highland Power, Kansas City Power and Light, Knoxville Utility Board, Louis County Rural Electric, Macon Electric, Mascoutah City, McDonough Power, Missouri Electric, MJM Electric, Northeast Power, Ozark Electric, Rantoul Village, Ralls County Electric, Spoonriver Electric, Tri County Electric, Tennessee Valley Authority, Waterloo, Wayne White Electric, We Energy, and Western Illinois Electric.

[36] Navigant Consutling, Inc. Commonwealth Edison, PY5 Residential Utility ENERGY STAR Lighting Program Evaluation, 2013.

We recommended an overall leakage rate that combines leakage out as well as leakage in. Based on our estimates of both factors, we estimate an overall leakage rate of 11%.

Net-to-Gross Ratio

With a free ridership rate of 0.36 and no spillover, the overall program NTGR is 0.64, as seen in Table 30.

Table 30. Residential Lighting Program NTGR

Concept	Standard (n=286)	Specialty (n=70)	Overall (n=332)
Free Ridership	0.37	0.28	0.36
Spillover	0	0	0
NTG	0.63	0.72	0.64

6. Conclusions and Recommendations

The Residential Lighting Program ran smoothly in PY6. The program met its goals and sold more CFLs than any previous program year. The program had realization rates greater than 1.00 for gross and net energy and demand savings.

We conducted several studies that provide information about the state of the lighting market in AIC territory. The studies all indicate that the program has successfully moved the market for CFLs. CFL saturation has increased steadily over the past four years, and AIC has one of the highest CFL saturation rates in the country. However when we investigated more deeply, we find that this success is limited to standard CFLs. The increase in CFL saturation is due entirely to increased use of standard CFLs while use of specialty CFLs has remained flat. Moreover, nearly two-thirds of customers purchasing specialty CFLs at retailers that sell program-discounted specialty CFLs, purchase incandescents or halogens.

The program made some strides in this area in PY6. Program administrators increased the incentives on specialty CFLs, which in turn caused the percentage of specialty CFLs sold to increase from 13% in PY5 to 18% in PY6. Despite this growth in sales, our research suggests that significant barriers remain. Within this context, we make the following recommendations for program improvement.

- **For standard bulbs, keep incenting standard CFLs and do not make the switch to standard LEDs.** AIC Customers are satisfied with standard CFLs and most are not willing to switch to LEDs unless prices drop much lower than current market prices. The program would need to discount standard LEDs heavily to encourage customers to purchase the bulbs at the rates they purchase standard CFLs. At this discount level, the program is not likely to be cost-effective.
- **Keep incentives for standard CFLs at their current level.** Incentives for CFLs are still important. Because AIC customers purchase incandescents and halogens at higher rates when they are stocked alongside program-discounted CFLs, removing incentives from standard CFLs would likely cause many customers to switch to a less efficient product. Without discounts, our stocking study showed that CFLs cost more than EISA-compliant halogens. Because incandescents are still available in the most

commonly purchased wattage (i.e. 60 watts), it is too soon to say if customers will purchase CFLs if they cost more than halogens when incandescents are no longer available.

- **For specialty bulbs, consider switching incentives from CFLs to LEDs.** Our research shows that specialty CFLs are a hard sell but LEDs are a viable alternative. Between the drop in market prices and the longer life of LEDs, specialty LEDs could be a cost-effective alternative to specialty CFLs. Our consumer preference study showed that more consumers prefer LEDs to CFLs when LED prices reach $10 a bulb. Our in-store stocking study found that the average price for specialty LEDs was much higher than $10, but this price was across a range of bulb types. There may be some LED types, such as reflectors, that are more common and have lower market prices. Prices are also dropping rapidly. AIC could continue to provide increased incentives for specialty CFLs as well as increased education on the specialty CFL options available and sales would likely continue at the PY6 improved rate. Yet there is a risk that customers who purchase these bulbs will be dissatisfied and resist future purchases of efficient specialty bulbs, including LEDs. If market pricing allows, our research suggests that the program would benefit by switching these incentives to specialty LEDs.

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- **Consider some changes to participating store selection to reduce program leakage.** The evaluation found that 15% of program-discounted bulbs are being purchased by non-AIC customers. Much of AIC's leakage is due to customers of municipal utilities purchasing AIC-discounted bulbs. Given the location of these utilities, this problem could be challenging to address. We recommend conducting additional research with more rigorous methods in PY8 to confirm the leakage rate found in PY6. This research will also identify the store locations that have the greatest impact on leakage so that program administrators can consider whether they should continue to keep these locations in the program.

- **Use the methods outlined in the approved Statewide TRM to calculate program savings.** Program administrators improved the program tracking systems between PY5 and PY6 and began tracking all of the necessary information to calculate savings using the method outlined in the Statewide TRM Version 2. However, the program did not follow the method outlined in the TRM and used different savings assumptions. Using the methods outlined in the TRM approved for the program year will aid in program tracking and routine reporting.

A. Appendix – Gross Impact Assumptions

In this appendix, we provide details on the savings assumptions for each quantity used to estimate gross electric and demand savings. The appendix also contains an attached Excel file that provides, for each product sold through the program, the program tracking data we received and assumptions the program used to calculate ex ante savings compared to the final corrected data and assumptions we used to calculate ex post savings.

Base Wattage – EISA Compliance

The baseline wattages in the Statewide TRM Version 2 are based on the lumen output and the year the bulb is installed, as shown in Table 31. For example, 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. EISA affected CFLs in the top two lumen ranges in PY6. To calculate the carry over savings of bulbs purchased in PY6 that will be installed in PY7 and PY8, we used the post-EISA baselines for all wattages.

Table 31. Baseline Wattages for Calculation of Gross Savings after EISA

Minimum Lumens	Maximum Lumens	Incandescent Equivalent Pre-EISA 2007 (WattsBase)	Incandescent Equivalent Post-EISA 2007 (WattsBase)	Effective Date from which Post-EISA 2007 Assumption Should Be Used
1,490	2,600	100	72	June 2012
1,050	1,489	75	53	June 2013
750	1,049	60	43	June 2014
310	749	40	29	June 2014

The program-tracking data provided the lumens per bulb, and the evaluation team was able to match and verify the program-tracked base wattages using Table 31.

Hours of Use (HOU)

For the 96% of bulbs sold to residential customers, we applied the residential HOU assumptions, and for the 4% of bulbs sold to commercial entities we applied the commercial HOU assumptions from the Statewide TRM Version 2 (see Table 32). The TRM provides different HOU assumptions for different bulb types. It also provides HOU assumptions for A-Line LEDs in residential settings, which we used as inputs to the residential HOU assumption.

