NAVIGANT

Energy Efficiency / Demand Response Plan: Plan Year 3 (6/1/2010-5/31/2011)

Evaluation Report: Residential ENERGY STAR® Lighting

Presented to

Commonwealth Edison Company

May 16, 2012

Presented by

Randy Gunn
Managing Director

Navigant Consulting
30 S. Wacker Drive, Suite 3100
Chicago, IL 60606

phone 312.583.5700
fax 312.583.5701

www.navigantconsulting.com

Itron

ODC OPINION DYNAMICS CORPORATION

Michaels engineering

NAVIGANT

Submitted to:

ComEd
Three Lincoln Centre
Oakbrook Terrace, IL 60181

Submitted by:

Navigant Consulting, Inc.
30 S. Wacker Drive, Suite 3100
Chicago, IL 60606
Phone 312.583.5700
Fax 312.583.5701

Contact:

Randy Gunn, Managing Director
312.938.4242
Randy.Gunn@Navigant.Com

Jeff Erickson, Director
608.497.2322
Jeff.Erickson@Navigant.Com

Prepared by:

Amy Buege, Principal Energy Consultant
510.844.2873
amy.buege@itron.com

Tami Buhr, Director of Field Research
617.492.1400 ext. 254
tbuhr@opiniondynamics.com

NAVIGANT

Table of Contents

NAVIGANT

Section E. Executive Summary

This report presents a summary of the findings and results from the evaluation of ComEd's Residential ENERGY STAR® (ES) Lighting program in Program Year 2011 (PY3)[1]. The main goal of this residential lighting program is to increase the market penetration of energy efficient lighting within ComEd's service territory by offering incentives for bulbs purchased through various retail channels. The program also seeks to increase customer awareness and acceptance of energy efficient lighting technologies, as well as proper bulb disposal, through the distribution of educational materials.

E.1 Evaluation Objectives

The primary objectives of this evaluation are to quantify the gross and net energy impacts resulting from the Residential ES Lighting program and to assess program participants' prior awareness of compact fluorescent lamps (CFLs) and satisfaction with the program.

E.2 Evaluation Methods

Table E-1 provides a summary of the data collection activities conducted as part of the PY3 Residential ES Lighting Program evaluation. As this table shows, the data collection activities were quite extensive. The primary data collection activities included a series of in-depth interviews with program managers, program implementers and program trade allies (manufacturers and retailers); in-store intercept surveys with customers purchasing program and non-program bulbs; shelf surveys; and computer-aided telephone interviews (CATI) conducted with random samples of program participants and non-participants. Data collected during these interviews and surveys were essential in estimating gross and net savings parameters, and in evaluating the program from a process point of view.

[1] June 1, 2010 to May 31, 2011.

Table E-1. PY3 Data Collection Activities

Data Collection Type	Targeted Population	Sample Size	Timing
Tracking Data	Program Participants	All	Ongoing
On-Site Inventories / Metering	Program Participants	67	June 2010 - March 2411
In-Depth Phone Interviews	Program Manager	1	May 2011
	Program Implementer	1	May 2011
	Lighting Manufacturers	8 Attempts 8 Completes	March – May 2011
	Corporate Retailers	12 Attempts 5 Completes	April 2011
In-Store Intercept Surveys	Program and Non-Program Lighting Purchasers	496	February - June 2011
In-Store Shelf Surveys	Program Stores	8 Stores	March - July 2011
CATI Phone Surveys	Upstream Participants	305	June 2011
	Non-Participants	441	June 2011

Source: Navigant Evaluation Team

E.3 Key Impact Findings and Recommendations

The revised goal of the Residential ES Lighting program for PY3 was to sell 11.1 million[2] discounted CFLs and CFL fixtures to residential customers within ComEd's service territory. A total of 9,893,196 standard CFL bulbs, 1,217,723 specialty CFL bulbs and 86,943 fixtures were sold as part of the program for a grand total of 11,197,862 bulbs. Table E-2 below provides the TRM verified and evaluation estimated gross and net savings parameter estimates (displaced watts, average daily hours of use, in-service rate, and net-to-gross ratio), as well as the first-year gross and net savings estimates. The TRM verified estimates reflect deemed values for average displaced watts, hours of use, and peak load coincidence factor. The evaluation verified savings estimates, by contrast, are derived from independent values for these same parameters, developed using both data collected in the current evaluation and information derived from reviews of other studies. Both the TRM-verified and evaluation-estimated values in this table are overall averages across all bulb types (standard, specialty and fixtures) and include an adjustment for the bulbs believed to have been installed in non-residential locations. 3.1 provides the evaluation estimates by bulb type and installation location (residential versus non-residential).

[2] The original goal was to sell approximately 5 million bulbs in PY3.

Table E-2. PY3 Ex-Post Program Savings

Gross and Net Parameter and Savings Estimates	Evaluation Verified[3]	Evaluation TRM Verified
CFLs Distributed through the Program	11,197,862	11,197,862
Average Displaced Watts (Delta Watts)	48.1	48.7
Average Daily Hours of Use (Res and Non-Res)	2.98	2.60[4]
Gross kWh Impact per unit	52.4	46.1
Gross kW Impact per unit	0.05	0.05
Total First-Year Gross MWh Savings	**586,995**	**516,115**
Total First-Year Gross MW Savings	**539**	**545**
Realization Rate (Install Rate * Leakage)	71%	71%
Energy Interactive Effects[5]	1.02	1.02
Peak-Load Coincidence Factor	0.121	0.100[6]
Total Installed First-Year Gross MWh Savings	**423,677**	**373,991**
Total Installed First-Year Gross MW Savings	**381**	**386**
Total Installed First-Year Gross Peak MW Savings	**46**	**39**
Net-to-Gross Ratio (1-FR+SO)	71%	71%
Total First-Year Net MWh Savings	**299,788**	**264,631**
Total First-Year Net MW Savings	**270**	**273**
Total First-Year Net Peak MW Savings	**33**	**27**

Source: ComEd PY3 Tracking Database, and Navigant Evaluation Team Analysis

Table E-3 below provides the PY3 bulb sales, net MWh savings estimates and resulting realization rates (from the revised PY3 target and the TRM verified savings) based on ComEd reported savings and the evaluation estimated savings. It also provides the estimated savings attributable to PY3 resulting from the PY1 and PY2 Late Installs (which are the savings resulting from 50% of the PY1 and PY2 uninstalled (stored) bulbs believed to have been installed during PY3).

[3] Excluding late installs.

[4] This uses the deemed HOU estimate of 2.34 bulbs installed within Residential locations.

[5] Interactive Effects on home temperature control load due to decreased waste heat from lighting.

[6] This uses the deemed Peak CF estimate of 0.081 bulbs installed within Residential locations.

Table E-3. PY3 Bulb Sales and Net MWh Savings Comparison

Estimate	PY3 Bulb Sales	Net MWh Savings Estimate	PY3 Target[7] Realization Rate	PY3 TRM Verified Realization Rate
Original PY3 Target	5,121,168	149,322	n/a	n/a
Revised PY3 Target	11,100,000	181,155	n/a	n/a
Program Reported - PY3	11,104,815	232,975	129%	n/a
TRM Verified	11,197,862	264,631	146%	n/a
Evaluation Estimate[8]	11,197,862	299,788	165%	113%
PY1 and PY2 Late Installs	1,519,013	48,193	n/a	n/a
Total PY3 Evaluation Estimate w/ Late Installs	12,716,875	347,980	192%	131%

Source: Navigant Evaluation Team Analysis

The PY3 net claimed ex ante energy savings for this program, excluding carryover savings for previous program year uninstalled bulbs, was estimated to be 232,975 MWh[9]. The evaluation net estimated ex-post savings was estimated to be 299,788 MWh[10] resulting in a net energy saving realization rate on the program reported savings of 129% (299,788/232,975) for the bulbs sold in PY3.

A summary of the evaluation results for each of the key program impact parameter estimates is provided below.

Delta Watts (DW)

For this evaluation, delta watts were deemed for CFL bulb sizes and lumens, resulting in an average of 48.7 watts based on ICC-adopted guidelines, however an additional lumen-based method was employed to calculate the ex-post evaluation delta watts estimate. This lumen-only based method result in an average delta watts estimate of 48.1, which was just 1% lower than the deemed DW estimate. Going forward the evaluation team recommends using this lumen-based method to estimate the displaced watts from all program bulbs (including any additional technologies added to the program such as LEDs). This approach will require that manufacturers provide lumen output for all program bulbs and that the lumen data is included in the program tracking data.

[7] From PY3 revised target.
[8] Excluding PY1 and PY2 late installs.
[9] The original goals for the PY3 Residential ES Lighting program were 149,322 MWh and 14.2 MW (coincident peak). The revised target energy goal was 181,155 MWh.
[10] Excluding PY1 and PY2 late CFLs installs.

Hours-of-Use (HOU)

The ex-post HOU estimate used to calculate the evaluation verified savings came from the PY3 metering study. The average overall HOU estimate from this study was 2.74 hours per day, which was 17% higher than the deemed ex-ante estimate of 2.34 hours per day. The indoor HOU estimate from the metering study was calculated to be 2.57[11] hours per day and the exterior HOU estimate was calculated to be 5.0 hours per day.

Peak Coincidence Factor (CF)

Similarly, the ex-post Peak CF estimate used to calculate the evaluation verified savings also came from the PY3 metering study. The average overall Peak CF estimate from this study was 0.102, which was 26% higher than the deemed ex-ante estimate of 0.081. The indoor CF estimate from the metering study was calculated to be 0.095[12] hours per day and the exterior CF estimate was calculated to be 0.184 hours per day.

Residential/Non-Residential Installation Split

The PY3 evaluation found a portion of program bulbs were being installed in non-residential locations (approximately 3% of program bulb sales) and thus the non-residential HOU and Peak CF estimates, which are much higher than residential HOU and Peak CF estimates, were applied for the percentage of bulbs estimated to be installed in non-residential locations. The resulting residential and non-residential weighted HOU estimate is 2.98 hours per day, and the Peak CF estimate is 0.121.

Gross Realization Rate (RR)

The Gross Realization Rate for PY3 was calculated as follows:

RR = Installation Rate * Leakage Rate

The installation rate in PY3 was found to be down slightly from the PY2 estimate (71% across all bulb types[13] in PY3 versus 74% in PY2). Leakage of program bulbs outside of ComEd service territory was again found to be very minimal (less than 1%). The gross realization rate across all program bulb types was estimated to be 71%. By bulb type the gross realization rates were estimated to be 70% for standard bulbs, 77% for specialty bulbs and 85% for fixtures. This differentiation between bulb type realization rates is entirely driven by the installation rate as the leakage rate applied was consistent across bulb types.

---

[11] The interior HOU estimate of 2.57 hours per day would be the appropriate value for bulbs installed in interior locations through ComEd direct install programs.

[12] The interior Peak CF estimate of 0.095 hours per day would be the appropriate value for bulbs installed in interior locations through ComEd direct install programs.

[13] Installation rates by bulb type were estimated to be 71% for standard CFLs, 78% for specialty CFLs and 86% for CFL fixtures.

Interactive Effects (IE)

The PY3 evaluation estimated the energy cooling benefits, or interactive effects, resulting from a decrease in the cooling required as a result of a CFL retrofit. The average energy IE across all home types was estimated to be 2.4%. The results by home type ranged from a high of 3.1% for single-family detached homes to a low of 0.9% for single-family attached homes or duplexes.

Net-to-Gross Ratio (NTGR)

As part of the PY3 evaluation, a total of five methods were used to estimate the Residential ES Lighting program NTGR. The final overall recommended NTGR is 0.71 which is roughly 20% than the PY2 NTGR estimate (0.58 in PY2). This PY3 estimate was calculated as the retailer sales-weighted average of in-store intercept self-report results. For PY3 the evaluation team attempted to estimate separate NTGR ratios for standard and specialty bulbs. The standard versus specialty NTGR estimates from both of the customer self report methods were not significantly different (although in both cases the standard bulb NTGR was slightly higher than the specialty bulb NTGR). The absence of customer tracking data and the low volume of program fixtures sold made estimating a NTGR for program fixtures infeasible.

Late Installs

The overall annual gross and net program savings show an increase when the savings associated with the PY1 and PY2 late installs are added (48,193 MWh). The final net energy realization rate on the program reported savings with these additional savings included is 149%. The net energy savings that can be attributed to PY4 from the delayed installation of bulbs purchased through the PY2 and PY3 Residential ES Lighting program is estimated to be 88,515 MWh.

Many of ComEd's energy efficiency programs, including the Residential ES Lighting Program, were subject to revised goals after the start of PY3 based on the overall portfolio performance and PY2 results. Table E-4 below compares the initial goals, the revised goals, the Ex-Ante results (program reported), the evaluation estimated and the TRM verified results.

Table E-4. Comparison of Findings to Initial Program Goals

Savings Parameter	Initial PY3 Goal	Revised PY3 Goal	PY3 *Ex-Ante* Results	PY3 Ex-Post Evaluation Estimated	PY3 TRM Verified
# of Bulbs	4,935,940	11,016,400	11,018,054	11,110,919	11,110,919
# of Fixtures	185,098	83,600	86,761	86,943	86,943
Net MWh Savings	149,322	181,155	232,975	299,788	264,631

Source: Navigant Evaluation Team Analysis

E.4 Key Process Findings and Recommendations

The following list summarizes the key process findings from the study:

- ComEd customers are very awareness of CFLs and the level of familiarity continues to increase.

- Approximately 70% of ComEd customers have at least one CFL installed in their home and the average number of CFLs per home is around 9.
- Approximately half of ComEd customers purchase at least one CFL per year.
- The ComEd lighting program is reaching customers with relatively low CFL socket saturation prior to purchasing the program bulbs, as well as those who already have a lot of CFLs installed.
- ComEd customers who have ComEd discounted CFLs installed report high levels of satisfaction with the program bulbs
- The primary barriers for the 20% of ComEd customers who have never purchased a CFL include concerns about mercury, light quality and bulb brightness. Price was also reported to be a very important reason for not purchasing CFLs.
- Program awareness seems to be increasing in the general population, although still less than 30% of customers know about the program and many program bulb purchasers are unaware the bulbs they are purchasing are discounted.
- In-store marketing appears to be more effective than the out-of-store marketing and customers who see the materials reported that the materials were highly influential in their purchase decision.

Comparison Across Program Years

Table E-5 below provides a comparison of the key impact parameter estimates across the three program year evaluations. As this table shows bulb sales have nearly quadrupled since the first program year, realization rates have consistently remained in the low 70% range, and the net-to-gross ratio has also remained fairly steady ranging from 58% to 71%.

Table E-5. Comparison of Key Impact Parameters across Program Years

Estimate	PY1	PY2	PY3
Bulb Sales	3,001,367	8,284,376	11,197,862
Realization Rate	70%	74%	71%
Gross Installed MWh Savings	87,917	341,398	373,991
Residential Sales %	100%	90%	97%
Net-to-Gross Ratio	69%	58%	71%
Net MWh Savings	60,769	199,560	264,631
Net MWh Savings from Late Installs	0	12,973	48,193

Recommendations

Before offering recommendations for future program improvement, the evaluation team would like to acknowledge the impressive and consistent success of the ComEd Residential ES Lighting Program. The program was again successful in PY3 in meeting its goals in terms of number of bulbs sold. Spiral CFLs in particular are selling at very high rates. Manufacturers and retailers are almost universally pleased with the program and its implementation. ComEd successfully put plans in place to expand the program to discount stores in PY4, which was a specific recommendation in the PY2 evaluation report. The program

has also been successful at getting CFLs into homes with lower socket saturation, another of the recommendations from the PY2 evaluation.

Because of this success, the recommendations below are more in the nature of fine-tuning. These recommendations are based on findings from the current evaluation and upcoming changes in the CFL market.

- Increase focus on using EISA 2007 to educate customers about proper CFL replacement.
- Consider language-based program outreach to non-English speaking households.
- Improve recording and reporting of lumen output in the program tracking data.
- Improve recording of retail price per package in the program tracking data.
- Screen key tracking data fields for incorrect or missing entries.
- Encourage retail participants to participate more actively in the program evaluation.
- Increase promotion of the CFL disposal program.

E.5 Cost-Effectiveness Review

ComEd uses DSMore™ software for the calculation of the Illinois TRC test[14].Table E-6 summarizes the unique inputs used in the DSMore model to assess the TRC ratio for the Residential Lighting program in PY3. Most of the unique inputs come directly from the evaluation results presented previously in this report. Measure life estimates and program costs come directly from ComEd. All other inputs to the model, such as avoided costs, come from ComEd and are the same for this program and all programs in the ComEd portfolio.

Table E-6. Inputs to DSMore Model for Residential Lighting Program

Item	Value Used
Measure Life	9
Utility Administration and Implementation Costs	$2,895,306
Utility Incentive Costs	$12,710,832
Net Participant Costs	$19,084,516

Based on these inputs, the Illinois societal TRC for this program is 4.85 and the program passes the Illinois TRC test.

[14] Demand Side Management Option Risk Evaluator (DSMore) software is developed by Integral Analytics.

Section 1. Introduction to the Program

1.1 Program Description

The Residential ES Lighting Program provides incentives to increase the market share of ES qualified compact fluorescent lamp (CFL) bulbs and fixtures sold through retail sales channels. It also seeks to distribute educational materials that will increase customer awareness and acceptance of energy-efficient lighting technology, as well as promote proper bulb disposal. The Residential ES Lighting Program accounts for more than one-third of the expected Ex-Ante MWh impacts of ComEd's 2008-2010 energy efficiency portfolio, and thus the program is very important to meeting ComEd's energy efficiency goals.

The majority of the Residential ES Lighting Program is delivered midstream (at the retailer level), which minimizes the burden on consumers and lowers barriers to participation, but makes program participant identification (and thus evaluation) more difficult. A small percentage of the CFL rebates were delivered via in-store coupons[15] that allowed for the capture of participant names and contact information. However, due to the small proportion of the overall sales these coupons represent, as well as the limited retail categories where these coupons were distributed (restricted to small hardware stores), customers who participated via the coupon channel cannot be deemed representative of the entire participant population. As a result, it not possible to match specific purchases in the program tracking data to other characteristics of those bulb purchasers or to specific details on how the bulbs will be used. Instead, a wide variety of data collection methods, as characterized in Table E-1 above, is used to characterize the most likely downstream usage of bulbs purchased through the program.

The Residential ES Lighting Program kicked-off in June 2008 and completed its third full year of operation at the end of May 2011. Program sales in Program Year 2011 (PY3) were nearly four times larger than PY1 sales, and a third larger than PY2 sales. In PY3, the program generally maintained similar incentive levels to PY2 and similar proportions of each bulb type (standard, specialty and fixtures) made up overall program sales.

1.1.1 Implementation Strategy

The implementation strategy for the PY3 Residential ES Lighting Program has not changed significantly from PY2. For program implementation details on items that have remained static over the course of the last program year, such as roles of the implementation contractors (APT and EFI), program delivery mechanisms and marketing strategies, and retail recruitment, education and outreach, see the PY2 report[16]. Changes to the retailers participating in the program are described below.

[15] Coupon sales account for less than 0.1% of program sales (spiral and specialty bulbs) and were the sole means of program participation at one of the fourteen program retailers.

[16] Navigant Consulting, 2010. *Energy Efficiency/Demand Response Plan Year 2 Evaluation Report: Residential Energy Star Lighting*. Prepared for Commonwealth Edison Company, December, 2010.

Retailer Participation

In total, there were 14 retail chains that participated in the Residential ES Lighting Program in PY3, which encompassed 674 individual retail locations. Most of these retailers were recruited in PY1 by responding to an RFP issued by ComEd, and continued their participation in PY2 and PY3. Two new retailers joined the program in PY3 and one retailer from PY2 stopped participating. Table 1-1 below lists the retailer categories that participated in the PY3 Residential ES Lighting Program, including the number and percentage of program bulbs and/or fixtures sold in each of the participating retailer categories, the number of storefronts within each of these categories, and the delivery method utilized by the category for program participation. As this table shows, DIY (Do It Yourself) large home improvement stores were the largest category of participating retailers and accounted for 52% of the total program bulb sales. Warehouse stores were the next largest retail channel at 33% of total program bulb sales. Grocery stores, while having a relatively large number of participating storefronts, had the lowest overall program sales. This table also shows that overall, more than 99% of the program bulbs were distributed through the upstream delivery channel.

Table 1-1. PY3 Retailer Participation

Retailer Category	Standard CFLs Sold	Specialty CFLs Sold	CFL Fixtures Sold	% of CFLs Sold	Store Fronts	Delivery Mechanism
DIY	5,311,323	503,466	25,584	52%	133	Upstream
Warehouse	3,137,796	515,563	9,211	33%	37	Upstream
Big Box	781,825	142,685	3,000	8%	86	Upstream
Grocery/Drug	175,179	15,894	34,819	2%	272	Upstream
Small Hardware	480,236	39,518	14,329	5%	146	Upstream/Coupon
Total Coupon	**6,837**	**597**	**0**	**0.1%**	**n/a**	**Coupon**
Total Upstream	**9,886,359**	**1,217,126**	**86,943**	**99.9%**	**674**	**Upstream**

Source: Evaluation team analysis of ComEd Tracking database

Product Selection

In PY3, APT and ComEd have continued to work to ensure that a wide variety of independently tested ES CFLs are available for the ComEd Residential ES Lighting program. APT has advised the program to provide discounts for both spirals and specialty bulbs across a wide mix of wattages. The program also includes pin-based fixtures.

Table 1-2 shows the distribution of program bulbs sold in PY3 across the three bulb types and within specific product subcategories (wattages for standard and bulb type for specialty). As this table shows, in PY3 88% of the bulbs sold through the program were standard CFLs, 11% were specialty CFLs, and 1% was fixtures. Within the standard CFL group, the majority of bulbs sold continued to be low-wattage CFLs (13 and 14 watts, with lumens equivalent to a 60 watt incandescent). In PY2 these 60 watt

replacement lamps comprised 67% of program bulb sales, and in PY3 they increased to 72% of total program bulb sales. Consistent with PY2, most of the specialty CFLs sold in PY3 were reflectors, followed by A-lamps. Candelabra CFLs experienced more than a five-fold increase in sales from PY2 to PY3, but still comprise just 1% of total program sales.

Table 1-2. Distribution of PY3 Residential ES Lighting Program Sales across Bulb Types

Bulb Type	Product	Bulb Sales	%	Bulb Type Sales	%
Standard	40 Watt Replacement	367,738	3%	9,893,196	88%
	60 Watt Replacement	8,113,889	72%		
	75 Watt Replacement	466,547	4%		
	>=100 Watt Replacement	945,022	8%		
Specialty	Reflector	762,709	7%	1,217,723	11%
	A-bulb	187,141	2%		
	Globe	119,839	1%		
	Other Specialty	148,034	1%		
Fixture	Fixture	86,943	1%	86,943	1%
Residential ES Lighting Program		**11,197,862**	100%		

Source: Evaluation team analysis of PY3 ComEd Tracking data

1.2 Evaluation Questions

The evaluation sought to answer the following key researchable questions.

Impact Questions:

1. What is the level of gross annual energy (kWh) and peak demand (kW) savings induced by the program?
2. What are the net impacts from the program? What is the level of free-ridership associated with the program, and how can it be reduced? What is the level of spillover associated with the program?
3. Did the program meet its energy and demand goals? If not, why not?

Process questions:

1. What are key barriers to participation for ComEd customers? How can they be addressed by the program?
2. How did customers become aware of the program? What marketing strategies could be used to boost program awareness and participation, if needed?
3. What is the customer experience and satisfaction with the program and program bulbs?
4. What are the market effects induced by the program?

Section 2. Evaluation Methods

Numerous analytic methods and data collection activities have been, and continue to be utilized for the 3-year process and impact evaluations of the Residential ES Lighting Program. This section presents an overview of the analytic methods used during this third year of the 3-year evaluation. It also provides details on the extensive data collection activities implemented during PY3, including the data sources and sample designs used as a base for these data collection activities.

2.1 Analytical Methods

In PY3, the analytical methods used for the evaluation of the Residential ES Lighting Program were driven to a large extent by the data available for programs that are delivered upstream at the retailer level such as this one. This delivery approach, while allowing for ease of program implementation and customer participation, increases the complexity of the program evaluation, since the program participants cannot be easily identified. The budget for PY3 was the largest to-date, which supported a second year of data collection in retail stores (via in-store intercepts and shelf surveys) and a small metering study. The latter included onsite visits to 67 ComEd customer's homes to conduct a complete lighting inventory and install/remove lighting loggers in order to gather data which was used to estimate the average hours of use and peak coincidence factors of program incented CFLs.

2.1.1 Impact Evaluation Methods

Gross Program Savings

Gross energy and demand (coincident peak and overall) savings resulting from the PY3 Residential ES Lighting Program were calculated using the following algorithms:

Per Unit kWh Savings = Delta Watts/1000 * HOU * Realization Rate * Energy Interactive Effects

Where:

Delta Watts = Difference between Baseline Wattage (incandescent wattage) and CFL Wattage

HOU = Annual Hours of Use

Realization Rate = Installation Rate * Leakage Rate

Annual kWh Savings = Program bulbs * Per Unit kWh Savings

Per Unit kW Savings = Delta Watts/1000 * Realization Rate

Annual kW Savings = Program bulbs * Per Unit kW Savings

Per Unit Peak kW Savings = Per Unit kW Savings * Mean Load Coincidence Factor

Where Mean Load Coincidence Factor is calculated as the percentage of program bulbs turned on during peak hours (weekdays from 1 to 5 p.m.) throughout the summer.

Annual Peak kW Savings = Program bulbs * Per Unit Peak kW Savings

Table 2-1 below shows the data sources used to estimate the input parameters in the energy and demand savings algorithms for the Residential ES Lighting Program. Each of these parameters is described in further detail below.

Table 2-1. Gross Savings Parameter Data Sources

Gross Savings Input Parameters	Residential ES Lighting Program
Rebated Bulbs (Measures)	PY1/PY2/PY3 Program Tracking Data
Delta Watts	Deemed Estimates (Val Jensen Testimony) / ES Standard Equivalency Tables / Lumen-based Incandescent Equivalents
Hours of Use	ComEd Metering Study
Peak Load Coincidence Factor	ComEd Metering Study
Installation Rate	Telephone and In-store Intercept Surveys
Interactive Effects	eQuest Modeling
Leakage	In-store Intercept Surveys
Residential versus Non-Residential Installations	In-store Intercept Surveys

Program Bulbs

The number of bulbs distributed through the program during PY3 is a key parameter in the calculation of total gross and net program savings and is derived from the Residential Lighting tracking databases (upstream and coupon) provided to the evaluation team by ComEd. PY3 bulb sales numbers include a small number of bulbs sold during PY2 (prior to May 31st 2010) that were invoiced after the PY2 sales cutoff date (and thus were not counted as PY2 sales in the Year 2 evaluation).

Delta Watts

The delta watts parameter is a measurement of the wattage displaced by the newly installed program CFLs. To estimate the number of watts displaced by program bulbs it is necessary to estimate the most probable incandescent wattage that the program bulb is likely to have replaced. Once this incandescent wattage has been estimated, the displaced watts (or delta watts) can be calculated as the difference between the wattage of the replaced incandescent bulb and the wattage of the new CFL. For this evaluation, delta watts were deemed for CFL bulb sizes and lumens, resulting in an average of 48.7 watts based on ICC-adopted guidelines, however an additional lumen-based method was employed to

calculate the evaluation delta watts estimate. Delta watts estimates based on the program tracking data are also provided in this report.

Annual Hours of Use (HOU)

In order to estimate the energy savings from a newly installed CFL, it is necessary to understand the average number of hours the lamp is turned on each day (which can then be annualized by multiplying the daily value by 365 days). Assuming you have two bulbs that have displaced the same number of watts, the lamp that is turned on for a greater number of hours over the course of the year will yield a larger number of kilowatt hours saved. For the PY3 evaluation a metering study was conducted at a sample of ComEd residential customers' homes. This metering study involved installing lighting loggers on randomly selected CFLs that customers had installed in their homes, which allowed for the direct measurement of on/off usage patterns and enabled the modeling of an annual HOU estimate for each loggered CFL. A total of 527 lighting loggers were installed across 67 homes starting in June of 2010 and were removed starting in January of 2011.

Peak Load Coincidence Factor

The peak load coincidence factor (CF) allows for the estimation of the average demand savings that occur during ComEd's peak period (summer weekdays from 1 to 5 p.m.[17]). The metering study mentioned above also allowed for the direct measurement of peak CF for PY3.

Installation Rate

In order for a program bulb to receive credit for energy savings in the Residential ES Lighting Program within a given program year, it must be installed within that program year. For PY3, the evaluation team had two data sources from which to calculate the installation rate: the General Population survey and the in-store intercept surveys. All customers surveyed as part of the PY3 General Population survey were asked whether or not they had installed (and not since removed) all or a portion of the CFLs they had purchased within the last year. Their responses were used to calculate an installation rate for the PY3 Residential ES Lighting Program. A second effort to calculate the PY3 installation rate relied on data collected during in-store intercept surveys with program bulb purchasers. Each of these respondents was asked how many of the CFLs that they were purchasing at the time of the survey they intended to install when they got home.

Energy Interactive Effects

CFLs use less energy than incandescent lamps to produce the same amount of useful light. As a result, CFLs produce less waste heat than incandescent lamps. At times of year when people cool their homes with air conditioning systems, this reduction in heat produced by replacing incandescent bulbs with CFLs can provide the additional benefit of reducing cooling loads. Conversely, during the heating season,

[17] This is also the PJM bidding "peak" (2 p.m. to 6 p.m. Eastern Standard Time).

the reduced heat can result in net increases in heating requirements. These cooling benefits and heating penalties associated with CFL retrofits are referred to as "interactive effects".[18]

For PY3, the evaluation team estimated the size of the energy interactive effects using building simulation modeling (eQuest), based on building prototypes developed to reflect the residential building stock and equipment holdings in ComEd's service territory.

Leakage

When program bulbs are sold through an upstream channel, as is done for the Residential ES Lighting Program, it is possible for program bulbs to be purchased at program stores and then installed in areas outside of ComEd service territory (therefore negating any ComEd energy savings from the installation of these bulbs). This phenomenon is referred to as leakage. Again in the PY3 evaluation, leakage was estimated by asking all in-store intercept survey respondents who were purchasing program bulbs if they received their electrical service from ComEd. This provided the data necessary to estimate the percentage of program bulb that are leaving ComEd's service territory.

Residential versus Non-Residential Installation Locations

The Residential ES Lighting Program assumes that all program bulbs will be installed in residential locations. This assumption was initially tested as part of the PY2 evaluation, and then tested again as part of the PY3 evaluation via the in-store intercept surveys. All surveyed ComEd customers who were purchasing program bulbs were asked whether they intended to install the bulbs in their home, their business, or a combination of each. Those responding that they intended to install the bulbs at their business were also asked to specify the type of business this was. This data was then used to estimate the percentage of program bulbs that are installed in residential versus non-residential locations, and the gross impact parameters (HOU and CF) were adjusted to account for these non-residential installations.

Net Program Savings

Net savings analyses seek to determine a program's net effect on customers' electricity usage. This requires estimating what would have happened in the absence of the program. Thus, after gross program impacts have been assessed, net program impacts are derived by estimating a net-to-gross ratio (NTGR) that quantifies the percentage of the gross program impacts that can reliably be attributed to the program. The NTGR can be thought of as a metric of program influence.

For the PY3 Residential ES Lighting program evaluation, a number of methods were used to estimate the net program savings. The results from these methods were then evaluated (based on their perceived level of relevance/accuracy) to produce a final NTGR estimate. The methods employed for the PY3 evaluation included:

[18] For any CFL programs that are administered jointly between ComEd and the gas utilities, the interactive effects associated with cooling savings should only be applied in combination with heating penalties resulting from increased heating loads.

1. Customer Self-Reported NTGR (via a general population telephone survey and in-store intercept participant surveys)

2. Supplier Self-Reported NTGR (via in-depth interviews with lighting manufacturers and retailers)

3. Revealed Preference Demand Model (based on data gathered during the in-store intercept customer surveys and the shelf stocking surveys)

4. Multi-state Modeling (based on data gathered during telephone surveys and onsite lighting inventories)

Customer Self-Report NTGR

Estimating the NTGR using the self-report method requires the calculation of free-ridership and spillover[19] (both participant and non-participant). Free-ridership refers to program bulb purchases that would have taken place anyway in the absence of the program, and spillover refers to positive impacts of the program on sales of non-program energy efficient lighting products. Once these three parameters have been estimated, the NTGR can be calculated as follows:

NTGR = 1 – Free-ridership Rate + Spillover Rate (Participant and Non-Participant)

Free-Ridership

The calculation of free-ridership using the customer self-report method relies on customer survey questions addressing the following two items:

1. The degree of influence the program had on the customer's decision to install CFLs (Program Influence Score); and

2. What actions the customer would have taken on their own in the absence of the program (No-Program Score).

The calculation of free-ridership combines the Program Influence score and the No-Program score for each customer to come up with a customer-level free-ridership score. The Program Influence and No-Program scores can take values of zero to ten, where a lower score indicates a higher level of free-ridership. Program-level free-ridership is then determined by taking a program bulb-weighted average of the individual customer-level free-ridership scores.

The Program Influence score was estimated based on the self-reported influence level the program had (on a scale of zero to ten, where zero equals not at all influential and ten equals very influential) on the customers' decision to install CFLs instead of standard efficiency bulbs. The No-Program score was based on a number of factors including:

[19] Spillover could only be calculated for the General Population survey self-reports. The in-store intercept surveys needed to be much shorter surveys to avoid customer fatigue and thus information on non-program bulb purchases was not collected.

1. Would the customer have purchased CFLs in the absence of the program?

2. Would they have purchased the CFLs at the same time?

3. Would they have purchased the same number of CFLs?

4. How likely is it (on a scale of zero to ten, where zero equals not at all likely and ten equals very likely) that they would have bought the same CFLs in the absence of the program?[20]

The algorithm used to calculate the No-Program score adjusts the score assigned to customers upward if they indicate that they would have purchased and installed the CFLs on their own in the absence of the program, but that the program either accelerated their CFL installation or led them to install a greater number of CFLs.

Once these two scores have been calculated, the customer-level free-ridership is equal to:

Customer-level Free-Ridership = 1 – (Program Influence Score + No-Program Score)/20

As with all NTGR method the customer self-report method also has threats to validity such as customers who either overstate their preference for CFLs because they think of themselves as "green" or understate their sensitivity to price, both of which would result in lower NTGR estimates. Conversely, some customers may overstate the influence the program is having on their decision to purchase CFLs in hopes that such a response will result in continued incentives being provided by ComEd for the purchase of CFLs.

The data underlying the In-Store Intercept surveys is the most reliable since it is based on a large sample of interviews, and focuses on customer perceptions at the time of purchase, while the purchase experience and influential factors are still fresh in the respondent's mind. However a limitation of the in-store intercept surveys compared to the CATI telephone format of the General Population surveys is that the CATI approach allows for the real-time identification of response inconsistencies that can then be more clearly explained by a respondent in his or her own words. Such inconsistencies are more difficult to identify and correct during in-store intercept surveys.

Spillover

Two types of spillover were estimated for the General Population self-report method; participant and non-participant spillover. Spillover for both participants and non-participants includes all adoptions of energy efficient lighting measures that are influenced by the program, but are not done through the program (i.e., are not rebated). It is reasonable to expect that the program, by providing information on the benefits of energy efficient lighting and experience with such technologies, motivates customers to install energy efficient lighting without the program rebate.

[20] This specific question was only asked as part of the General Population survey. However, a combination of similar questions was used as a proxy for this question in the intercept survey.

The participant and non-participant surveys fielded as part of this evaluation gathered information on CFL lighting installations that were made by program participants and non-participants for which they did not receive a program rebate. The information collected included:

a) The quantity and type of the efficient lighting equipment installed without a rebate;

b) The degree of self-reported influence of the program on the decision to purchase the efficient lighting equipment; and

c) Whether the customer received any rebates whatsoever for the installation or purchase of high efficiency lighting equipment (to confirm the measure was not rebated).

Lighting purchases were considered a spillover adoption if the following conditions were met:

a) The lighting product was energy efficient.

b) The degree of self-reported influence of the program on the purchase of the energy efficient lighting equipment was sufficiently high to reasonably conclude that the adoption would not have occurred in the absence of the program. Additionally, for non-participants, this required that the customer was aware of the Smart Lighting Discounts program prior to making the purchase.

c) The customer did not receive any rebates whatsoever for the efficient lighting purchase.

The participant spillover rate was calculated by summing the spillover adoptions over all program participants and then dividing this sum by the total number of purchases made through the program. The non-participant spillover rate was calculated in a similar manner as participant spillover except the spillover adoptions were divided by the number of surveyed customers. This value then was applied to the appropriate population of non-participating customers to estimate the number of spillover adoptions occurring in that population.

Supplier Self-Report NTGR

The supplier self-report approach relies on information collected from in-depth interviews with participating manufacturers and high level retail buyers to estimate free-ridership and the influence of the program on non-program CFL sales for various bulb categories. During the interviews, respondents were asked to estimate the percentage by which their sales of compact fluorescent products would have been different in the absence of the ComEd Residential ES Lighting Program. These self-reported estimates were cross-checked for consistency with other questions. Distinct free-ridership estimates were requested for standard spiral bulbs, specialty bulbs, and CFL fixtures.

Elements of the survey design provided checks of internal consistency and served to enhance the accuracy of NTGR estimates. Prior to the scheduled interviews, respondents were asked to provide a summary of their company's program bulb and fixture sales as well as their non-program bulb and fixture sales. Questions of a general nature about bulb sales were asked early in the survey to get respondents thinking about overall bulb sales and the different components of the Residential ES Lighting Program prior to asking them directly about the quantitative influence of the program on their sales of CFL products. The intent of these questions was to enhance their ability to estimate the influence of the program on sales of each bulb type.

NTGR values were estimated both within and across categories of market actors for the same product type. Overall answers to survey questions provided a sense of whether the basic description of bulb sales trends and impacts was consistent across manufacturers and high level retail buyers for a given product.

It is recognized that the supplier self-report approach to NTGR estimation has some threats to internal validity. Respondents may have motivations that introduce bias in their NTGR-related responses. For example, one possible source of bias would be a tendency on the part of manufacturers and retail buyers, who have a vested interest in the continuation of the program, to overestimate its impacts. Conversely, retail buyers may tend to underestimate the impacts of the program based on a belief that they can sell CFL products based on their own merits, even in the absence of program discounts. Another threat to validity arises because the manufacturers and high level retail buyers are not the ultimate purchasing and installation decision makers for the bulbs sold through the program.