Table 32. Statewide TRM Version 2 Hours of Use Assumptions

Bulb Type	Program Tracked	Residential	Commercial
Standard			
Standard	885	938	3,198
Specialty			
Dimmable Spiral	921	897	3,198
Three-Way	921	897	3,198
A-Line	963	938	3,198
High Output Spiral	963	938	3,198
Interior Reflector	963	938	3,198
Globe	1,274	1,240	3,198
Candelabra	1,364	1,328	3,198
Bug Light	1,768	1,825	4,903
Exterior Reflector	1,768	1,825	4,903
Post Light	1,768	1,825	3,198
LEDs			
A-Line	963	1,010	3,198

Waste Heat Factors

The Statewide TRM Version 2 provides different WHFe values for different installation locations (such as single family, multifamily in unit, multifamily common area, exterior, etc.) (see Table 33). For electric savings, we used a WHFe of 1.06 for the 96% of bulbs installed in residential locations and 1.24 for the 4% installed in commercial locations.[37] Bulb types that customers would normally install in exterior locations take on a value of 1.00 because these bulbs do not affect the heated areas of a building.

[37] The TRM provides a large variety of waste heat factors for commercial installations based on building type. Because we do not know the installation locations of bulbs sold to commercial customers, we followed the TRM guidelines and chose the WHFe for miscellaneous buildings.

Table 33. Waste Heat Factor of Energy Savings by Bulb Type

	Program Tracked	Ex-Post Residential	Ex-Post Commercial
Bulb Type	WHFe	WHFe	WHFe
Standard			
Standard	1.0	1.06	1.24
Specialty			
A-Line	1.0	1.06	1.24
Bug Light	1.0	1.00	1.00
Candelabra	1.0	1.06	1.24
Dimmable Spiral	1.0	1.06	1.24
Exterior Reflector	1.0	1.00	1.00
Globe	1.0	1.06	1.24
High Output Spiral	1.0	1.06	1.24
Interior Reflector	1.0	1.06	1.24
Post Light	1.0	1.06	1.24
Three-Way	1.0	1.06	1.24
LEDs			
A-Line	1.0	1.06	1.24

For demand savings, we used a WHFe of 1.11 for the 96% of bulbs installed in residential locations and 1.46 for the 4% installed in commercial locations, as seen in Table 34. As with electric savings, bulbs that we assume to be installed in exterior locations take on a value of 1.00 because they do not affect the heated areas of a building.

Table 34. Waste Heat Factor of Demand Savings by Bulb Type

	Program Tracked	Ex-Post Residential	Ex-Post Commercial
Bulb Type	WHFd	WHFd	WHFd
Standard			
Standard	1.0	1.11	1.46
Specialty			
A-Line	1.0	1.11	1.46
Bug Light	1.0	1.00	1.00
Candelabra	1.0	1.11	1.46
Dimmable Spiral	1.0	1.11	1.46
Exterior Reflector	1.0	1.00	1.00
Globe	1.0	1.11	1.46
High Output Spiral	1.0	1.11	1.46
Interior Reflector	1.0	1.11	1.46
Post Light	1.0	1.11	1.46
Three-Way	1.0	1.11	1.46
LEDs			
A-Line	1.0	1.11	1.46

Coincidence Factors

The Statewide TRM Version 2 provides different peak coincidence factors based on installation location. For the 96% of bulbs sold to residential customers, we applied the residential factors, and for the remaining 4% we applied the commercial factors from the Statewide TRM Version 2 (see Table 35). The TRM provides a coincidence factor only for standard CFLs installed in commercial locations, so we applied the standard CFL coincidence factor to all commercial installations except bug lights and exterior lighting. 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 used the coincidence factor for standard CFLs for these LEDs.

Table 35. Statewide TRM Version 2 Coincidence Factor Assumptions

Bulb Type	Program Tracked	Ex-Post Residential	Ex-Post Commercial
Standard			
Standard	0.094	0.095	0.66
Specialty			
Three-Way	0.088	0.081	0.66
Dimmable Spiral	0.087	0.081	0.66
Interior Reflector	0.102	0.095	0.66
A-Line	0.102	0.095	0.66
High Output Spiral	0.102	0.095	0.66
Globe	0.124	0.116	0.66
Candelabra	0.120	0.122	0.66
Bug Light	0.178	0.184	0.00
Exterior Reflector	0.178	0.184	0.00
Post Light	0.178	0.184	0.66
LEDs			
A-Line	0.102	0.09	0.66

AIC Residential
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B. Appendix – 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 inputs include installation location, program leakage, in-service rate, and attribution.

Installation Location

The Residential Lighting Program is an upstream program that discounts efficient lighting at participating retailers. This program delivery mechanism makes it impossible to require that the people who purchase the discounted bulbs are AIC customers who will install them in a residential location. AIC cannot claim savings for bulbs sold to non-AIC customers, but AIC can claim additional savings for bulbs that will be installed in commercial facilities because of their longer operating hours. The in-store survey contained questions that we used to estimate the percentage of bulbs sold to non-AIC customers and the percentage of bulbs that will be installed in non-residential locations.

Residential versus Commercial Installations

We asked customers if they intended to install the bulbs in a home or business. If a business, we further asked for the type of business, and if a rental property, inquired as to whether the bulbs would be installed in a common area or a tenant unit. We classified the installation of bulbs in tenant units as residential installations. 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 96% of discounted bulbs would be installed in residential locations and 4% in commercial locations, as seen in Table 36.

Table 36. Bulb Installation Location

Location	Percentage
Residential	96%
Commercial	4%

In-Service Rate

Of the total number of incandescent light bulbs in our study, 79% were in use, while the remaining 21% were in storage. This is a decrease from PY4 when 85% of incandescent bulbs were in use. The overall in-service rate for CFLs is slightly lower, at 77%, indicating little change in the CFL ISR since PY4 (78%). CFL in-service rates vary by bulb type. Specialty CFLs have a higher ISR than standard CFLs (82% compared to 76%).

Table 37. In-Service Rates

Bulb Type	2012		2014	
	N (Homes)	In Service Rate	N (Homes)	In Service Rate
Incandescent	221	85%	221	79%[A]
CFL	210	78%	216	77%
Standard CFL	203	76%	212	76%
Specialty CFL (All non-twist)	95	88%	75	82%[A]
A-Lamp CFL	*	*	30	85%
Other Specialty CFL	*	*	61	81%

[A] Difference between 2012 and 2014 is significant at the 0.1 alpha level; * Data not reported for 2012

Based on these results, we recommend a first year installation rate of 76% for standard CFLs and 82% for specialty CFLs. This is the same first-year installation rate we recommended for standard CFLs in 2012. The recommended first-year installation rate for specialty CFLs is slightly lower than in 2012, reflecting their lower in-service rate.

Using the carryover method outlined in the 2012 Illinois Statewide TRM, we assumed 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 (see Table 38). 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 38. Recommended Installation Rates for AIC

Bulb Type	First Year	Second Year	Third Year	Final
Standard CFLs	76%	12%	10%	98%
Specialty CFLs	81%	9%	8%	98%
LEDs (medium screw-based)	100%	--	--	100%

Net-to-Gross Ratios

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 PY8. We used the in-store interviews to estimate program free ridership, and the in-home study to estimate program spillover.[38] We describe the methods used for free ridership and spillover below, and provide results for both.