An advantage of the supplier self-report approach to estimating free-ridership is that by focusing on the manufacturers and high level retail buyers it covers the large majority of bulbs sold through all retail channels. Also, interview respondents at this level have perspective on the net impacts of all of the program's components, in terms of sales of program CFLs and non-program CFLs.

Revealed Preference Demand Modeling

The revealed preference demand modeling approach to estimating NTGR values utilizes data collected during in-store intercept surveys and the shelf surveys to model the probability of the CFL purchase and the influence of the program on these purchases. The influence of the ComEd lighting program on the CFL purchase can occur through a direct price effect, changes in stocking patterns at stores and the influence of the program marketing material on customer knowledge.

Data gathered from the shelf surveys was used to develop measures describing CFL and equivalent incandescent bulb price variables including average and minimum prices and price differentials for equivalent usage bulbs. The shelf survey data was also employed to develop variables characterizing the display of CFL promotional material and the share of CFL shelf space. The in-store intercept survey data was used to determine the types of lighting products consumers purchased and whether or not the consumers were aware of the ComEd lighting discount program at the time of purchase.

To estimate the program NTGR using a demand model, the probability of purchasing a CFL was calculated under the actual program conditions (P_p) and then simulated under non-program conditions (P_{np}). The NTGR is then calculated as the increase in the CFL purchase probability due to the program, relative to the total probability of purchase.

$$NTGR = (P_p - P_{np})/P_p$$

The NTGR calculated from the revealed preference model has the advantage of relying on actual CFL and incandescent bulb purchases, and real-time customer recall of their intent to purchase lighting and their knowledge of ComEd's lighting program. The model also uses actual information on store level pre-program CFL, discounted CFL, and incandescent prices. However, this method also has several limitations. The NTGR calculated using this approach is only applicable to stores and chains that permitted surveyors to undertake both shelf surveys and customer intercept surveys. Unfortunately, the

ability to persuade stores to participate in both lighting shelf surveys and customer intercept surveys was a limiting factor again for the PY3 evaluation. It is also extremely difficult to ensure that customers are selected at random for the intercept surveys. Where a store locates their program CFLs and other lighting products can significantly impact who is surveyed. One retailer in PY3, where a large number of the intercept surveys took place, had a large lighting display in the front of the store. This display was very effective at capturing customer's attention and many bulbs were selected from this display, but it resulted in little price variation across the program bulb purchases which proved to be very problematic for the models. And finally, stores that do not stock non-discounted CFLs and/or incandescent bulbs cannot be included in the models. Regrettably, these limitations substantially reduced the data available to estimate the NTGR using the revealed preference model for PY3.

Multi-State Modeling

The multistate model approach relies on a multivariate regression model to determine the hypothetical baseline. This model requires primary data to be collected from regions with varying levels of program activity, from no programs to long-standing established programs. Collecting respondent data from states that represent a wide range of program activity levels, and demographic and economic characteristics, can help to explain the effects of individual program activity on CFL sales. In addition, another advantage of a statistical model is that it controls for many variables (income, education, access to big-box stores, energy prices, etc.) that can impact CFL sales, plus the model utilizes thousands of records, providing more statistical power.

The CFL sales data used in this modeling approach was collected through telephone surveys and onsite lighting audits with randomly selected customers from ComEd service territory as well as various other regions around the U.S. (with varying levels of CFL lighting programs). The phone surveys attempted to interview the person in each home most responsible for lighting purchases and recruit participants for the onsite lighting audits. A trained technician then performed the onsite audits recording the characteristics of every light bulb throughout the home, including the bulb type (incandescent, CFL, halogen, etc.), the bulb manufacturer, model number and any specialty features. The technician also inquired about when CFLs were purchased and counted CFLs in storage, thereby providing a verified, reliable estimate of both CFL sales and saturation.

Using this sales data, a multi-state modeling team developed a regression model to estimate CFL purchases, controlling for other factors that impact CFL sales, such as income, education, home ownership, housing size, utility rates, and the presence or absence of big-box stores in the vicinity. By controlling for these variables, the model is able to isolate the effect of the program on sales and to establish a modeled baseline of CFL purchases in the absence of the utility program. The "lift" in purchases, as indicated by the program variable in the model, is the effect that is attributable to the program activities.

A final NTGR estimate was then derived from a careful review of both the resulting NTGR estimates from each of the methods and an assessment of the limitations and strengths of each of the methods.

2.1.2 Process Evaluation Methods

The process evaluation primarily makes use of quantitative analysis of surveys conducted with ComEd customers. Details on these surveys are provided below. Comparisons between prior program years (PY1 and/or PY2), or between subgroups in PY3, are tested for statistical significance at the 0.10 level.

2.2 PY3 Data Collection Activities

The data collected for the evaluation of the PY3 Residential ES Lighting Program was gathered via a number of activities including in-depth phone interviews with ComEd program staff, APT program implementers, and Supply-Side market actors (Lighting Manufacturers and Corporate Retailers), On-Site Audits (which included conducting detailed lighting inventories and installing lighting loggers), Computer Aided Telephone Interviews (CATI) conducted with Residential ES Lighting Program participants and nonparticipating ComEd residential customers, and ComEd tracking data analysis. Table 2-2 below provides a summary of these data collection activities including the targeted population, the sample frame, and timing in which the data collection occurred.

Table 2-2. PY3 Data Collection Activities

Data Collection Type	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data	Program Participants (Upstream / Coupon)	Tracking Database	-	All	Ongoing
On-Site Lighting Inventories / Metering	Residential Lighting Program Participants	PY1 & PY2 Program Participants	Random Sample	67	June 2010-March 2411
In-Depth Phone Interviews	ComEd Res Lighting Program Manager	Contact from ComEd	Residential Lighting Program Manager	1	May 2011
	ComEd Res Lighting Program Implementer	Contact from APT	APT Program Manager	1	May 2011
	Lighting Manufacturers	Tracking Database	Census of Program Manufacturers	8 Attempts 8 Completes	March – May 2011
	Corporate Retailers	Tracking Database	Census of Program Retailers	12 Attempts 5 Completes	April 2011
In-Store Intercept Surveys	Program and Non-Program Lighting Purchasers	Tracking Database	Random Sample of stores that would allow intercepts	496	February-June 2011
In-Store Shelf Surveys	Program Stores	Tracking Database	Random Sample of Program Stores	8 Program Stores	March-July 2011
CATI Phone Surveys	Residential Lighting Upstream Participants	Residential CIS	Random Sample. Survey questions used to identify Program Participants	305	June 2011
	ComEd Non-Participating Customers	Residential CIS	Random Sample. Survey questions used to identify Program Non-Participants	441	June 2011

Source: Navigant Evaluation Team

2.3 *Data Sources*

2.3.1 Tracking Data

The tracking data delivered for this evaluation consisted of five databases, three corresponding to the upstream lighting sales, one for the coupon sales, and one that tracked cumulative weekly program bulbs sales compared to sales goals and included an estimate of delta watts and retail price per package for all program bulbs. These databases consisted of the following:

- *Residential Lighting Project Info Database* - This database was the primary upstream lighting database and contained a record for all 342,387 retail program bulb sales invoices (by model number and store) that were sold during PY1 through PY3, 173,655 of which are specific to PY3. The key variables in this database included the retailer store name and address, the MOU number, the bulb description and model number, the number of program bulbs sold, the rebates paid for these program bulbs, and the date of invoice.
- *Residential Lighting Retailer Database* - This database contained the names of 10 of the 12 retailers participating in the upstream portion of the program, the retailer id assigned to the retailer, and the number of stores the retailer had participating in the program. In cases where the retailer was not identified from the retailer database, it was identified from the store name variable in the project information database.
- *Residential Lighting Measure Lookup Database* - This database contained a record for each CFL model sold through the upstream lighting program. Along with the model number and a description of the bulb, this database included for all program CFLs the wattage of the CFL, an estimate of the wattage of its incandescent equivalent (basewatt), the bulb's rated life, the number of bulbs included in the package, the bulb manufacturer, the program year, and for a portion of model numbers it included the bulbs lumen output.
- *Residential Lighting Coupon Database* - This database contained a record for all 9,304 customers[21] who purchased a program bulb using a ComEd coupon at one of three coupon retailers (small hardware stores). This database contained key information including the name, address and phone number of the coupon participant, the model and manufacturer of the program bulbs purchased, the store where the program bulbs were purchased, the wattage grouping of the bulbs purchased, the date of the program purchase and the number of bulbs in the program package.
- *Final PY3 Goals Tracker* - This spreadsheet tracked cumulative weekly program bulbs sales compared to sales goals and allocated program dollars. Along with bulb sales, the record for each combination of model number and retailer included the suggested retail price per package and incentive requested from sponsor per package. Records also included manufacturer, product description, bulb type, CFL wattage, rated life, and the number of bulbs per package.

The final tracking databases for this program were generally comprehensive and easy to use. There were a number of instances, however, where the information in the tracking databases was either missing or inaccurate. Lumen output was only listed for 48% of program CFL models (89% of total program bulb sales). There were a number of cases where the alphanumeric value listed as the model number was in fact the item number rather than the model number. This made it challenging to do manual online lookups for models that were missing lumen output in the tracking data. Also, model numbers in the tracking data did not match those in the PY3 goals tracker in 27% of the cases. This made it difficult for the evaluation team to merge the goals tracker data with the tracking database to pick up variables such as the retail price per package which were not provided in the tracking data.

[21] The number of customers purchasing bulbs through the coupon channel was estimated by removing all records for which the first and last names were duplicates with other records.

Also, although the tracking data included base wattage estimates that in some cases were based on PY2 evaluation results, the values appear to have been applied inappropriately. Beginning in PY2, a lumen based equivalency method has been used to calculate the evaluation estimated delta watts. This method maps program CFLs to an incandescent-equivalent wattage based on lumen output of the program bulb. Average lumen output for typical incandescent bulb wattages are estimated based on the lumen output of the three highest-selling incandescent bulbs supplied by technical representatives at General Electric and Sylvania: two values for soft white bulbs and one value for clear bulbs for each incandescent wattage. Program CFLs are assigned a base wattage value based on this mapping.

In a memo accompanying the PY2 evaluation report, the evaluation team provided a set of three spreadsheets to ComEd that illustrated both the deemed mapping of CFLs to incandescent equivalent wattage (based on testimony to the ICC from Mr. Val Jensen, Docket 07-0540) and the evaluation-based mapping of CFLs to incandescent equivalent wattage. One of these spreadsheets was associated with the deemed mapping. The other two spreadsheets were associated with the evaluation-based mapping, one showed the incandescent equivalent wattage for each combination of CFL wattage and lumen output, and the other showed the weighted average delta watts by CFL wattage based on the distribution of PY2 bulb sales from the tracking data. It appears that some of the base wattage values included in the PY3 tracking data may have been derived by adding the average delta watts from this latter spreadsheet to the PY3 program bulb CFL wattages. This is not an accurate application of the PY2 evaluation-based delta watts values because those average values by CFL wattage were a function of the particular model numbers and quantities in the PY2 tracking data.

Lumen output was included in the PY3 tracking data for 48% of model numbers, representing 89% of bulb sales. The evaluation team researched lumen output for the remaining model numbers on-line and used the lumen-based equivalency method developed in PY2 to calculate evaluation-based delta watts estimates by bulb type.

Last, in the case of a small number of fixture sales, the retailer was incorrectly listed in the tracking data with the name of a non-participating retailer. The evaluation team identified the correct retailer through communication with APT, and ComEd staff and made the necessary updates to the tracking database used for the PY3 analyses.

The evaluation team recommends that ComEd add retail sales price per package (based on program sales data, if available, or the goals tracker) as a variable in the tracking data, so as to obviate the need for merging the goals tracker data to the program tracking data in the evaluation phase. Similarly, ComEd may wish to incorporate the lumen output values by model number found through online research by the evaluation team into its tracking data system for PY4.

Program and Implementer Staff Interviews

The evaluation team conducted two in-depth interviews with program staff as part of this evaluation. One of these interviews was conducted with the ComEd Residential Lighting Program Manager and one with the APT Implementation Manager. These interviews were completed over the phone in May 2011. Both interviews focused on changes to the program from PY2 to PY3, the perceived effectiveness of the program, and plans for PY4. The interview guides used are included in Appendix 5.1.1.

Supply-side Market Actor Interviews

A series of supply-side market actor interviews was conducted with lighting manufacturers that currently supply product to one or more program retailers and corporate-level retail buyers at participating retailers. The supply side market actor interviews served several purposes, in support of both the impact and process components of the evaluation.

Lighting Manufacturers

A total of 6 participating manufacturers were interviewed, all of whom were able to provide data used in the calculation of the NTGR estimates. In the case of one manufacturer, separate interviews were conducted with three different people, each representing sales through one retail channel, which resulted in a total of 8 manufacturing interviews. These manufacturers collectively represented 98% of total CFL shipments in PY3.

Once contact was made with a prospective interviewee, they were sent an overview of the questions to be asked in the interview and a table to fill out with their company's sales of both program and non-program bulbs and fixtures over the past two program years.

Corporate Retailers

Professional interviewers attempted to contact the 14 corporate retailers in the survey sample. Of the 14 retailers in the sample, 4 agreed to participate in interviews, and 1 sent an email response to the interview request that included high-level, useful information in lieu of participating in the interview itself. Of the remaining retailers, four firmly declined to participate in the interview, and five did not return phone calls despite being identified by multiple other individuals as the right people to be speaking with regarding their company's participation in the program. Of the 4 retailers who participated in the interviews, 3 were willing to provide estimates of the percentage by which the program had influenced sales. These 3 corporate retailers collectively represent 34% of total CFL shipments in PY3. One grocery retailer agreed to participate in the interview but was unwilling to provide any details on the program's quantitative impacts beyond saying it had led to double-digit growth in sales. The evaluation team was unable to use this response in the overall calculation of program impacts.

In-Store Intercept Surveys

The evaluation team also conducted surveys in participating retail stores with customers purchasing lighting. Interviews were conducted with customers purchasing program CFLs, non-program CFLs and incandescent light bulbs. The questionnaires contained questions for use in both the impact and process evaluations. For the impact evaluation, the survey contained questions designed to assess free-ridership and installation rates. For the process evaluation, the survey contained questions on reasons for purchasing different types of lighting and on awareness of ComEd marketing efforts. A copy of the survey instrument can be found in 5.1.3.

The evaluation team conducted in-store intercept surveys with customers at a mix of DIY, Warehouse and Big Box stores. Table 2-3 shows the number of retail locations at which surveys were conducted and the number of surveys completed for each retailer category. Retail locations were primarily selected on

the basis of lamp sales by retail channel in PY2. Stores located in the greater Chicagoland area were also prioritized as it was not cost effective to conduct intercept surveys in more rural areas.

Table 2-3. In-Store Intercept Retailer Category and Completed Surveys

Retailer Category	Stores	Completed Surveys
DIY	11	286
Warehouse	4	70
Big Box	3	140
Totals	**18**	**496**

Source: Navigant Evaluation Team In-store Intercept Survey Analysis

The intercept surveys took place between February 25, 2011 and June 5, 2011. In most cases, the first interviewing date in a given retail location coincided with an in-store demonstration, and subsequent interviewing in that store occurred independent of in-store demonstrations. In total, 228 of the 496 completed surveys were conducted during a store demonstration.

The field interviewers were instructed to station themselves in the lighting aisle of the store and approach customers after they had made their product selections and were preparing to leave the aisle. Interviewers asked customers to complete a short survey in exchange for a $5 gift card to that particular retailer. Customers received the gift card immediately after the survey was complete, and it could be used that day in the store.

After gaining consent to conduct the survey, the interviewer's first task was to record the products being purchased. This information was used to classify lighting customers into one of three categories: program participants purchasing CFLs that had been discounted through the ComEd program, non-program CFL purchasers purchasing CFLs that were not discounted through the ComEd program, and incandescent bulb purchasers. The distribution of customers interviewed is in Table 2-4.

Table 2-4. In-Store Intercept Survey Respondent Types

Respondent Type	Completed Surveys
CFL Program Participants	433
Non-Program CFL Purchasers	18
Incandescent Bulb Purchasers	45
Total	**496**

Source: Navigant Evaluation Team In-store Intercept Survey Analysis

In-store Shelf Surveys

The in-store field work also included shelf surveys of lighting products. The evaluation team conducted 8 of these shelf surveys across two program retailers. However, the store manager in one DIY store insisted that no pricing data be recorded in the shelf survey, so data from only 7 shelf surveys could only be used in the pricing analysis and demand modeling. The shelf surveys were most often conducted in conjunction with the in-store intercept surveys discussed in the previous section, though in three cases the shelf surveys were conducted on separate visits from the intercepts. As with the intercepts, stores for shelf surveys were selected primarily based on PY2 lamp sales..

Table 2-5 shows the retailer categories where shelf surveys were conducted and the number of surveys conducted for each category.

Table 2-5. Shelf Survey Retailer Categories

Program Retailer Categories	Surveys Completed
DIY	5
Big Box	3

Source: Navigant Evaluation Team Analysis of Shelf Surveys

The shelf survey contained two parts. The first was an assessment of the lighting products and promotional materials in the store. The field worker noted the presence of different types of marketing and promotional materials, the presence and location of different types of lighting products, and the format for product pricing. The second part of the shelf survey was an inventory of all CFL lighting and lighting products that could be used in place of CFLs. The inventory noted the product manufacturer, model number, type of bulb, wattage (both CFL and incandescent equivalent when available), SKU, location in the store, quantity in pack, approximate number of packages on the shelf, original price and discounted price when available.

General Population Telephone Survey

Similar to PY1 and PY2, the General Population survey was directed toward a random sample of ComEd residential customers. The survey used a series of screening questions to classify customers, into a customer user group (those unaware of CFLs, Aware non-purchasers, CFL user non-program purchasers, CFL program purchasers). This information was then used to stratify the sample. Program purchasers were identified as customers who purchased one or more program qualifying bulb at a participating retailer between June 2010 and May 2011. These telephone surveys also collected data to estimate most of the parameters necessary to calculate gross and net energy and demand impacts and assess process-related issues for program participants. This survey was fielded between June 1st, 2011 and June 20th, 2011.

A total of 746 surveys were conducted which yielded the following:

- 305 completed surveys with ComEd residential customers classified as PY3 participants, based on a CFL purchase (standard twisters, specialty bulbs and/or CFL fixtures) they reported making at one of the 14 participating retailers' stores between June 2010 and May 2011.
- 66 completed surveys with ComEd residential customers who purchased a CFL between June 2010 and May 2011 that was not a program bulb.
- 375 completed surveys with ComEd residential customers who did not purchase any CFLs between June 2010 and May 2011.

For the process evaluation, the surveys contained questions on familiarity with and usage of CFLs, awareness of the ComEd Residential ES Lighting program, sources of program awareness, satisfaction with CFLs, barriers to purchasing CFLs, and overall lighting purchase behaviors. All CATI telephone surveys were administered by Opinion Dynamics Corporation (ODC). For the impact evaluation, the survey focused primarily on questions designed to estimate the self-reported net program impacts (which included estimating participant free-ridership and participant and non-participant spillover).

The two customer surveys conducted as part of the PY3 evaluation (the General Population survey and the in-store intercepts survey) complement each other nicely as they allow for the collection of data for different net and gross parameter estimates.

Sampling

The sample used for the general population survey was pulled from the Residential CIS database provided to the evaluation team by ComEd for the PY3 evaluation. This database contained 3,550,363 records, one for each residential customer within ComEd service territory. All records with missing or invalid phone numbers or those surveyed during PY1 or PY2 were removed from the sample.

Survey Disposition

Table 2-6 below shows the final disposition of the nearly 12,000 ComEd residential customers selected for the PY3 General Population Lighting survey. As this figure shows, contact with all but 8% of the sample was attempted at least once and these contacts resulted in 775 survey completes. The survey center was unable to make contact with 44% of customers in the sample for a variety of reasons such as that: no one answered the phone, an answering machine picked up, or the phone line was busy. The phone numbers provided for 19%of the sample had problems such as being disconnected, blocked, an incorrect number, or a cell phone number [22].

[22] Some customers were reached on their cell phones and chose not to complete the survey.

Table 2-6. General Population Survey Call Disposition

Call Disposition	General Population Survey	%
Sample Pulled	11,806	100%
Completes	775	7%
Not Dialed	892	8%
Refusal	2,557	22%
Unable to Reach	5,152	44%
Language Barrier	192	2%
Phone Number Issue	2,238	19%

Source: Navigant Evaluation Team Analysis of General Population Survey Data

Participant Identification

The General Population survey was created in such a way that each customer could be classified into one of five groups based on their responses to a number of the survey questions. Those groups are:

1. Customers who are Unaware of CFLs (Labeled "Unaware" in the tables below)
2. Customers who were aware of CFLs but had never purchased or been given CFLs (NonPurchasers)
3. Customers who have purchased or been given CFLs in the past but not since June 2010 (Prior Purchasers)
4. Customers who have purchased or been given CFLs since June 2010 but at a non-program store, a store outside of ComEd service territory or those who are unable to provide any information about these CFL purchases (Non-Program Purchasers)
5. Customers who have purchased program qualifying CFLs since June 2010 at a program retailer (Likely Program Purchasers)

Table 2-7 below shows the initial classification of the General Population survey respondents across these five categories.

Table 2-7. Initial General Population Survey Customer Classification

Customer Classification	Customers	%
Unaware of CFLs	61	8%
NonPurchasers of CFLs	145	19%
Prior CFL Purchasers	169	23%
Non-Program CFL Purchasers	66	9%
Likely Program Purchasers	305	41%
All General Population Survey Respondents	746	100%

Source: PY3 General Population Survey

The distribution of customers across these five categories in PY3 was quite similar to the distributions seen in PY2. The most noticeable differences were an increase in the percentage of customers that were prior CFL purchasers (from 15% in PY2 to 23% in PY3) and a slight decrease in the percentage that were current PY3 CFL purchasers (program or non-program) from 54% in PY2 down to 50% in PY3. After the General Population survey was completed, the data were carefully reviewed, and respondents who provided answers with major inconsistencies were removed from various analysis sections. Eleven customers reportedly bought CFLs at program retailers but were not classified as program participants since those particular retail stores were located outside of Illinois.

Profile of Survey Respondents

As Table 2-8 below shows, 73% of those interviewed during the PY3 General Population survey indicated they owned their homes (similar to PY1 and PY2 where 75% and 77%, respectively, reported owning their own home). Of the PY3 program participants, 81% reported being homeowners (down slightly from 86% in PY1 and PY2) compared to 73% home ownership across all survey respondents, indicating homeowners are still more likely than non homeowners to purchase program CFLs. Ninety-eight percent of those contacted as part of the PY3 General Population survey reported that they paid their own electric bill.

Table 2-8. Home Ownership Status of General Population Survey Respondents

Home Ownership Status	Percent of Respondents (n=746)
Own	73%
Rent	26%
Other/Refused/Don't Know	2%

Source: PY3 General Population Survey

Section 3. Program Level Results

3.1 Impact Results

This section presents both the Gross and Net impact results from the PY3 Residential ES Lighting Program evaluation.

3.1.1 Verification and Due Diligence

Given modest changes in the program design, this topic was not revisited. Refer to the year 1 report for more information.

3.1.2 Tracking System Review

The Residential Lighting Project Info Database included all upstream program CFL sales since the program inception. A number of data cleaning steps were taken to make sure PY3 bulb sales were complementary and non-overlapping with bulb sales attributed to PY1 and PY2. A small number of bulbs sold in PY2 were counted as PY3 sales due to a delay in the receipt of the retailer invoices for these sales and thus their exclusion from the bulbs counted as PY2 sales. In addition, bulbs sold and included in PY2 sales estimates that were later returned (as indicated by negative quantities in the program tracking data) were subtracted from the PY3 sales. The PY3 analysis dataset was finalized based on the most recent program tracking database received from ComEd (dated July 20, 2011). This dataset contained 173,655 records, representing 11,190,428 program bulbs and fixtures sold in the upstream portion of the program in PY3. An additional 7,434 bulbs were sold through the coupon channel in PY3.

3.1.3 Gross Program Impact Results

As mentioned above there are eight key parameters necessary to calculate gross energy and demand savings estimates for the Residential ES Lighting Program. These include:

1. Number of discounted bulbs (Rebated bulbs) sold through the program (both via the Coupon and Markdown program delivery methods),
2. Average Displaced Watts (Delta Watts) across all program bulbs,
3. Average Hours of Use (HOU) per Day across all installed program bulbs,
4. Installation Rate (Install Rate) across all program bulbs sold,
5. Peak Load Coincidence Factor (CF),
6. Energy Interactive Effects (IE),
7. ComEd Service Territory Leakage, and
8. Residential versus Non-Residential Program Bulb Installations.

These parameter estimates were used to calculate gross energy and demand (coincident peak and overall) savings using the following savings algorithms:

Annual kWh Savings = Program bulbs * Delta Watts/1,000 * Annual HOU * Realization Rate[23] * Energy Interactive Effects

Annual kW Savings = Program bulbs * Delta Watts/1,000 * Realization Rate

Annual Coincident Peak kW Savings = Annual kW Savings * Peak Load Coincidence Factor

It was necessary to calculate energy (kWh) and demand (kW) savings separately for the residential and non-residential installations (since their HOU and CF differ) and then sum them up to get the total program savings. The calculations used to estimate each of these parameter estimates are described in detail below.

Program Bulb Distribution

The number of bulbs distributed through the program is a key parameter in the calculation of gross and net program impacts and is used to extrapolate the per-bulb savings estimates to the program level.

Because the savings analysis for this evaluation is completed by delivery mechanism (in-store coupon and upstream markdown), program bulb sales have been delineated by these two delivery mechanisms. Table 3-1 below provides the total number of CFLs (including standard and specialty CFLs and CFL fixtures) by retailer category and delivery mechanism. These data are based on the coupon and upstream tracking databases provided to the evaluation team by ComEd

Table 3-1. PY3 Rebated Bulbs Sold by Retailer Category and Delivery Mechanism

Retailer Category	Standard CFLs Sold	Specialty CFLs Sold	CFL Fixtures Sold	% of CFLs Sold	Store fronts	Delivery Mechanism
DIY	5,311,323	503,466	25,584	52%	133	Upstream
Warehouse	3,137,796	515,563	9,211	33%	37	Upstream
Big Box	781,825	142,685	3,000	8%	86	Upstream
Grocery/Drug	175,179	15,894	34,819	2%	272	Upstream
Small Hardware	480,236	39,518	14,329	5%	146	Upstream/Coupon
Total Coupon	**6,837**	**597**	**0**	**0.1%**	**na**	**Coupon**
Total Upstream	**9,886,359**	**1,217,126**	**86,943**	**99.9%**	**674**	**Upstream**

Source: Evaluation team analysis of ComEd Tracking database

[23] Realization rate for PY3 is equal to the installation rate * leakage rate

As the table above shows, the vast majority of the program is distributed via the upstream markdown approach (99.9%), and DIY and Warehouse stores are responsible for 85% of all program sales. Table 3-2. and Table 3-3 below provide the total number of CFLs sold (standard and specialty, respectively) through the program by bulb wattage. More than 85% of the standard bulbs sold through the program were low-wattage bulbs (17 watts or less), and approximately 90% of the specialty bulbs sold through the program were low-wattage bulbs. These are both slight increases from PY2, in which 81% of standard bulbs and 86% of specialty bulbs were low-wattage. The single largest-selling wattage for standard CFLs in PY3 was 13 watts[24], which constituted 52% of total standard bulb sales. This was also up from 46% in PY2.

Table 3-2. Distribution of Standard Program Bulbs by Wattage Group

Program Bulb Wattage Group	Standard Bulbs Sold	% of Program Sales
12 Watts or less	367,738	4%
13 Watt	5,097,407	52%
14-17 Watt	3,016,482	30%
18-21 Watt	466,547	5%
22-27 Watt	933,633	9%
28-55 Watt	11,389	0.1%
Total	**9,893,196**	**100%**

Source: Residential Lighting Tracking Data

[24] It is interesting to note that the deemed base wattage values for these 13W standard program bulbs was 40 or 60 (depending on the lumen output), resulting in DW estimates of 27 or 47 which are both less than the PY3 average standard delta watts estimate of 49.3.

Table 3-3. Distribution of Specialty Program Bulbs by Wattage Group

Program Bulb Wattage Group	Specialty Bulbs Sold	% of Program Sales
12 Watts or less	248,512	20%
13 Watt	18,280	2%
14 Watt	276,418	23%
15 Watt	457,728	38%
16-17 Watt	82,873	7%
18-23 Watt	96,337	8%
24-28 Watt	29,580	2%
29-39 Watt	7,995	1%
Total	**1,217,723**	**100%**

Source: PY3 Residential Lighting Tracking Data

Similar to standard and specialty bulbs, program CFL fixtures were predominantly on the low-wattage category. As shown in Table 3-4 below, CFL fixtures designed for low-wattage CFLs represent 72% of total program CFL fixture sales in PY3.

Table 3-4. Distribution of Program CFL Fixtures by Wattage Group

Program Bulb Wattage Group	CFL Fixtures Sold	% of Program Sales
12 Watts or less	8,800	10%
13 Watt	53,889	62%
14-17 Watt	0	0%
18-23 Watt	10,832	12%
24-28 Watt	8,224	9%
29-52 Watt	5,198	6%
Total	**86,943**	**100%**

Source: Residential Lighting Tracking Data

Table 3-5 below provides the distribution of PY3 program bulbs by bulb type. Nearly 90% of the program bulbs sold in PY3 were standard twister bulbs, which is similar to the proportion sold in PY2. Within the specialty bulb group, reflectors comprised 63% of bulb sales in PY3, a modest decline from 67% of specialty CFL sales in PY2.

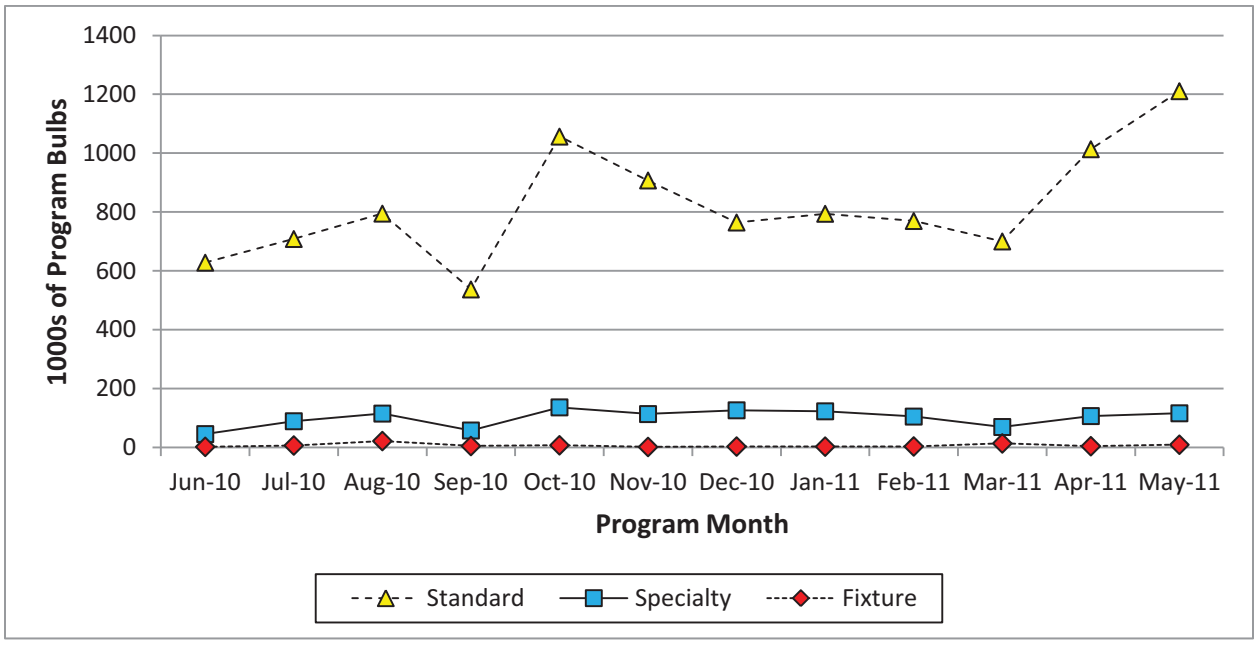
Table 3-5. Distribution of PY3 Program Bulbs by Bulb Type

CFL Bulb Type	Bulbs Sold	% of Program Sales
Standard	9,893,789	88%
Dimmable Twist	11,258	0.1%
3-way	17,701	0.2%
A-bulb	187,141	2%
Globe	119,839	1%
Post	3,568	0.03%
Dimmable Reflector	5,053	0.05%
Reflector	757,656	7%
Candelabra	114,914	1%
Fixture	86,943	1%
Total	**11,197,862**	**100%**

Source: Residential Lighting Tracking Data

Figure 3-1 below presents the distribution of program bulbs sales by month and bulb type (standard, specialty and fixtures). For standard bulbs in both PY2 and PY3, there was a general upward trend in sales rates across years and within each program year. Overall sales of standard bulbs were almost 35% higher in PY3 than PY2. Sales in the second half of PY3 were 13% higher than in the first half, with peak sales months in November 2010, April 2011, and May 2011. There were 6 months in the program year where sales of standard bulbs were between 700,000 and 800,000 per month. The sales rate of specialty bulbs also rose over the course of PY3, with sales in the second half of PY3 16% higher than in the first half of the year. CFL fixture sales were marked by a distinct spike in August 2010, up from an average of 7,100 fixtures per month across the year to over 22,000 for that particular month. A new participant joined the program that month, and August also marks the start of the fall "lighting season," during which program bulbs and fixtures typically receive more exposure on end caps and register displays. March 2411 also showed a CFL fixture sales spike to over 14,000, which corresponded with an increased incentive for some models and increased end cap exposure at one retailer. The observed spikes may also reflect some unevenness in replenishment rates as stores sought to match replenishment with sales. There was an overall downward trend in CFL fixture sales, with sales in the second half of the year 17% lower than in the first half.

Figure 3-1. Program Bulb Sales by Month and Bulb Type



Source: Residential Lighting Tracking Data

Installation Rate

The evaluation estimates of installation rate for CFLs purchased as part of the PY3 Residential ES Lighting program were calculated based on data gathered during the General Population telephone surveys and the in-store intercept surveys. The questions asked of respondents during the General Population surveys included:

How many of the CFLs that you purchased in the last year have you installed in your home?

Where are the discounted CFLs that you did not install?

How many are in storage?

Similarly, in-store intercept participants were asked "Of the CFLs you are purchasing today, how many do you expect to install right away?"

Based on the responses to these questions the installation rate was calculated as the number of bulbs installed (or planned to be installed) divided by the total number of bulbs sold. Table 3-6 below shows the installation rates for both the general population and in-store intercept surveys. As this table shows, the estimated installation rate based on the PY3 in-store intercept surveys (47%) was significantly lower than was estimated via the PY3 General Population surveys (77%).

Table 3-6. Current Status of PY3 Program Bulbs

Program Bulb Status	General Population		In-Store Intercepts[25]	
	Bulbs	%	Bulbs	%
Installed	2,445	77%	1,415	47%
In Storage	694	22%	1,573	53%
Other/Don't Know	37	1%	-	-
All	**2,403**	**100%**	**2,988**	**100%**

Source: PY3 General Population Surveys and In-store Intercept Surveys

While the installation rate estimated based on the General Population survey remained fairly consistent between PY2 and PY3 (80% in PY2 compared with 77% in PY3), the installation rate based on the in-store intercept surveys dropped significantly between the two program years, falling from 70% in PY2 to 49% in PY3 (weighted by the PY3 retailer bulb sales). One difference between the intercept survey fielded in PY2 and the one fielded in PY3 was that in PY2 customers were asked to forecast how many bulbs they planned to install within the next 6 months, and in PY3 they were asked how many they expected to install right away. It is impossible to know how literally customers interpreted "right away" and whether this change in wording was responsible for this significant reduction in the installation rate estimate. However, a recent lighting report issued for AEP Ohio[26]found that the CFL installation rate 20 days from purchases was about 36% compared with the installation rate 40+ days from purchase which was closer to 63%. This shows the correlation between the installation rate and the length of time the customer has the program bulbs, and the dramatic increase that occurs as you go further out in time.

As part of the PY3 evaluation analysis, the in-store intercept installation rate results were broken out using a number of different factors:

- Whether the intercept was conducted in conjunction with an APT demonstration,
- Retailer type (Big Box, DIY, Warehouse),
- Bulb type (Standard, Specialty)[27],
- CFL package size (Single vs. Multi-pack),
- Influence (self-reported) of the CFL price on decision to purchase CFLs (0-10 scale),
- Total number of CFLs purchased.

Table 3-7 below presents the installation rates found for each of these subgroups. As this table shows, customers purchasing their CFLs in conjunction with APT demonstration events reported higher planned

[25] These results for the intercept surveys are not weighted by program retailer sales. When weighted by PY3 program retailer sales the installation rate increases slightly to 49%.
[26] Navigant Consulting, AEP Ohio Program Year 2010 Evaluation Report: Efficient Products Program. Prepared for AEP Ohio, March 7, 2011.
[27] Customers purchasing program fixtures were not included in the in-store intercept surveys since program fixtures were not located in the same aisle with program bulbs in many of the retailers where the surveys were conducted.

installation rates. This may indicate that the demonstrations are encouraging customers to install their CFLs right away rather than wait for currently installed incandescent bulbs to burn out. This table also shows that customers purchasing specialty bulbs or bulbs in single packs (versus multi-packs, which dominated sales in PY3) reported more frequently that they planned to install their program bulbs right away. We also found that the more influential a customer indicated price was in their decision to buy the CFLs, the lower the installation rate. This relationship seems intuitive since customers who are currently in need of CFLs are likely less sensitive to the price of the CFL compared to customers who are not currently in need of CFLs but are buying (and then storing them) because of their low price.

Table 3-7. In-store Intercept Installation Rates Analysis

Population		Installation Rate
Overall NonWeighted		48%
Demo Event	Demo Days	53%
	Non-Demo Days	41%
Retailer Type	Big Box	55%
	DIY	50%
	Warehouse	46%
	Retailer Sales Wt'd	49%
Bulb Type	Standard	46%
	Specialty	54%
Pack Size	Single Pack	54%
	Multi-Pack	47%
Price Influence	Low (0,1,2)	79%
	Med (3,4,5,6)	57%
	High (7,8,9)	52%
	Very High (10)	45%
Total # CFLS Purchased	1	91%
	2-4	55%
	5-10	47%
	> 20	45%

Source: Navigant Consulting Team Analysis

In the PY2 evaluation, the installation rate was calculated by averaging the general population and in-store intercept installation rate results by retail channel and then weighting those results by the PY2 retailer sales distributions. For PY3, the evaluation team does not recommend this same approach

because we feel the change in the intercept survey question wording (from planned installation "in 6 months" to "right away"), has likely led to an underestimation of the true installation rate that is impossible to quantify. However, we do believe that the installation rate is likely decreasing (as seen in both surveys) as a result of the continued rise in the CFL socket saturation level that is expected as the CFL market matures. As a result, we estimate the PY3 installation rate by applying an adjustment factor to the PY2 installation rate. The PY2 rate was based on an average of the intercept and general population surveys. The adjustment factor is calculated as the ratio of the PY3 results over the PY2 results, 77%/80% = 0.96. Applying this adjustment factor to the PY2 installation rates by bulb type results in a PY3 installation rate of 71% for standard bulbs, 78% for specialty bulbs and 86% for fixtures (which equates to an overall installation rate across all bulb types of 71%).