[38] We collaborated with the ComEd evaluation team when conducting this research. We used the same survey instrument to interview customers in stores. The algorithm we used to calculate free ridership was similar though not identical to that used by the ComEd team.

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. 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 asked what customers would have purchased if the CFLs were more expensive, and referenced the average per-bulb discount. We asked 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 composed of two scores: a quantity score, and 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 said 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 indicating not a free rider and 1 indicating a full free rider. Table 39 further outlines this scoring method.

Table 39. Program Discount Free Ridership Score: Quantity

Question	Response	Program Discount Free Ridership Score
(Q37stan/spec) If the Ameren discount had not been offered, and the X standard CFL(s) you are purchasing had instead cost approximately $1.25/$3.00 more PER BULB, or a total of $X more, would you still have purchased all of these standard/specialty CFLs, some of them, or none of them?	All	1.0
	Some	Go onto Question 25
	None	0.0
(Q37stan2/spec2) How many of the X standard/specialty CFLs would you have purchased if they had cost $1.25/$3.00 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 were given a score of 0. Customers who would have purchased less-efficient bulbs if the CFLs cost more were also given a value of 0. Customers who would have not purchased a less-efficient bulb are given a value of 1. Table 40 further outlines this scoring method.

Table 40. Program Discount Free Ridership Score: Efficiency

Question	Response	Program Discount Free Ridership Score
(Q38stan/spec) Would you have purchased a different type of light bulb instead of the standard/specialty CFL(s)?	Yes	Go to QH28 or QH33
	No	1
(Q38stan2/spec2) What type of light bulbs would you have purchased instead of standard/specialty 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 converted this scale so it ranges from 0 to 1, and reversed 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 was based solely on their program discount score. Table 41 details how the program information score is calculated.

Table 41. Program Information Free Ridership Score

Question	Response	Program Information Free Ridership Score
(Q41stan/spec) 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 standard/specialty 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 PY6 program sales to produce an overall free ridership score that represents all bulbs sold through the program.

Free Ridership Results

As we discussed in the methodology section, to gain access 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 hours was 0.31. The free-ridership of customers who purchased lighting during the demonstration was 0.15 compared to 0.36 for those who purchased lighting absent the demonstration (see Table 42). Because of the magnitude of this difference, we used the free ridership estimate from interviews conducted during non-demonstration hours in the store to calculate the program NTG ratio because this better represents the normal store environment.[39]

We also calculated free ridership separately for purchases of standard and specialty bulbs. Free ridership was lower for specialty bulbs. The free ridership estimate for those who purchased standard light bulbs without the demonstration present was 0.37 compared to 0.29 for those who purchased specialty light bulbs.

Table 42. Program Free Ridership

Day Type	Standard Free Ridership (n=377)	Specialty Free Ridership (n=95)	Overall Free Ridership (n=439)
All Hours	0.32	0.24	0.31
Demonstration Hours	0.15	0.13	0.15
Non-Demonstration Hours[a]	0.37	0.28	0.36

[39] We conducted 76% of the interviews when a demonstration was not taking place.

Spillover

We used the results from the in-home lighting audits conducted in AIC customers' homes in 2012 and 2014 to estimate potential program spillover. The method involves estimating the number of CFLs in AIC homes in both years, and comparing the change 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.

We conducted a similar analysis in 2012 by comparing the results of that study to one conducted in 2010. We did not find any evidence of spillover in 2012, but the 2010 study was conducted using a slightly different method and had a smaller sample size, which we felt might have affected the result. However, once again we did not find any potential spillover by comparing the 2014 study results to 2012. Though we found more CFLs in AIC homes in 2014 than we did in 2012, the program sold an even greater number of bulbs between these two years than our study found. Given the number of CFLs that the program sold between 2012 and 2014, CFL saturation should have increased from 33% in 2012 to 45% in 2014.[40] Instead, CFL saturation increased to 38%, which is still one the highest rates in the country.

Recent evaluations of programs in other areas have found similar results. For example, CFL saturation in Massachusetts has plateaued for the past several years despite the residential lighting program selling millions of bulbs during the same period.[41] We recommend conducting additional research to determine what customers are doing with the bulbs they are purchasing through the program.

Another method that could be used to estimate spillover is the in-store customer interviews. We interviewed 33 customers who purchased CFLs that were not discounted by the AIC program. Unfortunately, this sample is too small to produce a reliable estimate. We also believe that restricting spillover estimation to purchases made at participating retailers is a partial estimate of spillover.

Net-to-Gross Ratio

The program NTG ratio is calculated as:

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

With a free ridership rate of 0.36 and no spillover, the overall program NTGR is 0.64, as seen in Table 43.

Table 43. Residential Lighting Program NTGR

Concept	Standard (n=286)	Specialty (n=70)	Overall (n=332)
Free Ridership	0.37	0.28	0.36
Spillover	0	0	0
NTG	0..63	0.72	0.64

[40] This saturation estimate takes into account leakage, sales to commercial customers, and placing bulbs in storage.

[41] NMR Group, Inc. June 7, 2013. Final Results of the Massachusetts Onsite Lighting Inventory submitted to Cape Light Compact, NSTAR, National Grid, Unitil, Western Massachusetts Electric, and Energy Efficiency Advisory Council Consultants.

C. Appendix – Cost Effectiveness Inputs

Program Leakage

There is no way for the program to require lighting buyers 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).

The location of the retailer relative to other utility territories should affect the leakage rate. Therefore, we constructed and applied a weight using the distance of our store sample to AIC borders relative to the larger population of participating stores.

We found that 15% of program-discounted bulbs were purchased by customers of another utility. Table 44. Program Bulbs Purchased by Electric Utility Provider**Error! Reference source not found.** lists 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.

Table 44. Program Bulbs Purchased by Electric Utility Provider

Utility	Percent
Ameren Illinois	85%
Illinois Rural Electric	3%
Southwestern Electric	3%
Ameren Missouri	1%
Other[42]	9%
Total	**100%**

The program leakage rate varied by retailer type. Leakage was highest at warehouse stores and lowest at big box stores.

[42] These other utilities individually made up less than 1% of program bulb purchases. They were Adams Electric, City of Shelbina, Clinton County Electric, Coles Moultrie, ComEd, Corn Belt Energy, City Water, Light & Power, Dayton Power and Light, Eastern Illini Electric, Highland Power, Kansas City Power and Light, Knoxville Utility Board, Louis County Rural Electric, Macon Electric, Mascoutah City, McDonough Power, Missouri Electric, MJM Electric, Northeast Power, Ozark Electric, Rantoul Village, Ralls County Electric, Spoonriver Electric, Tri County Electric, Tennessee Valley Authority, Waterloo, Wayne White Electric, We Energy, and Western Illinois Electric.

Table 45. Leakage by Retailer Type

	Leakage
DIY	12%
Big Box	6%
Warehouse	22%

AIC has a challenging territory because it encompasses a large number of municipal cooperatives. However, for our sample of stores, distance to the territory border does not predict leakage very well. Stores that were between three and five miles from another utility had the highest leakage rate (see Table 46. Leakage by Distance to AIC Border**Error! Reference source not found.**). The sample size is too small to examine the leakage rate by border distance by retailer type to determine whether customers are more willing to drive longer distances to some store types than others.

Table 46. Leakage by Distance to AIC Border

Distance to Border	Leakage Rate
< 3 Miles	11%
3 – 5 Miles	20%
5-10 Miles	13%
10+ Miles	18%

Because AIC did not have a map of its territory that showed its borders with municipal cooperatives, we had to estimate the approximate location of municipal cooperatives using the addresses of AIC residential customers. We assumed that any zip code without AIC customers indicated the presence of a municipal cooperative. Despite our best attempts to identify the location of other utilities relative to participating retailers, we are not confident that we have a good understanding of AIC's borders, which might explain the lack of relationship between territory borders and leakage.

CFLs from other utility programs may also be leaking into AIC territory though fewer bulbs are likely leaking in than are leaking out. Most of AIC's leakage is going to customers of municipal cooperatives, most of which do not have lighting programs. Still, it is important to estimate the number of bulbs that are likely leaking in so the most accurate overall estimate of leakage is applied to program savings. AIC shares a border with Ameren Missouri, ComEd, and utilities in Indiana, all of which run upstream programs. Recent evaluations of the Ameren Missouri and ComEd programs suggest that these programs have little leakage going to AIC customers. However, the intercept surveys used to estimate leakage included few, if any, stores near the AIC border. Therefore, we do not think these studies accurately estimate leakage to AIC. ComEd evaluations have traditionally found a 2% leakage rate. If past evaluations had conducted intercepts near the AIC border, it is reasonable to assume a similar leakage rate into AIC. AIC comprises approximately one-third of ComEd's border with other utilities. If we assume that ComEd bulbs leak equally into surrounding territories, AIC customers would have purchased approximately 95,158 bulbs discounted through the ComEd program in

PY6.[43] It is reasonable to assume a similar number of bulbs coming into AIC from Ameren Missouri and Indiana for a total of 190,317 bulbs, which is equivalent to 4% of AIC PY6 sales.

Based on our estimates of both leakage out as well as leakage in, we applied an overall leakage rate of 11% to gross savings.

Heating Penalty Methods

The heating penalty represents the increase in gas usage because of the additional space heating needed due to the reduction of waste heat generated by the more efficient lighting.[44] The penalty is used in the analysis of program cost effectiveness. The Statewide TRM Version 2 provides different algorithms to calculate the heat penalty for residential and commercial installations.

For residential homes:

$$Year\ 1\ \Delta\ Therms = \left[\frac{(Base\ Watt_{2013} - Bulb\ Watt)}{1000} \times ISR_{res,yr1} \times HOU_{res} \times HF_{res} \times 0.03412\right] \Big/ \eta Heat$$

Where:

Base Watt = EISA complaint base wattage in 2013
Bulb Watt = Actual wattage of installed CFL bulb
ISR = First year In-Service Rate
HOU = Hours of Use
HF = Heating Factor or percentage of light savings that must be heated
0.03412 = Conversion factor from kWh to Therms
ŋHeat = Efficiency of heating system.

For commercial facilities:

$$Year\ 1\ \Delta\ Therms = \frac{(Base\ Watt_{2013} - Bulb\ Watt)}{1000} \times ISR_{com,yr1} \times HOU_{com} \times IFTherms_{com}$$

Where:

Base Watt = EISA complaint base wattage in 2013
Bulb Watt = Actual wattage of installed CFL bulb
ISR = First year In-Service Rate
HOU = Hours of Use
IFTherms = Lighting-HVAC Integration Factor for gas heating impacts; this factor represents the increased gas space heating requirements due to the reduction of waste heat rejected by the efficient lighting.

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[43] ComEd sold 11,090,725 CFLs in PY6, which amounts to 288,359 bulbs sold to non-ComEd customers with a 2% leakage rate. One-third of this total is 95,158 bulbs.

[44] We follow the direction of the Statewide TRM Version 2 and assume all homes are gas heated since we do not have information on the heating fuel of customers' homes. Thus, we only calculate a gas-heating penalty.

To calculate the weighted program heat penalty, we apply both the residential and commercial savings algorithms outlined in the Statewide TRM Version 2 and multiply them by the probability of being installed in each location. Our weighted savings equation is:

$$Year\ 1\ \Delta\ Therms = 0.11 \times 0.96 \times \left[\frac{(Base\ Watt_{2013} - Bulb\ Watt)}{1000} \times ISR_{res,yr1} \times HOU_{res} \times HF_{res} \times 0.03412\right] \Big/ \eta Heat$$

$$+ 0.11 \times\ 0.04 \times \left[\frac{(Base\ Watt_{2013} - Bulb\ Watt)}{1000} \times ISR_{com,yr1} \times HOU_{com} \times IFTherms_{com}\right]$$

Where:

Res = Residential values
Com = Commercial values

To calculate the heating penalty for PY6 purchases that will be installed during the next two years we simply apply the in-service rate (ISR) for year 2 and year 3 and modify the base wattage for the bulb to be EISA complaint:

$$Year\ 2\ \Delta\ Therms\ Heat\ Penalty = 0.11 \times 0.96 \times \left[\frac{(Base\ Watt_{2014} - Bulb\ Watt)}{1000} \times ISR_{res,yr2} \times HOU_{res} \times HF_{res} \times 0.03412\right] \Big/ \eta Heat$$

$$+ 0.11 \times 0.04 \times \left[\frac{(Base\ Watt_{2014} - Bulb\ Watt)}{1000} \times ISR_{com,yr2} \times HOU_{com} \times IFTherms_{com}\right]$$

$$Year\ 3\ \Delta\ Therms\ Heat\ Penalty = 0.11 \times 0.96 \times \left[\frac{(Base\ Watt_{2015} - Bulb\ Watt)}{1000} \times ISR_{res,yr3} \times HOU_{res} \times HF_{res} \times 0.03412\right] \Big/ \eta Heat$$

$$+ 0.11 \times 0.04 \times \left[\frac{(Base\ Watt_{2015} - Bulb\ Watt)}{1000} \times ISR_{com,yr3} \times HOU_{com} \times IFTherms_{com}\right]$$

Heat Penalty Related Factors

The heating factors represent the increased gas space heating needed due to the reduction of waste heat generated by the more efficient lighting. The Statewide TRM Version 2 provides different factors based on installation location.