PY3 Late Installs Savings Estimation

The estimation of PY3 Residential CFL energy and demand savings includes savings resulting from bulbs that were purchased during PY1 and PY2 but were found to not have been installed during those program years. Based on an analysis that was done as part of the PY2 evaluation on future installation patterns for stored CFLs, it was determined that savings from all bulbs not installed during the initial program year (and also not installed outside of ComEd service territory) would be divided equally between the two subsequent program years. The estimation of the savings resulting from the installation of prior year program bulbs are calculated using the impact parameter estimates (HOU, DW, NTGR) from the program year of sale and with an assumed installation rate of 100%. Table 3-8 below shows the net energy savings in PY3 attributable to the approximately 1.5 million bulbs sold but not installed during PY1 and PY2, resulting in an additional 48,193 MWh of net energy savings attributable to PY3.

Table 3-8. PY3 Late Installs Net Energy Savings Estimation

PY3 Late Install Estimation	PY1 Bulbs	PY2 Bulbs	Total for PY3
Total Bulbs Sold in the Program Year	3,001,367	8,284,376	
Bulbs Installed Outside ComEd Service Territory	0	34,500	
Bulbs Installed During PY1	2,115,627	n/a	
Bulbs Installed During PY2	442,870	6,097,590	
Bulbs Installed During PY3	442,870	1,076,143	1,519,013
PY3 Late Installs Net Energy Savings (MWh)	12,973	35,220	48,193

Source: Navigant Consulting Team Analysis

PY4 Late Installs Savings Estimation

Based on PY2 and PY3 sales and installation rates, it is also possible at this time to estimate the net energy savings resulting from late installs that will be counted in PY4. As mentioned above the net energy savings resulting from these late installations are calculated based on the evaluation verified impact parameters estimates from the program year when the bulbs were sold and thus are in no way dependent

upon the results of the PY4 program evaluation. For example, the net energy savings results from the 1.6 million PY3 bulbs installed during PY4 are calculated as:

PY4 Late Install Saving from PY3 Bulbs = Bulbs * Gross MWh per bulb * IE * NTGR

= 1,596,986 * 52.4/1,000 * 1.024 * 0.71 = 60,614 MWh

Table 3-9 below shows that the net savings from nearly 2.7 million bulbs can will be attributed to PY4 which will result in approximately 95,834 MWh of net energy savings, not included in the PY2 or PY3 net savings estimate.

Table 3-9. PY4 Late Installs Net Energy Savings Estimation

PY4 Late Install Estimation	PY2 Bulbs	PY3 Bulbs	Total for PY4
Total Bulbs Sold in PY	8,284,376	11,197,862	
Bulbs Installed Outside ComEd Service Territory	34,500	74,232	
Bulbs Installed During PY2	6,097,590	n/a	
Bulbs Installed During PY3	1,076,143	7,929,658	
Bulbs Installed During PY4	1,076,143	1,596,986	2,673,129
PY4 Late Installs Net Energy Savings (MWh)	35,220	60,614	95,834

Source: Navigant Consulting Team Analysis

Delta Watts

In order to estimate the watts displaced by installing a program bulb, it is necessary to know the wattage of the program bulb and the approximate wattage of the bulb that it is replacing (the base watts). For each program bulb, delta watts was calculated as the difference between the program CFL wattage and the estimated base wattage for that particular bulb. As part of the PY3 evaluation, average delta watts values were estimated by bulb type (standard, specialty and fixture) and overall using three distinct methods. These three methods are described below.

Tracking Data Estimates

Delta watts were first estimated using the base wattage values provided in the program tracking data. These tracking data base wattage values appear to have come from multiple sources, including the DEER 2008 Measure Cost Database and the PY2 evaluation-based average delta watts values by CFL wattage. Calculating delta watts based on the base wattage values included in the PY3 tracking data resulted in an average program-level delta watts estimate of 48.4 watts.

TRM Deemed Estimates

The deemed TRM delta watts estimates were calculated by assigning a base wattage to all PY3 program bulbs from a series of three sources. The first source used to assign base wattage estimates was testimony

from Mr. Val Jensen (Docket 07-0540) that was adopted by the Illinois Commerce Commission as the deemed DW estimate. This source covered 94% of the program bulbs sold in PY3. For PY3 bulbs that this mapping did not cover, the standard ES CFL Purchasing guide[28] was used to assign base wattages. This second source left only a handful of bulb types without an assigned base wattage. For these remaining bulbs, the base wattage was assigned based on the lumen mapping described in the section below. This method resulted in an average program-level delta watts estimate of 48.7 watts.

Lumen Equivalence Estimates

A lumen based equivalency method was used to calculate the evaluation estimated delta watts. This method mapped program CFLs to an incandescent equivalent wattage based on lumen output of the program bulb. Lumen output estimates were provided in the tracking data for 48% of the models[29] sold during PY3. For program CFL models which were missing lumen output in the tracking data, the evaluation team completed manual internet lookups to determine the lumen output. Average lumen output for incandescent bulbs were estimated based on the lumen output of the three highest-selling incandescent bulbs supplied by technical representatives at General Electric and Sylvania: two values for soft white bulbs and one value for clear bulbs for each incandescent wattage. The resulting lumen output to base wattage mapping is provided below in Table 3-10. Program CFLs were assigned a base wattage value based on this mapping. Overall evaluation-based delta watts were then calculated as the weighted average difference between CFL wattage and the assigned lumen based base wattage for each bulb in the tracking data. This method resulted in an average program-level delta watts estimate of 48.1 watts.

Table 3-10. Lumen Output to Base Wattage Mapping

Lumen Range	Base Wattage
0 - 313	25
314 - 648	40
649 - 1016	60
1017 - 1437	75
1438 - 2207	100
2208 - 3297	150
> = 3298	200

Source: Navigant Consulting Team Analysis

Table 3-11 below compares the overall delta watts estimates resulting from the application of the three methods. The PY3 evaluation estimated Ex-Post savings estimates are calculated using the deemed lumen equivalence method.

[28] This second source was selected based on an e-mail received from Dave Nichols on 9/30/2010.
[29] Representing 89% of total PY3 bulb sales

Table 3-11. Estimated Delta Watts based on the Various Methods

Delta Watts Calculation Method	Delta Watts Estimate
Program Tracking Data	48.4
TRM Deemed Values	48.7
Lumen Equivalence	48.1

Source: Navigant Consulting Team Analysis

Table 3-12 below shows delta watts were lower for specialty bulbs than for standard bulbs and fixtures by all calculation methodologies. Looking specifically at the evaluation-based method, the delta watts estimate for standard CFLs was 49 watts, 39 watts for specialty CFLs, and 52 watts for CFL fixtures. In comparison, the PY2 evaluation-based values were 50 watts for standard CFLs, 42 watts for specialty CFLs, and 61 watts for CFL fixtures. The drop in value for both specialty CFLs and CFL fixtures from PY2 to PY3 is driven by a shift toward more low wattage CFLs sold through the program, which tend to have lower delta watts than their high wattage counterparts.

A similar comparison can be seen in the deemed delta watts estimates for PY2 and PY3. The PY3 values are 49 watts for standard CFLs, 43 watts for specialty CFLs, and 51 watts for CFL fixtures, while the PY2 values are 50 watts for standard CFLs, 45 watts for specialty CFLs, and 62 watts for CFL fixtures. Again, this difference is driven by the shift toward a greater proportion of low wattage bulbs.

Interestingly, the evaluation team notes that in the particular case of standard CFLs in PY3, the deemed delta watts method yielded the same base wattage value as the evaluation-based method for every standard CFL model number in the program. This was true despite the fact that the deemed method only incorporates a lumens threshold in the mapping of 5 specific CFL wattages, whereas the evaluation-based method used lumens for all base wattage mappings.

Table 3-12. Estimated Delta Watts based on Various Methods by Bulb Type

Bulb Type	Program Tracking Data	TRM Deemed	Lumen Equivalence
Standard	49.0	49.3	49.3
Specialty	43.4	43.3	38.5
Fixture	52.2	51.3	52.1

Source: Navigant Consulting Team Analysis

As the delta watts comparison table above shows, the average delta watts estimate across all PY3 bulbs varies only slightly between methods. The only significant difference seen is for specialty bulbs for which the evaluation lumen based lookup approach resulted in an average delta watts estimate 11% lower than the deemed TRM estimate. The majority of this difference was driven by 14W reflector bulbs that were assigned a base wattage of 60 based on the TRM and 40 based on the lumen lookup table and 23W/26W reflector bulbs that were assigned a base wattage of 87 or 100W based on the TRM and 75W based on the lumen lookup table.

Table 3-13 below shows that the majority of program bulbs (82%) were reported to replace mostly incandescent bulbs, compared with 87% in PY2. Nine percent were reported to replace all or mostly CFLs, compared with 10% for PY2. The remaining bulbs replaced an unknown bulb type (3% of participants could not remember the previous bulb type or stated "other" but did not specify what it was).

Table 3-13. Distribution of Prior Bulb Type

Prior Bulb Type	Bulbs	%
All Incandescent	1,999	64%
Mostly Incandescent	564	18%
All CFL	222	7%
Mostly CFL	59	2%
Other	256	8%
Don't Know	48	2%
Total	**3,148**	**100%**

Source: PY3 General Population Surveys

A new battery of questions was added to the PY3 general population surveys to investigate the factors ComEd customers consider when selecting a particular wattage level of CFLs for their home. Table 3-14 below shows the percentage of customers that mentioned they consider a given factor when purchasing CFLs. These results indicate that CFL purchasers are still primarily selecting CFLs based on either incandescent or CFL wattages as opposed to the lumen output level of the CFL. Customers who responded they considered both incandescent equivalent wattages and lumens to select CFLs indicated they more often relied on incandescent equivalent wattages. These findings were corroborated by responses from trade ally interviewees who reported that in their experience, the majority of customers at this time are still thinking in terms of incandescent equivalent as opposed to lumen output level.

Table 3-14. Considerations when Purchasing CFLs

Considerations	%
CFL Wattage	85%
Incandescent Equivalent Wattage[30]	75%
Price	78%
Lumen Output	42%

Source: PY3 General Population Surveys

[30] This is the incandescent equivalent wattage that is often included prominently on the CFL package (often more prominently than the CFL wattage).

During the PY3 shelf surveys, the incandescent equivalent wattages printed on program bulb packages were captured and compared to the base wattages included in the tracking data.[31] The incandescent equivalent values from these two sources were compared and, in the large majority of instances (95%), the incandescent wattage printed on the program bulb package was the same as the base wattage found in the program tracking data. When the data differed it was typically due to an error in the tracking data (i.e., the base wattage in the tracking data did not match the deemed tables), a CFL wattage (and lumen level) that was excluded from the deemed values, or simply a difference between the deemed base wattage and the base wattage printed on the CFL package.

Hours of Use and Peak Coincidence Factor

Average daily hours of use (HOU) and peak coincidence factor (CF)[32] are key parameters in the estimation of both gross and net program impacts. The HOU and Peak CF estimates used for the calculation of the evaluation TRM verified impacts are the deemed estimates of 2.34 hours per day and 0.081 which are based on testimony from Mr. Val Jensen and adopted by the Illinois Commerce Commission (Docket 07-0540).

As part of the PY3 evaluation of ComEd's Residential ES Lighting program, the evaluation team conducted a lighting logger study[33] in order to estimate the average HOU and Peak CF of CFLs installed in homes within ComEd service territory. The section below presents high level details of the lighting logger study as well as the resulting parameter estimates. Complete details on the lighting logger study are provided in Appendix 5.2.

To estimate HOU and Peak CF for the ComEd Residential ES Lighting Program, the evaluation team installed Dent Lighting Loggers (hereafter referred to as "loggers") in 67 households where CFLs were currently in use. These loggers allow for the calculation of the usage of a particular CFL by recording the exact date and time each light is switched on or off over the entire period they are installed. The PY2 General Population survey served in part to prescreen ComEd households for inclusion in this logger study. All customers who participated in the logger study received two $50 gift cards (one at the time of logger installation and one and the time of logger removal) in appreciation for their participation in the study. A total of 527 lighting loggers were installed across the final sample of 67 homes between June and August 2010 and were left in place for an average of 7.5 months.

Of the 527 installed loggers, only 359 could be used for the analysis. There were several reasons for determining that data from a given logger could not be used in the analysis. Approximately 40 of the loggers were excluded because they had been lost, were removed from the light that they had been installed upon, or had malfunctioned. Data from the remaining loggers was visually inspected for signs

---

[31] It was only possible to make this comparison for 41% of the program bulbs for which shelf survey data was collected.

[32] Peak CF represents the average percent of a given load that is operated during the peak period. For residential CFLs it can also be characterized as the likelihood that a bulb in a given room will be in use at the peak period.

[33] A detailed description of the lighting logger study can be found in a document titled *ComEd Residential Energy Star Lighting Program Metering Study: Overview of Study Protocols*. Submitted to ComEd on June 3, 2010.

of unrealistic patterns of on/off switching, and additional loggers were dropped from the analysis when necessary based on this inspection.[34] An annual HOU estimate for each logger was developed based on a sinusoid projection of the 7 ½ months of collected data to an entire year's use, and weights were applied to expand the collected lighting logger data to the entire ComEd customer population.[35]

HOU Estimation

Table 3-15 below provides the average HOU estimates by room type, the 90% (two-tailed) confidence intervals for each of these estimates, and the number of loggers each estimate is based on for each of the interior room types. As this table shows, the HOU estimates vary significantly by room type from a low of 1.54 HOU/day in laundry/closet areas to a high of 7.16 HOU/day in foyers.[36] It should be noted that some of these results (such as those for foyers, dining rooms and garages) are based on relatively small sample sizes and thus have high levels of uncertainty at the room type level. As one might expect, the CFLs found in the common living spaces have HOU estimates right around the mean (such as living rooms and dining rooms), while CFLs in kitchens typically have higher than average use, and those in bedrooms and bathrooms have lower than average use.

[34] A typical reason that a logger was thrown out was that the logger was logging natural or ambient light, rather than the intended lamp. Often this was identified by the technician when they were extracting the logger and confirmed by the visual inspection of the data.

[35] See Appendix 5.2, "Lighting Logger Study Details", for an explanation of the sinusoid projection.

[36] This table does not contain HOU estimates for CFLs installed in exterior locations. The exterior logger data collected as part of this study was unusable due to the extremely limited sample (only 4 loggers had valid data after the data cleaning was completed). Issues accessing the bulbs and difficulty getting quality data as a result of ambient light issues (which are prevalent in outdoor locations) were the causes of this limited sample. The method by which exterior HOU was estimated in lieu of reliable outdoor logger data is based on the interior lighting data and secondary data and is presented below.

Table 3-15. Average Interior Daily Hours of Use by Room Type

Room Type	n	Average HOU	Lower 90% CL[37]	Upper 90% CL
Basement	41	2.24	1.5	2.98
Bathroom	34	1.70	1.03	2.36
Bedroom	74	1.69	1.12	2.25
Dining	7	2.94	0	6.66
Foyer	7	7.16	0.8	13.52
Garage	8	2.94	0	7.67
Hallway	21	4.39	2.23	6.54
Kitchen	18	4.09	2.7	5.49
Laundry/Closet	32	1.54	0.54	2.55
Living Room	69	2.61	1.96	3.26
Office/Den	29	2.59	1.01	4.16
Other	2	2.82	1.38	4.26
Mean Interior HOU	**342**	**2.57**	**2.23**	**2.91**

Source: PY3 Metering study and Navigant Team Analysis

Table 3-16 below shows the average daily HOU by month based on the metering study, also expressed in terms of the percentage of maximum monthly average HOU. As this table shows, the longest regression based daily HOU estimate for the year was found in December (2.95 hours) and the shortest was found in June (2.22 hours and 75% of the December daily HOU estimate).

[37] Lower Confidence Limits were set equal to a minimum of 0.

Table 3-16. Average Interior Daily Hours of Use by Month

Month	HOU Estimate	% of Max HOU
June	2.22	75%
July	2.25	76%
August	2.37	80%
September	2.55	86%
October	2.74	93%
November	2.89	98%
December	2.95	100%
January	2.92	99%
February	2.8	95%
March	2.63	89%
April	2.44	82%
May	2.29	77%

Source: PY3 Metering study and Navigant Team Analysis

As mentioned above, due to the very limited amount of outdoor loggered CFL data available and the relatively large proportion of the CFLs installed outside the home (they represent 7% of total bulbs), the evaluation team found it necessary to estimate HOU for exterior CFLs using secondary research rather than logger data collected as part of this study.[38]

Table 3-17 below provides a listing of the studies found that included separate HOU estimates for interior and exterior CFLs. This table also shows the percentage of CFLs that were installed in exterior locations for each of these studies and the resulting overall, interior, and exterior HOU estimates. Using this data, two ratios were calculated; the ratio of the overall HOU to the interior HOU and the ratio of the exterior HOU to the overall HOU. The average overall/interior ratio was 107%, and the average exterior/overall ratio was 180%. The distribution of CFLs installed in interior versus exterior locations was estimated for each study based on the interior, exterior, and overall HOU results. As this table shows, the average percentage installed in outdoor locations across these four studies was found to be 7%, which matches the percentage installed in outdoor locations found for ComEd service territory in the onsite inventory audits. Applying these ratios to the ComEd Interior HOU estimate resulted in an exterior HOU estimate of 5.0 hours and an overall HOU estimate of 2.74 hours.

[38] The data from the four usable outdoor loggers had HOU estimates of 0, 3, 15, and 24 hours resulting in a weighted HOU estimate of 10.4 hours +/- 11.8 hours (133%).

Table 3-17. HOU Ratio Estimation

Study (Yr)	% Exterior	Overall HOU Estimate	Interior HOU Estimate	Ratio of Overall/ Interior	Exterior HOU Estimate	Ratio of Exterior/Overall
Efficiency Maine ('05-'06)	7%	3.2	3.2	107%	5.5	172%
CA Metering Study ('06-'08)	10%	1.9	1.7	112%	3.8	200%
CA Metering Study ('05)	4%	2.3	2.3	103%	3.1	132%
EmPower Maryland ('10)	5%	2.9	2.7	106%	6.2	217%
Average	**7%**			**107%**		**180%**
ComEd HOU Ratio Estimate		**2.74**	**2.57**	**107%**	**5.00**	**182%**

Source: PY3 Metering study and Navigant Team Analysis

Peak CF Estimation

In order to estimate the Peak CF resulting from the lighting logger study, the evaluation team calculated the percentage of time a given logger was turned on during the "peak" time period. The results presented here are for the ComEd "peak" defined as weekdays from 1 p.m. to 5 p.m.[39] Logger data from the period between June 24th and August 31st was used to estimate the Peak CF, and all loggers having at least 11 days worth of data during this period were included in the analysis dataset (325 loggers, 536 lamps loggered). Table 3-18. below provides the Peak CF estimates, the 90% confidence intervals for each of these estimates, and the number of loggers each estimate is based on across all interior room types. As this table shows, similar to the HOU analysis, the Peak CF estimates vary significantly by room type, from a low of 0.043 in the bedroom to a high of 0.237 in foyers. Again, it should be noted that some of these results (such as those for foyers, dining rooms and garages) are based on small sample sizes and thus, have high levels of uncertainty at the room type level. The weighted average Peak CF estimate across all interior room types is 0.095 +/- 0.017(18%).

[39] This is also the PJM bidding "peak" (2 p.m. to 6 p.m. Eastern Standard Time).

Table 3-18. Interior Peak CF Results by Room Type

Room Type	n	Average Peak CF	Lower 90% CL[40]	Upper 90% CL
Basement	41	0.128	0.068	0.189
Bathroom	31	0.072	0.032	0.111
Bedroom	69	0.043	0.026	0.059
Dining	6	0.134	0.010	0.258
Foyer	7	0.237	0	0.517
Garage	8	0.099	0	0.275
Hallway	19	0.095	0.047	0.143
Kitchen	17	0.149	0.055	0.243
Laundry/Closet	31	0.066	0.020	0.113
Living Room	62	0.094	0.053	0.136
Office/Den	28	0.105	0.032	0.178
Other	2	0.062	0	0.393
Mean CF, Interior	321	0.095	0.079	0.112

Source: PY3 Metering study and Navigant Team Analysis

As mentioned above, due to the very limited amount of outdoor loggered CFL data available (4 loggers) and the relatively large proportion of the CFLs installed inside or outside a home (they represent 7%), the evaluation team recommends estimating Peak CF using the same ratio estimation method employed in the HOU analysis for exterior CFLs, rather than the small amount of reliable exterior lighting data collected for this study.[41] This method results in an exterior Peak CF estimate of 0.184 and an overall Peak CF estimate of 0.102.

Ex-Ante versus Ex-Post Results

Table 3-19 below presents the Ex-Ante and Ex-Post results based on the PY3 ComEd metering study. As this table shows, the Ex-Post result for HOU was 17% higher than the Ex-Ante estimate, and the 90% confidence interval on the Ex-Post estimate falls outside the Ex-Ante estimate. The Ex-Post result for Peak

[40] Lower Confidence Limits were set equal to a minimum of 0.

[41] The data from the four usable outdoor loggers had Peak CF estimates of 0, 0.01, 0.99, and 1, resulting in a weighted Peak CF estimate of 0.570 +/- 0.663 (116%) which includes both 0 and 1 (the minimum and maximum Peak CF estimates).

CF was 25% higher than the Ex-Ante estimate, and again the 90% confidence interval falls outside the Ex-Ante estimate.

Table 3-19. Ex-Ante versus Ex-Post Results

Estimate	Ex-Ante	Ex-Post	Lower 90% CL	Upper 90% CL	% Increase in Ex-Post
HOU	2.34	2.74	2.41	3.07	17%
Peak CF[42]	0.081	0.102	0.085	0.118	25%

Source: PY3 Metering study and Navigant Team Analysis

Leakage

Based on the in-store intercept interviews conducted for the PY3 evaluation, leakage continues to be an insignificant problem. More than 99% of those who purchased program bulbs indicated that ComEd was the electrical service provider for the location (home or office) where they intended to install the program bulbs they were purchasing. When weighted by bulbs sold, this represented 99.3% of all program bulbs. This leakage adjustment factor was included in the realization rate applied to calculate the PY3 evaluation verified savings estimates.

Residential versus Non-Residential Installation Location

The percentage of program bulbs being installed in residential versus nonresidential locations was estimated again in PY3 using data collected during the in-store intercept surveys. During these surveys, all respondents were asked where they planned to install (home, business or other location) the program CFLs they were purchasing on the day the intercept survey was completed. In PY2, the residential/nonresidential installation split based on the intercept surveys was estimated at 90/10. As mentioned in the PY2 report, the evaluation team was somewhat skeptical of this estimate as it was significantly higher than what had been estimated within other jurisdictions that were selling program bulbs through similar channels (such as the 2006-2008 California Upstream Lighting Program evaluation, which estimated the residential/nonresidential split to be 94/6). Also, it was based on only a single year of data collected at a small sample of retailers (intercepts were only conducted at three retailers in PY2) and was almost entirely driven by one program retailer, at which 44% of bulbs sold were reported to be installed in the customer's business rather than residence.

This analysis was completed again as part of the PY3 evaluation (based on in-store intercept surveys conducted at 5 program retailers), and Table 3-20 below shows the self-reported installation location by retailer category. As this table shows, the percentage of respondents reporting that they planned to install the program bulbs in a business location showed little variation by retailer category in PY3. This is in contrast to PY2 where nearly a third of those who purchased program bulbs at a DIY store reported they

[42] The precision associated with the one-tailed 90% CL on the Peak CF estimate is 12.5%.

planned to install at least some of the bulbs they were purchasing in a location other than their home. To estimate the PY3 residential/nonresidential split, the bulbs purchased by customers who reported that they planned to install the bulbs they were purchasing in both home and business locations were divided evenly between these two locations. This resulted in an overall PY3 residential/nonresidential split of 97/3.

Table 3-20. Self-Reported Installation Location by Retailer Category

Installation Location	Retailer Category			
	DIY	Warehouse	Big Box	Weighted Total
Home	95%	96%	98%	96%
Business	2%	1%	2%	2%
Both	3%	3%	0%	2%
% of Program Bulbs Sold	**52%**	**33%**	**8%**	

Source: In-store Intercept Surveys

Calculating the PY3 gross Ex-Post impacts to reflect this residential versus non-residential split requires estimating the non-residential HOU and CF parameters and then applying these estimates to the percentage of bulbs estimated to have been installed in non-residential locations. In order to get the most accurate estimate of these non-residential HOU and CF estimates, all in-store intercept respondents who reported they planned to install program bulbs in a business location were asked to describe the type of business this was. The majority of respondents (60%) reported the bulbs were for an apartment building, followed by K-12 schools, restaurants, and public assembly locations.[43] To estimate the HOU and Peak CF for these non-residential locations, the evaluation team used the prescriptive workpapers created by KEMA for the ComEd prescriptive program.[44] These workpapers did not include deemed HOU or Peak CF estimates for apartment buildings, and thus the "Miscellaneous" category estimates were used for the bulbs reportedly installed in apartment buildings.[45] The evaluation team completed a secondary literature review to determine if HOU or Peak CF factors have been estimated for CFLs installed in common areas within apartment buildings, but none were found. The resulting non-residential HOU and Peak CF estimates are 10.88 and 0.73, respectively (HOU in the PY2 evaluation was estimated at 10.0, and the CF was estimated at 0.86). Table 3-21 below provides the details on how these estimates were calculated.

[43] It should be noted that this is based on a relatively small number of customers (n = 13) who reported they planned to install program bulbs in their business.
[44] KEMA. *Appendix A* of the *KEMA Operations Manual*. Prepared for Commonwealth Edison Company, August, 2009.
[45] The "Miscellaneous" category HOU estimate is close to 12 hours/day.

Table 3-21. Self-Reported Installation Location by Retailer Category

ComEd Business Type[46]	n	Bulbs	Annual HOU	Daily HOU	Peak CF
Apartments	7	55	4,321	11.84	0.77
Office Building	1	4	2,616	7.17	0.81
Public Assembly	1	6	4,321	11.84	0.77
Restaurant	1	6	4,816	13.19	0.68
Retail	1	5	4,117	11.28	0.88
School, K-12	1	11	1,873	5.13	0.42
Missing	1	4	4,321	11.84	0.77
Bulb Weighted Average	13	91	3,970	10.88	0.73

Source: In-store Intercept Surveys and KEMA Operations Manual

Interactive Effects

Compact Fluorescent Lamps (CFLs) use less energy than incandescent lamps to produce the same amount of useful light. As a result, CFLs produce less waste heat than incandescent lamps. At times of year when people cool their homes with air conditioning systems, this reduction in heat produced by replacing incandescent bulbs with CFLs can provide the additional benefit of reducing cooling loads. Conversely, during the heating season, the reduced heat can result in net increases in heating requirements. These cooling benefits and heating penalties associated with the lighting retrofits are referred to as "interactive effects."[47]

To estimate the cooling benefits that result from installing program bulbs, the evaluators modeled three "typical" home types in eQUEST (Quick Energy Simulation Tool) that simulated average homes located within ComEd service territory. eQuest is a whole building energy simulation program that provides a graphical user interface for the DOE2.2 simulation engine to estimate overall building performance parameters. The tool can calculate hourly, monthly, and annual energy usage values for each end-use being modeled or evaluated, while applying weather data for the modeled geographical location to gauge the interactions between the end-uses and the changing seasonal climatic parameters. Complete details on the interactive effects modeling performed as part of the PY3 evaluation are included in Appendix 5.3.

[46] The HOU and Peak CF estimates for Apartments, Public Assembly and Missing business types were set equal to the Miscellaneous HOU and Peak CF estimates from the Operations Manual.

[47] For any CFL programs that are administered jointly between ComEd and the gas utilities, the interactive effects associated with cooling savings should only be applied in combination with heating penalties resulting from increased heating loads.

The intent of this analysis was to determine the cooling interactive factors[48] applicable to homes in the ComEd service territory based on a variety of model parameters derived from several data sources. To estimate these interactive factors, it is necessary to estimate the additional cooling energy savings resulting from a hypothetical lighting retrofit, as well as the direct energy savings resulting from the lighting retrofit itself. The interactive factors are then calculated as the ratio of the cooling savings divided by the lighting savings.

As mentioned above, three "typical" homes were modeled as part of this evaluation; a single family detached home (SFD), a single family attached home (SFA), and a multi-family home (MF).[49] Primary demographic and home design parameters for these "typical" homes were estimated from the 2009 ComEd Residential Appliance Saturation Survey (RASS).[50] If the design and demographic data were not found in the RASS, the eQUEST model default values (based on the prevailing 2009 International Energy Conservation Code (IECC 2009)) or the ASHRAE 90.1 stipulated minimum standards for Chicago, IL (the location of the "typical" house) were used. The codes and standards used for this analysis apply to new buildings and additions to/alterations of existing buildings. Climate zone 5B (Cool, Humid), for Chicago - Illinois, was used to represent the typical weather for this model.

Parameters taken from the RASS included the average square footage of a SFD/SFA/MF home; information on construction materials; HVAC system type, efficiency, and sizing; and thermostat setpoints.[51]

Once the "typical" homes were modeled, the interactive effects were estimated by running simulations using the baseline lighting conditions and then re-running the simulations with the efficient lighting condition and holding all other parameters fixed. These simulations produced estimates of the total annual whole building energy usage, as well as estimates of the individual annual lighting and cooling demand (kW) and energy consumption (kWh), for both the baseline and efficient lighting conditions. The difference between the cooling energy consumption for the baseline and efficient lighting conditions, as a ratio of the difference in the lighting energy consumption over baseline conditions, yielded an energy interactive factor; a similar ratio for baseline and efficient case cooling and lighting demand savings was calculated to establish a demand interactive factor.

---

[48] Electric heating penalties were not considered for this analysis as ComEd has a relatively small percentage of customers who have electric space heaters as their primary heat source.

[49] This distribution of these "typical" home types was determined based on the distribution found during the PY3 General Population survey. A total 746 randomly selected ComEd Residential customers were included in this survey and 57% reported living in a SFD home, 18% resided in a SFA home and 24% in a multi-family home.

[50] 2009 Commonwealth Edison Residential Appliance Saturation Survey RASS, Final Residential Audit Data/ Data Dictionary

[51] ComEd provided the evaluation team with eQuest modeled homes that had been built by ECW for planning purposes for ComEd. We ran simulations with these models in addition to the ones we build, and the results were quite similar. The evaluation team decided to use the results based on the models we build since we were more familiar with those models and they had been built specifically for the purpose of estimating interactive effects. The results from both eQuest models are presented below.

Table 3-22 below provides estimates of the cooling benefits resulting from lighting retrofits based upon the eQuest models developed as part of the PY3 Residential ES Lighting program, as well as the eQuest models developed by ECW. As this table shows, the cooling interactive effects estimated from both models were quite small. To calculate the evaluation estimated impacts, the Navigant Team models were used and thus the resulting cooling interactive effects estimate was 2.4%.

Table 3-22. Cooling Interactive Effects (IE) Estimates

Building Type	Estimated IE Navigant Team Models	Estimated IE ECW Models	Home Type Distribution
SFD	3.1%	0.9%	58%
SFA	0.9%	1.9%	18%
ME	1.8%	1.2%	24%
Weighted Average	**2.4%**	**1.2%**	

Source: Evaluation Team Analysis

Ex-Post Gross Impact Results

Based on the gross impact parameter estimates described in the previous section, estimates of the gross program impacts resulting from PY3 Residential ES Lighting program were developed. The results are provided in Table 3-23 below.

Table 3-23. Ex-Post Gross Parameter and Savings Estimates

Gross Parameter and Savings Estimates	Residential Installation			Non-Residential Installation		
	Standard	Specialty	Fixture	Standard	Specialty	Fixture
CFLs Distributed through the Program	9,597,022	1,181,268	84,340	296,174	36,455	2,603
Average Displaced Watts (Delta Watts)	49.3	38.6	51.8	49.3	38.6	51.8
Average Daily Hours of Use	2.74			10.88		
Gross kWh Impact per unit	49.3	38.6	51.8	195.6	153.1	205.5
Gross kW Impact per unit	0.05	0.04	0.05	0.05	0.04	0.05
Realization Rate	72%	79%	87%	72%	79%	87%
Peak-Load Coincidence Factor	0.102			0.73		
Total First-Year Gross MWh Savings	**338,486**	**35,970**	**3,806**	**41,463**	**4,406**	**466**
	424,597					
Total First-Year Gross MW Savings	**338**	**36**	**4**	**10**	**1**	**0**
	390					
Total First-Year Gross Peak MW Savings	**34.5**	**3.7**	**0.4**	**7.6**	**0.8**	**0.1**
	47					

Source: Evaluation Team Analysis

Another key input to estimate ex-post cost effectiveness analysis is the estimated useful life (EUL) of the program bulbs. Using program tracking data the average EUL for standard bulbs was calculated to be 9,262 hours, specialty bulbs were estimated to have a EUL of 8,466 hours and all fixtures had a EUL of 10,000 hours. The EUL values provided in the tracking data come from the CFL manufacturers and were not evaluated independently as part of this study.

3.1.4 Net Program Impact Results

As mentioned above, after gross program impacts have been estimated, net program impacts are calculated by multiplying the gross impact estimate by the program net-to-gross ratio (NTGR). In PY3, five primary methods were used to estimate the NTGR:

1. Customer self-report approach based on the General Population Surveys
2. Customer self-report approach based on the In-Store Intercept Surveys
3. Supplier self-reports based on in-depth interviews with program trade allies
4. Revealed Preference Demand Modeling
5. Multivariate Regression Modeling (Multi-State Study) based on data collected from regions with varied levels of program activity.

Comparison of Net Impact Results across Methods

Table 3-24 presents ranges of estimated NTGR resulting from the five NTGR methods employed during the PY3 evaluation.

Table 3-24. Ex-Post NTGR Estimates by Evaluation Method

Evaluation Method	Data Source	NTGR Estimate
Customer Self-Report	General Population Survey	0.54
	In-store Intercept Survey	0.71
Supplier Self-Report	Trade Ally In-depth Interviews	0.41
Revealed Preference Purchase Model	In-store Intercepts and Shelf Surveys	n/a
Multi-State Regression Model	Multi-jurisdictional Phone and Onsite Surveys	0.51 – 0.89
Recommended PY3 Ex-Post NTGR Estimate		**0.71**

The evaluation team thoroughly reviewed the PY3 Residential ES Lighting Program NTGR results from each of the methods employed, and recommends calculating the PY3 Ex-Post NTGR based on the results from the in-store intercept self-report method. In PY2 the results from the two customer self-report results (which were nearly identical at 0.57 and 0.60) were averaged to come up with the final NTGR estimate. However, in PY3 the results from these two methods did not converge as closely (0.54 from the Gen Pop surveys and 0.71 from the Intercept surveys) and thus the evaluation team recommends using the results from In-Store Intercept survey which we feel is the strongest of the 5 methods. The data underlying this method is the most reliable since it is based on a large sample of interviews, and focuses on customer perceptions at the time of purchase, while the purchase experience and influential factors are still fresh in the respondent's mind. The general population survey data was used as the basis for the estimation of both participant and nonparticipant spillover (a limitation of the in-store intercept surveys).

The supplier self-report NTGR estimate again provides strong evidence that high levels of free-ridership exist in the market. We do not recommended using this method in the final NTGR calculation, since it is based on the responses of a small sample of manufacturers and program retailers and can therefore easily be influenced by the responses provided from one or two supplier-respondents. We believe the results from this method likely represent a lower-bound on the NTGR for the Residential ES Lighting Program. The results of this method also suggest a slight increase in the NTGR between PY2 and PY3.

Unfortunately the revealed preference demand modeling results for PY3 are highly unstable due to the population of customers interviewed during the in-store intercept surveys (i.e., a sample heavily biased towards program participants). The over representation of program participants in this sample does not impact the customer self-report NTGR method - in fact, in some respects it helps it, by increasing the sample size for the SR method. However, it causes serious problems within the revealed preference demand models. While this method theoretically continues to have promise, the difficulties encountered collecting unbiased robust data make it nearly impossible to implement in practice.

The multi-state model NTGR results are also problematic. They were heavily dependent upon which modeling timeframe was selected and whether or not prior program activity was considered a program variable or not. The evaluation team believes the model's results do not provide enough strength in specifying market mechanics and decision making to provide a defensible estimate of the NTGR by itself. For this reason, we do not recommend using these results in the calculation of the program NTGR in PY3.

As was noted in the PY2 report, it is important to understand the challenges of estimating the NTGR for an upstream program such as the Residential ES Lighting program, where the market is dynamic and the product is very low cost relative to other energy efficiency investments. The evaluation team continues to believe that investigating free-ridership and spillover using multiple approaches results in the most robust final NTGR estimate. Given the problems experienced in applying the regression-based revealed preference and multi-state approaches, we will be revisiting their use in PY4.

Further details on regarding the NTGR estimation via each of the 5 methods employed are presented in the sections below.

Customer Self-Report Methods

The customer self-report methods relied on responses provided by program participants during the General Population CATI telephone survey and the in-store intercept surveys to determine the fraction of CFL installations that would have occurred by participants in the absence of the program (free-ridership). The incremental non-program CFL installations influenced by the program (spillover) could only be calculated from the General Population survey. Once these parameters have been estimated, the NTGR can be calculated as:

NTGR = 1 – Free-ridership + Spillover (Participant and Nonparticipant)

Free-ridership

Calculating free-ridership using the customer self-report method requires using collected survey data to assign the following two scores:

1) *Program Influence Score* - The degree of influence the program had on the customers' decision to install CFLs, and
2) *No-Program Score* - What actions the customer would have taken on their own if the program did not exist.