Table 47. Heating Penalty Factors for Calculating Gas Heat

Bulb Type	Ex-Post Residential Heating Factor (HF)	Ex-Post Commercial Lighting-HVAC Integration Factor
Standard		
Standard	0.49	0.014
Specialty		
A-Line	0.49	0.014
Bug Light	0.00	0.000
Candelabra	0.49	0.014
Dimmable Spiral	0.49	0.014
Exterior Reflector	0.00	0.000
Globe	0.49	0.014
High Output Spiral	0.49	0.014
Interior Reflector	0.49	0.014
Post Light	0.49	0.014
Three-Way	0.49	0.014
LEDs		
A-Line	0.49	0.014

Heating Penalty Results

The gas-heating penalty that results from the additional space heating needed due to the reduction of waste heat generated by more efficient lighting is shown in Table 48.

Table 48. Gas Heating Penalty

Measure	Heating Penalty (Therms)		
	PY6	PY7	PY8
Standard CFLs	-2,477,826		-331,785
Specialty CFLs	-582,036	-73,212	-62,230
LEDs	-760	-20	-17
Total	-3,060,623	-463,270	-394,032

D. Appendix – In-Home Lighting Assessment

In this appendix, we provide additional results from the In-Home Lighting Assessment.

Awareness of Installed CFLs and LEDs

Surveys are often used to estimate lighting penetration and saturation rates because they are less expensive to conduct than site visits. A comparison of the responses from the telephone recruitment for the site visits with actual data from the site visits shows the inaccuracies of self-reported lighting penetration and the value of in-home lighting audits. As part of the site visit recruitment survey, we asked respondents who were aware of CFLs whether they currently had any CFLs installed in the interior or exterior of their home. Eighty-seven percent of respondents reported that they had CFLs installed, 10% reported that they did not, and 2% reported that they were not sure.[45] During the site visits, we found that nearly all respondents who said they had CFLs installed actually did (98%), while all three of those who were unsure did have CFLs installed. However, we found that 84% of respondents who said they *did not* have any CFLs installed actually did have at least one installed, indicating that even those who report that they are familiar with CFLs may not realize that they have CFLs in their own home.

We also found inconsistencies between our self-report and site visit data for LEDs, but instead of under-reporting usage as we found with CFLs, we found respondents over-reported LED use. Only 34% of respondents who said they had medium screw-based LEDs installed (n=29) actually had one installed. Of the three respondents who reported that they were aware of LEDs but not sure if they had a medium screw based LED, none had an LED. Finally, we also found that 1% of the 145 people who reported not having a medium screw-based LED installed actually had one installed.

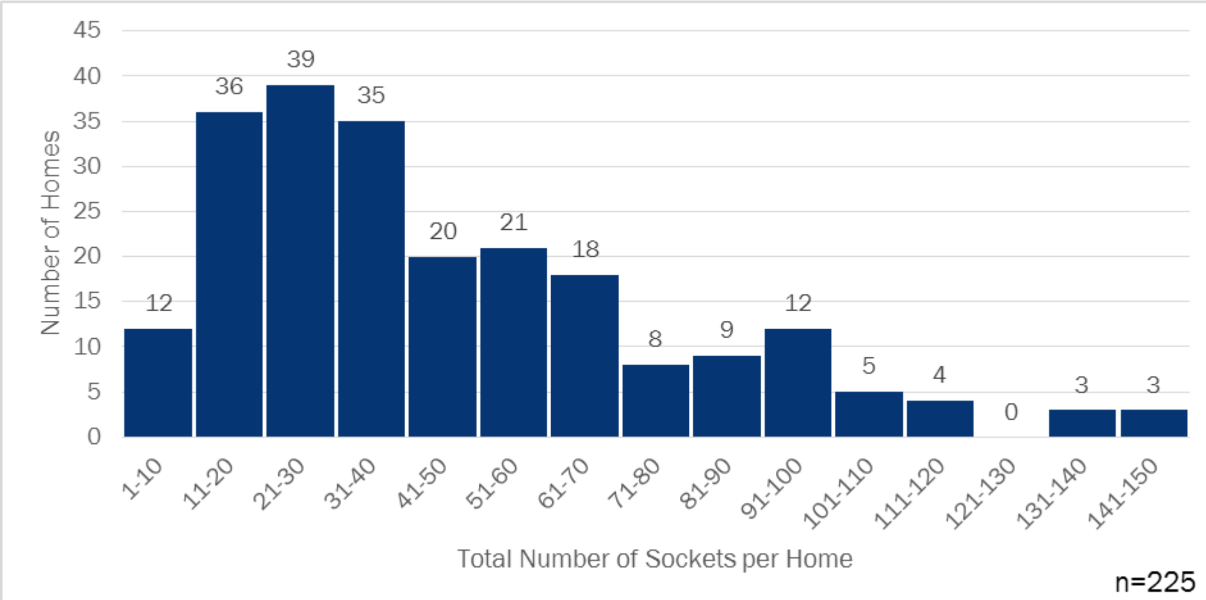
Total Sockets

Based on our in-home audit data, the average home in AIC territory has 47 bulbs in use.[46] The number of bulbs in use per home varies significantly from a low of seven sockets to a high of 146. Each bar in Figure 22 displays the number of homes with the designated number of bulbs in use.

[45] Does not add to 100% due to rounding.

[46] The median number of bulbs in use is 38.

Figure 22. Distribution of Bulbs in Use per Home



CFL Usage by Room Type

The evaluation team examined bulb saturation rates by room type. We found that CFL saturation is highest in living areas (46%) and dining rooms (45%). Conversely, offices (57%), bedrooms (54%), and bathrooms (54%) have the highest concentration of incandescent light bulbs in interior rooms. Fluorescent lighting is most commonly found in garages and basements, while saturation rates for LEDs and halogens were very low in all rooms.

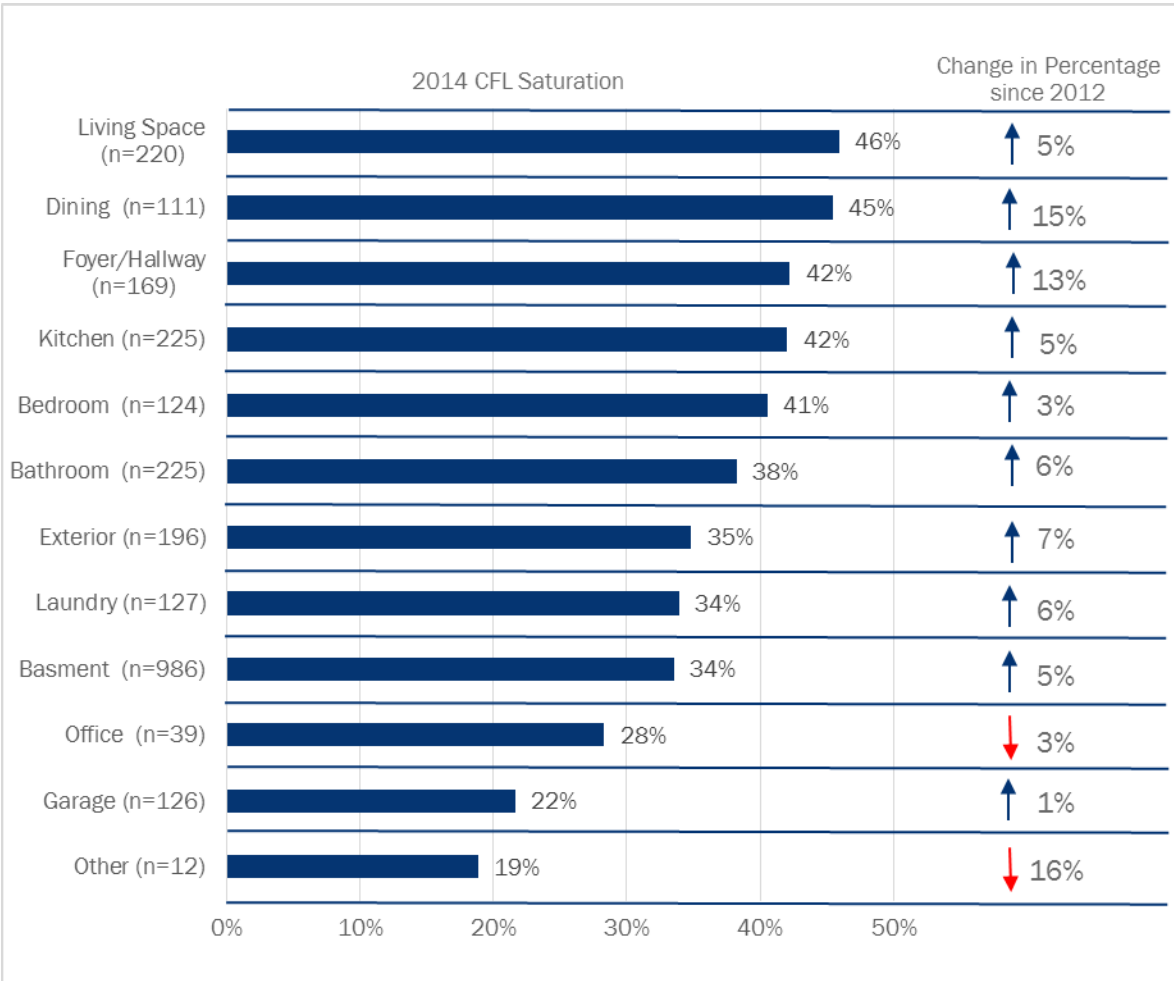
Table 49. Bulb Saturation Rates by Room Type

Room Type	N[1]	Average Bulbs per Room	Bulb Type				
			Incandescent	CFL	Halogen	LED	Fluorescent
Basement	98	9.4	43%	34%	1%	0%	22%
Bathroom	225	3.9	54%	38%	2%	1%	2%
Bedroom	224	3.5	54%	41%	1%	0%	2%
Dining	111	4.2	48%	45%	2%	0%	1%
Exterior	196	4.2	58%	35%	3%	2%	0%
Foyer/Hallway	169	2.4	51%	42%	3%	1%	3%
Garage	126	6.3	50%	22%	0%	1%	27%
Kitchen	225	5.5	38%	42%	4%	1%	14%
Laundry	127	1.8	53%	34%	0%	0%	12%
Living space	220	4.8	46%	46%	2%	1%	1%
Office	39	3.3	57%	28%	4%	0%	7%
Other	21	3.6	73%	19%	5%	0%	3%

[1]The number of homes with at least one of this type of room

The evaluation team also tracked changes over time in CFL saturation rates by room type. We compared the 2014 CFL saturation rates to those reported in 2012 and found that dining rooms and foyers/hallways had the largest increase in CFL saturation since 2012 (see Figure 23).

Figure 23. CFL Saturation Rates by Room Type and Year



Change in Percent Reported in Percentage Points

Bulb Wattage

During the in-home audit, the evaluation team collected information on the wattage of all bulbs in living rooms and kitchens (the two rooms where we expected the greatest saturation of CFLs) in order to investigate whether bin jumping might be taking place.[47] There is anecdotal evidence that consumers may

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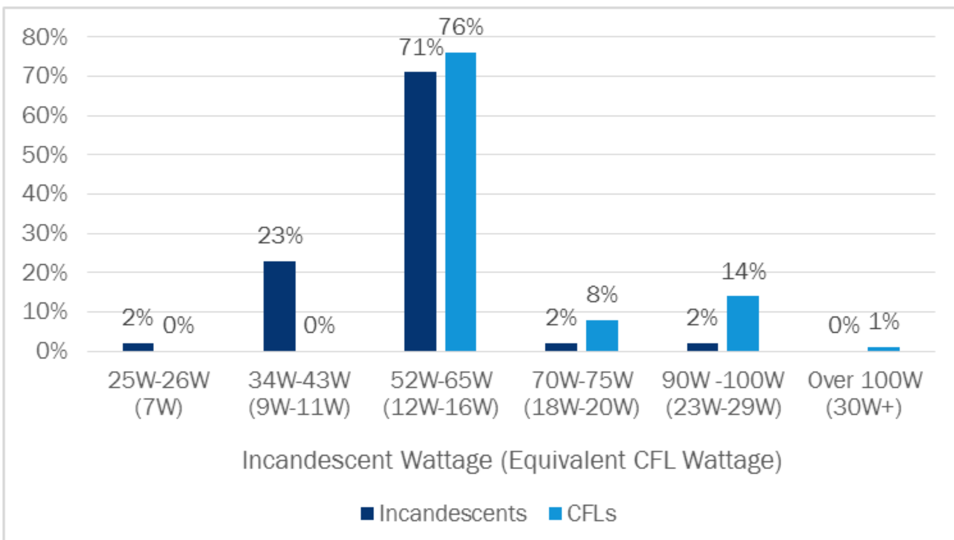
[47] Collecting wattages can be challenging since the wattage information is sometimes not visible on the bulb without unscrewing the bulb. Bulbs can also be in fixtures that we would require disassembly to see the wattage. We instructed auditors to only record wattage if they could do so *without* removing bulbs or taking apart fixtures. In kitchens, we obtained wattages for 74% of CFLs and 69% of incandescents in 2014 and 73% of CFLs and 71% of incandescents in in 2012. It was easier to identify wattages in living rooms where

be purchasing higher wattage CFLs than their incandescent wattage equivalencies to get the quality of light they associate with incandescents. For example, a consumer will replace a 75-watt incandescent with a 100-watt equivalent CFL instead of a 75-watt equivalent. The incandescent wattage equivalencies of CFLs are based on their lumen output, which is a measure of brightness. However, brightness is just one factor that influences how people perceive light. If many consumers are in fact bin jumping when purchasing CFLs, the energy savings associated with replacing an incandescent with a CFL would be less than expected and baseline wattages for energy savings may need to be adjusted.