Once these two scores have been calculated, customer-level free-ridership is equal to:

Customer-level Free-Ridership = 1 – (Program Influence Score + No-Program Score)/20

Using the NTGR scoring algorithm, customers fall into one of three free-ridership levels: Full, Partial, or Non Free-rider. A customer was classified as a *Full Free-rider*[52] if they reported that the program was not a

[52] Full Free-rider: Free-ridership score of 1.0 and NTGR score of 0.

critical factor in their decision to install CFLs as opposed to standard efficiency bulbs and that they would have purchased CFLs at the same time to install in their residence even if the program did not exist. Conversely, a customer was defined as a *Non Free-rider*[53] if they reported that the program was a critical factor in their decision to install CFLs and that it would have been highly unlikely that they would have purchased the same CFLs on their own without the program. Between these two extremes, customers were classified as Partial Free-riders[54] and were assigned a free-ridership score between 0% and 100% based on their answers regarding the influence of the program on their decisions and what they would have done in its absence.

General Population Survey

A few changes were made to the PY3 general population (Gen Pop) survey in an attempt to improve a respondent's comprehension of the average incentive amounts provided for CFLs through ComEd's Residential ES Lighting program.

In the PY2 Gen Pop survey, respondents were asked: If the CFLs had been $1.00 more per bulb would you still have purchased the CFLs or would you have purchased incandescent light bulbs? Those stating they would have still purchased CFLs were also asked if they would have purchased the same number or fewer.

In the PY3 Gen Pop survey, this question wording was changed to: If the (spiral or specialty) CFL(s) you purchased since June 2010 had been ($1.00 for spiral/$1.50 for specialty) more per bulb, [if customer purchased multi-packs also read: so a 4-pack of bulbs would have been $4 more (spiral)/$6 more (specialty)] would you still have purchased the CFLs or would you have purchased incandescent light bulbs?

Table 3-25 below compares the responses given to these questions in PY3 versus PY2. It also compares the results from similar questions asked as part of the in-store intercept surveys (which also underwent similar question wording changes). As this table shows, in PY3 more respondents indicated they would likely have purchased no CFLs or fewer CFLs if they had not been discounted. The differences found were more extreme for the intercept surveys, but significant for both surveys nonetheless.

[53] Non Free-rider: Free-ridership score of 0.0 and NTGR score of 1.
[54] Partial Free-rider: Free-riders score > 0 and < 1, NTGR score > 0 and < 1.

Table 3-25. Change in Program Bulb Purchases in the Absence of the Program Incentive

# of Program CFLs Purchased if Price Increased	General Population		In-store Intercept	
	PY3	PY2	PY3	PY2
The Same Number	32%	54%	22%	53%
Fewer	19%	12%	32%	24%
None	37%	20%	45%	19%
Don't Know	12%	14%	1%	2%

Source: PY3 Customer Surveys

A greater proportion of survey respondents in PY3 also indicated that price was highly influential in their decision to purchase CFLs. Table 3-26 below shows the percentage of survey respondents indicating that price had a low, medium or high level of influence in their decision to purchase CFLs. As this table shows, customers interviewed at the time of purchase (via in-store intercept surveys) reported much higher price influence levels than those who were interviewed possibly months after their CFL purchase (General Population surveys). The evaluation team believes that for lower priced measures, such as CFLs where the incentives offered are typically less than $5, intercept respondents are likely providing more realistic real-time estimates of price influence than Gen Pop customers who are asked to recall the influence of this incentive up to a year after they purchased the CFLs.

Table 3-26. Influence of Price in Decision to Purchase CFLs

Influence of Price in Decision to buy CFLs	General Population		In-store Intercept	
	PY3	PY2	PY3	PY2
Low (0,1,2)	14%	18%	3%	9%
Medium (3,4,5,6,7)	47%	50%	8%	33%
High (8,9,10)	40%	32%	89%	58%

Source: PY3 Customer Surveys

Despite this higher reported influence of price in PY3 compared to PY2 and the reported reduction in CFLs that would have been purchased without the program, the estimate of free-ridership remained fairly consistent from PY2 to PY3 (0.48 to 0.47), due largely to a small change made to the general population free-ridership scoring algorithm. As detailed in the PY2 report, customer self-reported free-ridership is estimated based on the average of two distinct scores. These scores include: 1) A program influence score (PI Score) that estimates the level of influence the program had on a customers' decision to install CFLs instead of standard efficiency bulbs, and 2) A no-program score (NP Score) that attempts to quantify what the customer would have done in the absence of the program (Would they still have purchased CFLs? Would they have purchased fewer CFLs? Would they have delayed the purchase of the CFLs?). The change made in PY3 altered the calculation of the NP Score for customers who stated they had been "considering" purchasing non-CFLs when they first learned about the program. In PY2 these

customers were assigned an NP Score of 10 (i.e., NTGR = 1.0), however in PY3 their NP Score was calculated based on their stated likelihood of buying CFLs without the incentive.

The PY3 General Population free-ridership results were broken down and analyzed according to three attributes: Bulb type (spiral versus specialty bulbs), pack size (single versus multi-packs), and retailer category. The only significant difference detected was across retailer categories. Free-ridership was found to be higher at DIY and big box stores, and lower at small hardware and warehouse stores. The PY3 tracking data shows there was a significant increase in the percentage of program bulbs sold at DIY/big box stores in PY3 (46% in PY2 and 60% in PY3) and a significant decrease in the number of bulbs sold at warehouse stores (45% in PY2 down to 33% in PY3). This shift across program retailers also led to an increase in free-ridership in PY3.

In-store Intercept Survey

The Customer Self-Report NTGR method based on the in-store intercept surveys increased substantially for PY3 from 0.54 to 0.69 (excluding spillover). The evaluation team believes one of the primary drivers for this increase was likely a clarification made to wording of a question in the survey so that the customers had a better comprehension of the true program incentive offered for the bulbs they were purchasing. This question is a key piece of the NTGR calculation algorithm. A second causal factor was the higher proportion of participants purchasing multi-packs in PY3, for whom the influence of the program discount on their purchase decision is stronger (14% of PY2 sales were single packs compared with 8% of PY3 sales that were single packs).

The question phrasing used in the PY2 intercept surveys was: How many CFLs would you have purchased if each bulb cost $1 more?

In PY3 this question wording was changed to: If the ComEd discount had not been offered and the CFLs had instead cost [(size of package being purchased) * ($1 for standard bulbs or $1.50 for specialty bulbs] more per pack how many CFLs would you have purchased?

As Table 3-25 above showed, there was a major decrease in PY3 in the percentage of respondents who stated they would have purchased the same number of bulbs if the discount had not been offered, and there was a major increase in PY3 in the percentage of respondents who stated they would not have purchased any bulbs if the discount hadn't been offered.

These major shifts seem understandable when you think of them in terms of the price increases inserted into the question wording in PY3. Seventy-seven percent of those interviewed in PY3 were purchasing multi-packs (the tracking data indicates that across all upstream retailers less than 10% of bulbs were sold in single packs), and the average multi-pack size was 3.5 for standard bulbs and 5.0 for specialty bulbs. This means that on average multi-pack purchasers were hearing that the packages they were purchasing would be $3 more expensive (for standard bulbs) or $7.50 more expensive (for specialty bulbs) without

the program. In PY3, the NTGR for bulbs sold in single-packs was 0.61, compared with 0.73 for bulbs sold in multi-packs[55].

The upward shift in how influential customers stated price was in their decision to buy CFLs is also consistent with the higher customer self-report NTGR value found in PY3. It could be reflective of the continued downward state of the economy and related increasing sensitivity customers have to prices.

Participant and Non-Participant Spillover

In PY3, participant spillover was estimated at 2%, down from 5% in PY2. This decrease was primarily driven by the decline in the number of program participants who reported having purchased additional non-discounted CFLs in PY3. The large number of program bulb models available in PY3 (a 35% increase over PY2) in the majority of lighting retailers lessens the likelihood that customers are purchasing non-discounted CFLs.

In PY3, non-participant spillover was calculated as 0% (compared with 1% in PY2). Only two of the non-participants surveyed reported they had purchased non-discounted CFLs after learning about the ComEd program, and both of these respondents reported that ComEd's program did not influence their decision to buy these non-discounted bulbs. Again, the wide availability of program bulbs may be limiting the level of non-participant spillover found. The discounts ComEd offers are found in the majority of lighting retailers within the ComEd service territory and are offered through the entire year on a wide variety of bulb types. This makes it unlikely there are any ComEd customers who have purchased non-discounted CFLs, know about the program, and claim to have been influenced by it.

Self-Reported Net-to-Gross Ratio

The overall customer self-reported free-ridership estimate was calculated based on the retailer specific in-store intercept free-ridership estimates, weighted to take into account the retailer's sales of PY3 bulbs. The result of this analysis was a free-ridership estimate of 0.31. Combining this with the Spillover (participant and nonparticipant) estimates provided above from the General Population survey, the program-level NTGR for the PY3 Residential ES Lighting Program is calculated as:

NTGR = 1 – Free-ridership + Participant Spillover + NonParticipant Spillover

= 1 – (0.31) + .02 + 0 = 0.71

Supplier Self-Report Method

This section provides the Net-to-Gross ratio (NTGR) values based on the supplier self-report method for standard bulbs, specialty bulbs, and fixtures in the Residential ES Lighting Program.

The final estimation of the NTGR for each CFL product category is the shipment-weighted average of the component NTGR values for each market actor.

[55] These are not retailer sales weighted results.

Looking across all three CFL types, overall supplier self-report NTGR for PY3 is 0.41. This represents a 2% increase from PY2, in which the overall supplier self-report NTGR across bulb types was 0.40. At the bulb type level, NTGR is 0.40 for standard CFLs in PY3, 0.46 for specialty CFLs, and 0.79 for CFL fixtures. Comparing the supplier self report NTGR values between PY2 and PY3, the most significant overarching observation is that overall NTGR for specialty CFLs decreased from 0.53 to 0.46, while it increased very modestly for standard CFLs from 0.39 to 0.40 and for CFL fixtures from 0.77 to 0.79. **Table** 3-27 through Table 3-29 below show how NTGR estimates and lamp sales at the retail channel level comprise the overall sales-weighted estimates by bulb type.

The text supporting the tables also describes changes in NTGR estimate by bulb type from PY2 to PY3. There were four underlying dynamics driving these changes: (1) For each bulb type, there were shifts in the relative size of each retail channel and therefore its contribution to overall sales-weighted NTGR for the bulb type; (2) there were changes in the sales lift estimates by individual interviewees between PY2 and PY3; (3) there were shifts in the specific manufacturers and corporate retailers providing sales lift estimates for a given retail channel, both due to entry/exit from the retail channel and changes in the mix of companies that agreed to participate in interviews; and (4) finally, a formal sales cannibalization element was incorporated into the PY3 NTGR calculation that was not included in the PY2 NTGR calculation.[56]

For standard CFL spiral bulbs, the overall supplier self report NTGR is 0.40. This reflects a weighting of NTGR values that range from 0.25 for grocery/drug stores to 0.56 for warehouse stores. NTGR values for big box/DIY stores and small hardware stores are between 0.30 and 0.50. Comparing PY2 and PY3, the overall NTGR for standard CFLs increased from 0.39 to 0.40. This net change reflects an increase in the weighted average raw NTGR from 0.39 to 0.44, which was then adjusted downward to reflect sales cannibalization effects in the form of decreased non-program standard CFL sales reported by interviewees. The overall increase in the raw NTGR estimate was driven largely by the Big Box and DIY retail channels. Standard CFL sales through Big Box and DIY stores represented a higher proportion of total program sales of standard CFLs in PY3 than in PY2, moving from 46% to 62% of total standard CFL program sales. Also, two respondents in this retail channel gave significantly higher sales lift estimates in PY3 than they did in the previous year, though they did not offer specific reasons for why the estimates changed. Specific questions that ask respondents to provide comments on any changes in their sales lift estimates from year to year will be incorporated into future supplier self report interviews. The warehouse channel declined in relative size from 45% to 32% of total program standard CFL sales. The NTGR for this channel rose from 0.47 to 0.56, due largely to a higher sales lift estimate by one respondent in PY3[57]. The Grocery/Drug/Misc channel saw a significant drop in raw NTGR from 0.82 to 0.38, due to a significant drop in the sales lift estimate by one respondent, but as this channel only represents just 2% of standard CFL program sales, it does not contribute meaningfully to the overall NTGR. The small hardware channel remained at 5% of standard CFL program sales, and the raw sales-weighted NTGR for this retail channel fell modestly from 0.43 to 0.38. This was due to declines in sales lift estimate by two respondents.

---

[56] Sales cannibalization refers to the loss of non-program CFL sales, as reported by interviewees, due to the existence of the program.

[57] A different individual was interviewed for this company in PY3 than in PY2

The evaluation team also looked at what the NTGR value would have been if the proportion of sales through each retail channel remained the same as it was in PY2. This serves as an illustration of the important role played in the overall NTGR calculation by these changing proportions. In the case of standard CFLs, NTGR would have been 0.43 if sales proportions were unchanged, rather than the PY3 estimate of 0.40.

When trade ally interview respondents were asked an open question about the impacts of the program on their non-program CFL sales, all respondents but one indicated the program either had no net effect on non-program standard CFL sales or had a negative effect. Estimates of this negative impact ranged from 0% to a 45% decline in non-program standard CFL sales, with one respondent indicating a net positive effect of the program on non-program standard CFL sales of 20% due to increased shopper foot traffic and spillover. These estimates were weighted by non-program standard CFL sales and applied to the overall NTGR estimate by retail channel. This step had no impact on the NTGR estimates in the Big Box and Warehouse retails channels. It led to a drop in the DIY NTGR estimate from 0.37 to 0.30, a drop in the Grocery/Drug NTGR estimate from 0.38 to 0.25, and a rise in the Small Hardware NTGR estimate from 0.38 to 0.41.

Table 3-27. Sales-Weighted Net-To-Gross Ratios for Standard Bulbs by Store Type

Retailer Channel	% CFLs	Type of Market Actor	# of Market Actors Interviewed	# of Program CFLs Sold	UnWt'd NTGR	Sales Wt'd Evaluation NTGR	Sales Wt'd Evaluation NTGR
Big Box	8%	Manufacturer	3	31,156	0.73	0.47	0.47
				473,449	0.17		
				255,893	1.00		
DIY	54%	Manufacturer	3	984,801	0.73	0.30	0.30
				711,279	0.14		
				3,449,359	0.22		
		Retailer	1	91,592	0.11	0.11	
Warehouse	32%	Manufacturer	2	817,454	0.80	0.78	0.56
				2,320,342	0.78		
		Retailer	2	817,454	0.56	0.34	
				2,320,342	0.26		
Grocery /Drug	2%	Manufacturer	3	4,128	0.60	0.25	0.25
				20,711	1.00		
				146,837	0.14		
Small Hardware	5%	Manufacturer	3	481,509	0.41	0.41	0.41
				29	1.00		
				3,157	0.14		
Total	**100%**						**0.40**

Source: Evaluation team interviews of CFL lighting manufacturers and high level retail buyers, March 2411-May 2011

For Specialty CFL bulbs, the overall supplier self-report NTGR estimate is 0.46. Similar to standard bulbs, the highest NTGR estimate by retail channel is for warehouse stores, at 0.61, while the lowest are for DIY

stores at 0.32 and for grocery stores at 0.40. NTGR values for big box stores and small hardware stores ranged from 0.40-0.50.

Comparing PY2 and PY3 for specialty CFLs, overall raw NTGR went down from 0.53 to 0.48 and was adjusted downward further to 0.46 when taking respondents' feedback about negative impacts on non-program CFL sales into account. Similar to standard CFLs, the relative size of the combined big box and DIY channels increased from PY2 to PY3, moving from 48% to 53% of total specialty CFL program sales. NTGR across the combination of these channels went from 0.41 to 0.38, driven largely by lower sales lift estimates from two respondents. The warehouse channel dropped slightly in its proportion of total specialty CFL sales, moving from 46% to 42%. NTGR for this channel declined slightly, from 0.63 to 0.61, driven by lower sales lift estimates by two respondents, but counterbalanced by a higher estimate from another respondent. Similar to standard CFLs, the Grocery/Drug/Misc channel experienced a significant decline in NTGR between PY2 and PY3, but does not represent a large enough proportion of total specialty CFL sales to have a significant impact on overall NTGR for this bulb type. Specifically, sales through this channel declined from 2% to 1% of the total, and the NTGR declined from 0.82 to 0.40. It is also worth noting that a retailer who participated in the PY2 interviews for this retail channel was unwilling to participate this year. The relative size of the small hardware channel also declined, moving from 4% to 3% of total specialty CFL program sales. NTGR declined from 0.75 to 0.47 due to a lower estimate by one respondent. Inclusion of the sales cannibalization effect of the program on non-program CFL sales led to a decrease in the NTGR estimate for two retail channels, had no effect on one retail channel, and led to an increase for one retail channel.

If the proportion of sales through each retail channel remained the same for specialty CFLs in PY3 as it was in PY2, NTGR would have been 0.47, rather than the PY3 estimate of 0.46.

Table 3-28. Sales-Weighted Net-To-Gross Ratios for Specialty Bulbs by Store Type

Retailer Channel	% CFLs	Type of Market Actor	# of Market Actors Interviewed	# of Program CFLs Sold	Un-Wt'd NTGR	Sales Wt'd Evaluation NTGR	Sales Wt'd Evaluation NTGR
Big Box	12%	Manufacturer	4	18,824	0.65	0.42	0.42
				44,927	0.26		
				68,531	0.47		
				6,310	0.23		
DIY	41%	Manufacturer	3	74,415	0.65	0.33	0.32
				83,493	0.40		
				316,820	0.23		
		Retailer	1	22,449	0.13	0.13	
Warehouse	42%	Manufacturer	2	417,482	0.78	0.76	0.61
				98,081	0.69		
		Retailer	2	417,482	0.50	0.45	
				98,081	0.23		
Grocery	1%	Manufacturer	1	15,894	0.40	0.40	0.40
Small Hardware	3%	Manufacturer	2	39,518	0.47	0.47	0.47
				38	0.40		
Total	**100%**						**0.46**

Source: Evaluation team interviews of CFL lighting manufacturers and high level retail buyers, March 2411-May 2011

The overall supplier self report NTGR value for CFL fixtures is the highest of all bulb types, at 0.79. Big box stores, grocery stores, and hardware stores' NTGR values are all 1.00, revealing they would not have sold CFL fixtures at all in the absence of the program. The fixture NTGR values for DIY stores and warehouse stores are considerably lower, at 0.50 and 0.42, respectively. The average $9.68 incentive per CFL fixture package through the program represented the largest discount percentage of all CFL product types.

Comparing PY2 and PY3 for CFL fixtures, the most significant observations are a rise in the overall NTGR estimate from 0.77 to 0.79 and significant growth in the relative size of the grocery/drug/misc channel. The relative size of the combined big box and DIY channels dropped from 52% to 32% of total program CFL fixture sales, while the combined NTGR for these two channels rose from 0.62 to 0.70. The warehouse channel also declined in proportion of CFL fixture sales, moving from 26% to 11% of the total, and the NTGR for this channel dropped from 0.87 to 0.42. This was driven in part by the inclusion of one interviewee who didn't participate in the PY2 interviews and who provided a relatively low sales lift estimate compared with other respondents. The grocery/drug/misc channel increased from 2% to 40% of

program CFL fixture sales, and NTGR for this channel was again estimated to be 1.0 in PY3. The small hardware channel dropped from 20% to 16% of program CFL fixture sales, and NTGR for this channel also remained at 1.0 for PY3. In contrast to the standard and specialty CFL NTGR estimates, there was no sales cannibalization adjustment made for CFL fixtures, as none of the interview respondents made reference to non-program CFL fixture sales being affected by program sales.