If consumers are replacing incandescents with CFLs that produce equivalent lumens, we would expect the central tendency and distribution of CFL equivalent bulb wattages to be similar to those of incandescents. We find mixed evidence for potential bin jumping. The median incandescent bulb wattage in kitchens in 2014 was 60 watts compared to 14 watts for CFLs, which is equivalent. However, we did find differences in the distribution of wattages. We found few low-wattage CFLs (26-40 watt equivalent) in kitchens compared to 23% for incandescents bulbs. Moreover, we found more 100-watt equivalent CFLs compared to incandescents (14% compared to 2%).[48]

Figure 24 Bulb Wattage of Incandescents and CFLs in Kitchens



Note: Halogen and LED bulbs are not included in this analysis due to insufficient sample size.

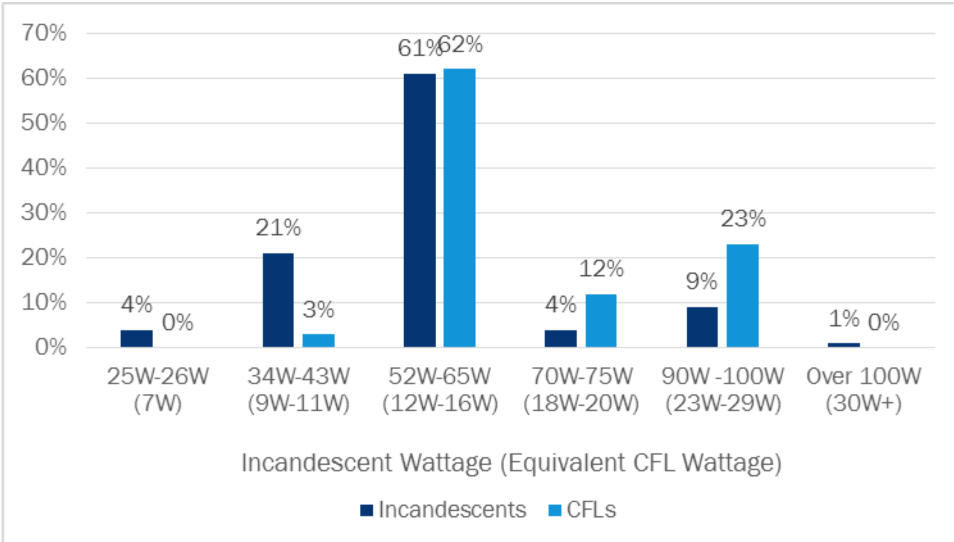
We found a similar pattern in the central tendency and distribution of bulb wattages for CFLs and incandescents in living rooms. Again, we see that the median wattage for incandescents and CFLs are equivalent (see Figure 25). However, once again we find a strong right skew in the distribution of CFL bulb wattages, which suggests that some differences do exist.[49]

we were able to collect wattages on 89% of CFLs in and 75% of incandescents in 2014, and 87% of CFLs and 76% of incandescents in 2012.

[48] These patterns are similar to those found in the 2012 study.

[49] These patterns are similar to those found in 2012 study.

Figure 25 Bulb Wattage of Incandescents and CFLs in Primary Living Rooms



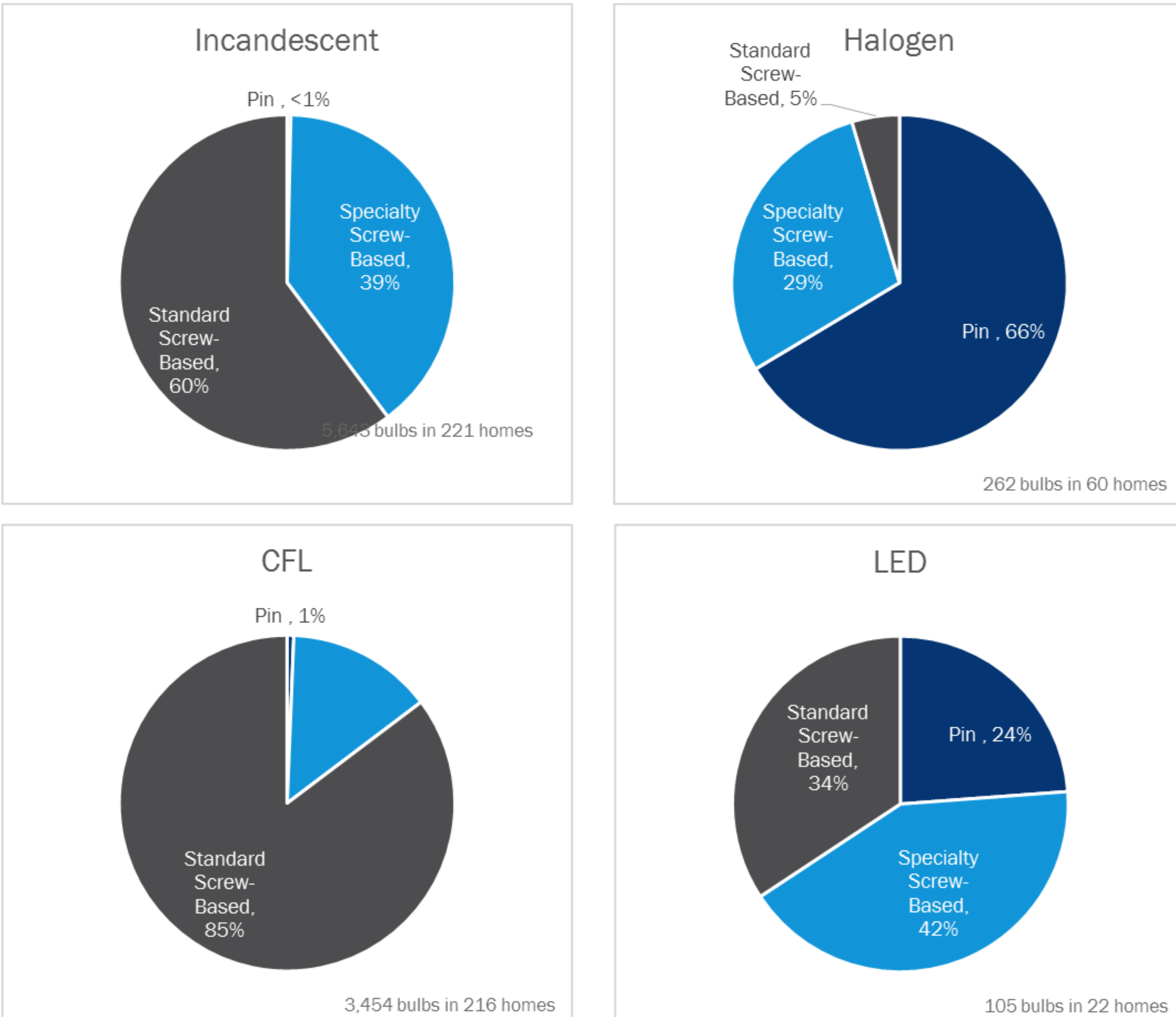
Note: Halogen and LED bulbs are not included in this analysis due to insufficient sample size.

Customer Usage of Different Bulb Technologies

Customers have been slower to adopt specialty CFLs, and some of the new lighting technologies may be more attractive to them as they become more widespread. To understand the types of bulbs (i.e., incandescent, CFL, halogen, LEDs) consumers are using for different lighting needs (i.e. standard, specialty, pin), we examined the socket types where each bulb technology was installed (see Figure 26). That is, for each bulb technology (i.e., incandescents, halogens, CFLs, and LEDs), we identified the socket types where customers were installing the bulbs.

We found that customers have installed nearly all incandescents and CFLs in screw-based sockets. A slight majority of incandescents (60%) are installed in standard screw-based sockets, while a large majority of CFLs (85%) are in standard sockets. AIC customers are using LEDs and halogens somewhat differently than incandescents and CFLs. Customers are using LEDs and halogens in pin-based as well screw-based sockets. In screw-based sockets, customers are more likely to use them for specialty lighting needs. This is opposite of what we found for incandescent and CFL use.

Figure 26. Types of Light Sockets by Different Bulb Technologies by Socket Type



E. Appendix – Consumer Preferences Study

Screenshots of Conjoint Survey

Standard bulb version

Assume that a light in your house that is used frequently has burned out and you need to replace the bulb. The light is not dimmable or three-way and takes a standard screw-in bulb of 60w or equivalent. You don't have a replacement bulb at home, so you need to purchase one. Finally, imagine that you need to install the bulb in a desk lamp that looks something like this:

We'll show you some different light bulbs and ask which one you would purchase. It is important you answer in the way you would if you were actually buying a light bulb. There is no "correct" answer as each person has different preferences and needs.

Ameren ILLINOIS

If these were your only options, which would you choose?

Choose by clicking one of the buttons below:

Light Bulb Type	CFL	LED	Halogen	Incandescent
Purchase Price	$2.00	$13.00	$1.50	$0.75
Yearly Energy Cost	$2.50	$1.75	$6.50	$10.00
Bulb Life	10 years	20 years	1 year	1 year
Turn On	Dim at first	Full brightness	Full brightness	Full brightness
Light Color	Cool White	Cool White	Warm White	Warm White

0% 100%

Specialty bulb version

Assume that a light in your house that is used frequently has burned out and you need to replace the bulb. The light is dimmable and uses a screw-in bulb of 65 watts if it were an incandescent bulb. You don't have a replacement bulb at home, so you need to purchase one. Finally, imagine that you need to install the bulb in a ceiling light fixture that looks something like this:

We'll show you some different light bulbs and ask ***which one you would purchase.*** *It is important you answer in the way you would if you were actually buying a light bulb*. There is no "correct" answer as each person has different preferences and needs.

Ameren ILLINOIS

If these were your only options, which would you choose?

Choose by clicking one of the buttons below:

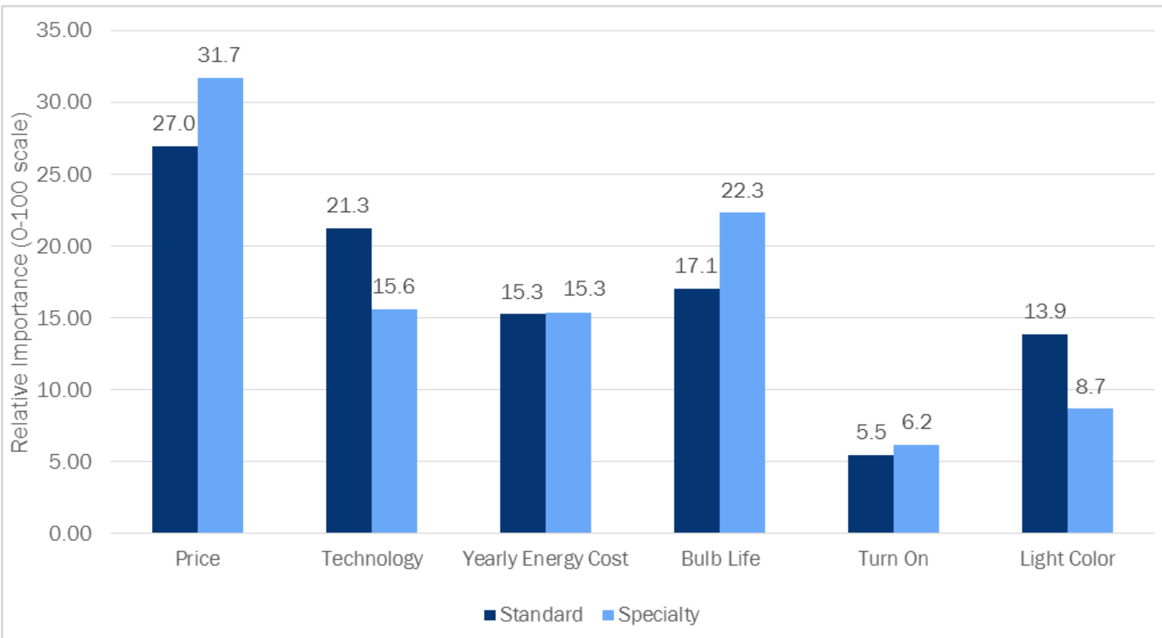
Light Bulb Type	LED	CFL	Halogen	Incandescent
Purchase Price	$20.00	$5.00	$8.50	$4.00
Yearly Energy Cost	$1.75	$2.50	$7.50	$11.00
Bulb Life	20 years	10 years	3 years	1 year
Turn On	Full brightness	Dim at first	Full brightness	Full brightness
Light Color	Cool White	Cool White	Warm White	Warm White

0% 100%

Relative Importance of Product Attributes

The evaluation team used the results from the conjoint survey to calculate relative attribute importance scores for both standard and specialty bulbs. We summarize this analysis in Figure 27. For both standard and specialty bulbs, we find price, bulb life, and bulb technology to be the three most important factors for customer decision-making. In contrast, light color and bulb turn-on capabilities were of low importance for both bulb types. Interestingly, we do see differences in the relative importance of attributes between bulb types (i.e., standard vs. specialty). Specifically, customers weight price and bulb life higher for specialty bulbs, while bulb technology and light color score higher for standard bulbs.

Figure 27. Relative Importance of Attributes by Bulb Type



The evaluation team also segmented relative importance scores by customer demographics, including age, CFL usage, education level, and gender. The results from these analyses yield no significant substantive differences.

F. Appendix – Data Collection Instruments

AIC Residential
Lighting PY6_ In-Sto

AIC Residential
Lighting PY6_ Myste

AIC Residential
Lighting PY6_Shelf S

AIU Conjoint
Instrument FINAL.dc

AIU Home Study
Auditor Instrument

AIU Lighting Study
Recruiter FINAL 201