If the proportion of sales through each retail channel remained the same for CFL fixtures in PY3 as it was in PY2, NTGR would have been 0.62, rather than the PY3 estimate of 0.79.

Table 3-29. Sales-Weighted Net-To-Gross Ratios for CFL Fixtures by Store Type

Retailer Channel	% CFLs	Type of Market Actor	# of Market Actors Interviewed	# of Program CFLs Sold	Un-Wt'd NTGR	Sales Wt'd Evaluation NTGR	Sales Wt'd Evaluation NTGR
Big Box	3%	Manufacturer	1	1,906	1.00	1.00	1.00
DIY	29%	Manufacturer	1	2,878	0.50	0.50	0.50
Warehouse	11%	Manufacturer	2	4,983	0.50	0.68	0.42
				2,759	1.00		
		Retailer	1	9,211	0.20	0.20	
Grocery/Drug/ Misc	40%	Manufacturer	1	2,153	1.00	1.00	1.00
Small Hardware	16%	Manufacturer	1	11,637	1.00	1.00	1.00
Total	**100%**						**0.79**

Source: Evaluation team interviews of CFL lighting manufacturers and high level retail buyers, March 2411-May 2011

Looking within each retail channel across all three bulb types, as shown in the table below, NTGR values in PY3 are highest for warehouse stores and lowest for DIY stores. NTGR values are also comparatively high for big box stores and comparatively low for grocery/drug stores. The whole range of estimates by store type falls within the reasonably narrow band of 0.30-0.60.

Table 3-30. Sales-Weighted Net-To-Gross Ratios Across All Bulb Types by Store Type

Retailer Category	Sales-Weighted Average NTGR
Big Box	0.46
DIY	0.30
Warehouse	0.57
Grocery/Drug	0.38
Small Hardware	0.43

Source: Evaluation team Analysis

Revealed Preference Demand Model NTGR

This section describes the data, methods, and results for the revealed preference demand model's estimate of the NTGR for PY3.

The revealed preference model utilized data collected during in-store customer intercept surveys and in-store shelf surveys. These data were used to model the probability of CFL purchase as a function of price, store characteristics, and customer characteristics. The estimated model parameters and the data were used to estimate the probability of purchasing a CFL given the existence of the program, and the probability of purchasing a CFL under non-program conditions. The NTGR was then calculated using the program and non-program predicted probabilities.

The revealed preference model relies on an intricate mix of in-store shelf survey and in-store intercept revealed preference data. Developing the data to be used in the model was a multistep process. Using ComEd's incandescent equivalent wattage values, the shelf survey data for CFLs and incandescent bulbs were grouped into wattage and style categories. Minimum, average, and maximum pricing values by category were then developed at the store level. These pricing variables were developed using shelf survey information for both the pre-program price of the CFLs and the program-discounted CFL price[58].

The shelf survey data reviewed for the revealed preference modeling was collected for 7 stores and 2 chains, a DIY store and a Big Box store[59]. The in-store intercept surveys were undertaken at 18 stores, representing the same 2 chains of stores, including the same 7 stores where the shelf surveys were conducted and 11 stores with no shelf surveys. Only data from those in-store intercept surveys that took place in retail stores with accompanying shelf surveys were included in the demand modeling.

Table 3-31 below lists the distribution of the bulbs recorded from the intercept surveys across the 7 stores with shelf survey data, where store ID D1 through D4 represent the 4 DIYT stores with shelf survey data, and the B1 through B3 are the 3 Big Box stores. The Program Bulb column lists the number of ComEd ES Lighting program bulb purchases, where one purchase is defined as one type of bulb bought by one customer interviewed. The Non-Program Bulb column, on the other hand, lists the number of purchases of bulbs not being rebated by the ComEd ES Lighting program.

[58] The surveyors conducting the shelf surveys recorded both the original bulb price and the program-discounted bulb price.

[59] Shelf survey data was also collected at one Menards store, however this data was not included in the revealed preference modeling since Menards did not allow for the collection of price data.

Table 3-31. Distribution of Bulbs Purchased by Intercept Survey Respondents

Store ID	Intercept Survey	
	Program Bulb	Non-Program Bulb
D1	37	31
D2	34	1
D3	33	11
D4	48	0
B1	40	3
B2	54	0
B3	30	19
Total	**276**	**65**

Source: Evaluation Team Analysis

It can be seen from the table above that none of the customers interviewed at stores D4 and B2 bought non-program bulbs, and only one interviewee bought non-program bulb(s) at store D2. This conflicts with the shelf survey data, which shows there were more non-program bulbs than program bulbs for sale in these stores.

Table 3-32 below lists the similar statistics for the shelf surveys across the 7 stores. The surveyed stores carried many more models of non-program bulbs than program bulbs, especially the 4 DIY stores.

Table 3-32. Distribution of Program vs. Non-Program Bulb Models Sold at Shelf Survey Stores

Store ID	Shelf Survey	
	Program Bulb	Non-Program Bulb
D1	38	201
D2	40	145
D3	38	219
D4	33	202
B1	50	25
B2	49	27
B3	43	59
Total	**324**	**1080**

Source: Evaluation Team Analysis

The inconsistencies in the data in Table 3-31 and Table 3-32 above addressing the proportions of program and non-program bulb purchasers interviewed and the proportion of program and non-program bulb models available, suggest the sample customers interviewed in D2, D4 and B2 might not have been random. Therefore, to ensure the quality of the study, the observations from these three stores were removed from the analysis.

Additional intercept surveys were also removed in cases where the bulb or bulbs purchased by the intercept survey respondent did not match any of the bulbs in the inventory of that particular store (as documented through the shelf survey). After removing these cases, there were 135 program bulbs and 51 non-program bulbs remaining in the demand modeling dataset.

The demand modeling analysis was conducted on a "market" level. A "market" was defined as a combination of the retail store and bulb type group.[60] So, for example, a dimmable bulb sold at store D1 is defined as a market. A customer went into D1 who planned to buy a dimmable light bulb can choose from all types of bulbs available in this market. Overall, there were 21 markets, and the distribution of the observations in the final sample across the 21 markets is shown in Table 3-33 below.

Table 3-33. Distribution of Observations by Market in Final DM Sample

Store ID	Three Way	Dimmable	Low Wattage	Mid-Low Wattage	Mid-High Wattage	High Wattage	Total
D1	1		13	37	5	7	63
D3	2		3	32	2	2	41
B1	1	1	1	27	11	1	42
B3		2	15	18	1	3	39
Total	**4**	**3**	**32**	**114**	**19**	**13**	**185**

Source: Evaluation Team Analysis

Since there were not very many customers who bought non-program lighting bulbs surveyed, in 1/3 of the markets, only program bulb purchases were recorded. Table 3-34 below lists the number of non-CFL purchases across the 21 markets.

[60] The 6 groups include (1) low wattage group (equivalent incandescent wattage less than 60), (2) middle low wattage group (equivalent incandescent wattage ranging from 60 to 75), (3) middle high wattage group (equivalent incandescent wattage ranging from 75 to 100), (4) high wattage group (equivalent incandescent wattage greater than 100), (5) three-way group, and (6) dimmable group.

Table 3-34. Distribution of non-CFL Observations by Market in Final Demand Modeling Sample

Store ID	Three Way	Dimmable	Low Wattage	Mid-Low Wattage	Mid-High Wattage	High Wattage	Total
D1	0	0	7	8	2	4	21
D3	0	0	1	3	2	0	60
B1	0	1	0	0	1	0	2
B3	0	1	5	4	0	2	12
Total	**0**	**2**	**13**	**15**	**5**	**6**	**41**

Source: Evaluation Team Analysis

As can be seen from comparing the two tables, in some markets, the CFL purchases were so dominant, the data turned out to have not enough variation, and hence the model went to an extreme to predict high impacts from the program. As a result, the NTGR was predicted to be 98% or 99%. This lack of variation also resulted in models that were highly unstable. A clear example of this was one intercept survey respondent who purchased a non-program three-way CFL for $9.97. The estimated NTGR with this bulb included in the sample was approximately 30% lower than the NTGR that resulted when this bulb was dropped from the sample.

The NTGR calculated from the revealed preference model has several advantages. First, it relies on actual CFL and incandescent bulb purchases and real time customer recall of their intent to purchase lighting and their knowledge of the ComEd Residential ES Lighting Program. The model also uses actual information on store level pre-program CFL, discount CFL, and incandescent bulb prices. However, this method also has significant limitations. The NTGR calculated using this approach is only applicable to stores and chains that permitted surveyors to undertake both shelf surveys and customer intercept surveys. Unfortunately, the ability to persuade stores to participate in both lighting shelf surveys and customer intercept surveys was a limiting factor again for the PY3 evaluation. It is also extremely difficult to ensure that customers are selected at random for the intercept surveys. Where a store locates their program CFLs and other lighting products can significantly impact who is surveyed. One retailer in PY3, where a large number of the intercept surveys took place, had a large lighting display in the front of the store. This display was very effective at capturing customers' attention, and many bulbs were selected from this display, but that resulted in little price variation across the program bulb purchases. This lack of price variation proved to be very problematic for the models. And finally, stores that do not stock non-discounted CFLs and/or incandescent bulbs cannot be included in the models. Regrettably, these limitations substantially reduced the data available to estimate the NTGR using the revealed preference model for PY3.

The model coefficients, predicted probabilities, and NTGR for unplanned purchases are also not presented due to the unstable nature of the model. The coefficients in the model were highly sensitive to the addition or deletion of additional variables into the model. The unstable nature of the estimated probabilities for unplanned purchases implies that an NTGR calculated from these results would be

unreliable. Therefore, the results of the revealed preference demand modeling are not being used to calculate the program NTGR in the PY3 evaluation.

Multi-State Modeling Results

This section provides an overview of the data, methods, and NTGR results associated with the multi-state modeling NTGR approach implemented in PY3. Complete study results are presented in the final ComEd multi-state modeling report issued by the NMR Group, Inc and Cadmus.[61]

Data

The multi-state modeling approach required extensive primary data collection from customers in ComEd service territory as well as other regions with varying levels of program activity, from no programs to long-standing established programs.[62] Customer CFL sales data from each of these, as well as demographic, social, and economic characteristics, were used in the model to quantify the effects of regional program activity on CFL sales. This data was collected through telephone surveys and on-site lighting audits with randomly selected customers.[63] The phone surveys attempted to interview the person in the household most responsible for lighting purchases. During these surveys, the respondent was also recruited to participate in the on-site portion of the data collection effort. During the on-site audits, trained technicians inventoried all light bulbs found inside or outside the customer's home, recording the manufacturer, model number and any specialty features associated with the bulb. The technician also collected data from the resident on CFL use, storage and purchases, thus providing a verified, reliable estimate of both CFL sales and saturation.

While the majority of the modeling data was collected through the telephone and on-site customer surveys, a few other key modeling variables were collected from other sources. These included regional variables for CFL Program activity, electricity pricing, unemployment levels, urban/rural classification, and retailer accessibility.[64]

Methods

Using this data the multi-state modeling team used a zero-inflated negative binomial (ZINB) model to predict CFL purchases. This type of model is commonly used to analyze count data (*e.g.*, the number of CFLs) with many cases falling at zero (non-purchasers) and with a fair degree of variability in the data. The model first identifies two subgroups of non-purchasers by running a logistic model:

- CFL users who happened not to have purchased during the observation time (i.e., the not-always zero group); and
- Households that will likely never purchase CFLs (i.e., the always zero group).

---

[61] NMR Group, Inc. and Cadmus Group, Inc. *Results of the Multistate CFL Modeling Effort*. Prepared for Commonwealth Edison Company, May, 2011.
[62] There were 15 different geographic areas included in this analysis, 11 program areas and 4 non-program areas.
[63] In total data was collected from 1,495 household across the 15 geographic regions included in the study.
[64] Used to represent the concentration of big box stores.

The zero-inflation portion of the model uses a logistic regression to identify persistent non-purchasers, who can be thought of as never considering a CFL purchase.[65] For those not identified as persistent non-purchasers, the probability of each possible count of CFL purchases (including zero) is modeled as a negative binomial distribution, which has more cases at smaller numbers and very few cases at larger numbers.

Two modeling timeframes were selected, a full eighteen month period (January 2009 - June 2010) and a first-half of 2010 model (January - June 2010). Using the specific models, the team used statistical software to predict purchases in the presence and absence of the program for these two modeling periods.[66]

Results

The models demonstrate that, after controlling for other factors, the number of CFLs incentivized per household had a significant and positive effect on CFL purchases in both time periods. CFL saturation was also a significant predictor of the number of bulbs purchased in both models (this effect was negative, indicating that, the higher the saturation, the fewer bulbs participants were purchasing). The most important source of variation between the two models was a variable meant to isolate the impact of prior program support on current CFL purchases. This variable was not statistically significant in the eighteen-month model but was significant in the first-half of 2010 model. This variable also has measurement error associated with it as it is the definition of "years supporting CFLs" is questionable. Within the multi-state model that was run ComEd was assigned a value of 5 years although the actual programs that is currently in place had only run for 2 years at the time of the data collection. While previous programs did exist they were significantly different in nature and thus did not likely affect the market in same fashion as current program(s).

As shown in Table 3-35 below, the NTGR values were 0.51 for the entire eighteen-month period and 0.89 for the first half of 2010. The estimate for the first half of 2010 assumes that the prior program support variable is *not* a measure of current program activity; the calculation of the NTGR, in other words, takes the impact of prior program activity into account[67]. When the models were re-run assuming all programs had no prior activity, the resulting NTGR is 0.55, similar to its ratio for the full eighteen-month model.

[65] In statistical parlance, it is most accurate to think in terms of the probability of being in the not-always zero purchasers group or the always zero purchasers group.
[66] Team members used STATA and SAS to predict these purchasers in order to confirm the reliability of the results.
[67] Some advisors to this project have made the argument that prior program activity should be treated as a current program variable.

Table 3-35. Household CFL Purchase and NTGR Estimates across 3 Multistate Model Specifications

Input	Full 18 Month Model	First half of 2010 Model	First half of 2010 w/o Prior Pgm Activity
Per-household purchases with program	9.20	2.98	2.98
Per-household purchases without program	7.26	1.75	2.21
Net program purchases per household	1.94	1.23	0.77
Incented CFLs per household	3.78	1.39	1.39
Total NTGR	**0.51**	**0.89**	**0.55**

Final Ex-Post Net Impact Results

The final net program impacts were derived by multiplying the Ex-Post gross program savings estimates by the Ex-Post NTGR. The Ex-Post program-level first-year net energy saving estimate resulting from this evaluation is 299,788 MWh, the net demand savings estimate is 270 MW, and the peak demand savings estimate is 33 MW. The net attainment rate on program reported net energy savings is 129% (299,788 /232,975).

3.2 Process Evaluation Results

The process evaluation component of the PY3 Residential Lighting Evaluation focused on familiarity with and usage of CFLs, overall lighting purchase behaviors, satisfaction with CFLs and program CFLs in particular, barriers to purchasing CFLs, awareness of the ComEd Residential Lighting program, and effectiveness of program marketing.

Data sources for the process evaluation include the General Population Purchaser and Non-Purchaser Telephone Survey (n=750), the in-store customer intercept survey (n=496), and in-store lighting shelf stocking survey. Comparisons between PY1, PY2 and PY3, or between subgroups in PY3, are tested for statistical significance at the 0.10 level. Significant differences are indicated by the presence of superscripts next to the value in the table. For example, if a value in column A has a superscript "B" next to it, the value in A is significantly different from the value in B at the 0.10 level.

3.2.1 Awareness and Use of CFLs

CFL Awareness

Most ComEd customers are aware of CFLs. In Program Year 3, 80% said they knew what CFLs were without any prompting, and an additional 12% remembered having heard of CFLs when read a brief description of the bulb type, bringing overall awareness of the CFLs to 92%. This level of awareness is largely on par with PY1 and PY2 when overall awareness of CFLs, aided and unaided combined, was at 95% and 91% respectively. It should be noted, however, that unaided awareness is significantly lower in PY2 and PY3 as compared to PY1.

The evaluation team explored whether this decrease could be due to inconsistencies in survey design and data collection strategies between the three studies. All three studies had similar distributions of respondents across major demographic characteristics indicating that we reached similar customers. In addition, the unaided awareness question and its position in the survey instrument remained unchanged. The PY1 survey was conducted in September 2009 whereas the PY2 and PY3 surveys were conducted in May 2010 and June 2011 respectively. Conducting the survey in the spring versus the fall could impact the results if there was a much larger marketing campaign undertaken in September 2009 compared to May in either year. However, the September 2009 campaign would have to have been considerably larger to account for this decline in awareness. In addition, the rest of the survey results do not show similar differences between PY1, PY2 and PY3. Further, the results from PY2 and PY3 on this question were nearly identical. As a result, it is concluded that the differences in awareness between PY1, PY2 and PY3 are due to the vagaries of random survey sampling. Surveys sometimes produce a result that falls outside the margin of error that cannot be explained.

Table 3-36. Awareness of CFLs by Program Year*

	PY1 Total (n=231)	PY2 Total (n=499)	PY3 Total (n=746)
	A	B	C
Yes – Unaided	86%[BC68]	79%	80%
Yes – Aided	10%	12%	12%
No	5%	9%[A]	8%[A]

Source: ComEd General Population Surveys (PY1, PY2 and PY3)
**Does not sum to 100% due to rounding*

Customers who were aware of CFLs were asked how familiar they were with the light bulbs. Familiarity with CFLs has increased since the end of PY1, though fewer customers are very familiar compared to PY2. The percentage of respondents who said they were very familiar with CFLs decreased from PY2 to PY3 while the percentage who said they were somewhat familiar increased. The percentage claiming to be at least somewhat familiar with CFLs remained roughly the same in PY3 compared to PY2.

[68] Significant differences are indicated by the presence of superscripts next to the value in the table. For example, if a value in column A has a superscript "B" next to it, the value in A is significantly different from the value in B at the .10 level.

Table 3-37. Familiarity with CFLs by Program Year

	PY1 Total (n=220) A	PY2 Total (n=456) B	PY3 Total (n=685) C
Very familiar	34%	46%[AC]	39%
Somewhat familiar	36%	38%	47%[AB]
Not too familiar	22%[BC]	10%	11%
Not at all familiar	8%[BC]	5%	4%
Don't know	0%	1%	0%

Source: ComEd General Population Surveys (PY1, PY2 and PY3)

Program purchasers specifically were asked about their familiarity with CFLs before they purchased them. As seen in Table 3-38, program purchasers in PY2 and PY3 were more familiar with CFL technology prior to purchasing the bulbs compared to purchasers in PY1. Somewhat fewer were very familiar with CFLs prior to their purchase in PY3 compared to PY2 while more were somewhat familiar in PY3.

Table 3-38. Familiarity with CFLs before Purchase of Bulbs

	PY1 Total (n=55) A	PY2 Total (n=201) B	PY3 Total (n=305) C
Very familiar	27%	39%[C69]	31%
Somewhat familiar	29%	44%[AC]	52%
Not too familiar	35%[BC]	10%	10%
Not at all familiar	9%	5%	6%
Don't know	0%	1%	0%

Source: ComEd General Population Surveys (PY1, PY2 and PY3)

Not surprisingly, ComEd customers who have purchased CFLs are more familiar with them than those who have not. Table 3-39 shows the percentage of customers who are very or somewhat familiar with CFLs across four distinct customer segments.

[69] Significant differences are indicated by the presence of superscripts next to the value in the table. For example, if a value in column A has a superscript "B" next to it, the value in A is significantly different from the value in B at the .10 level.

Table 3-39. Familiarity with CFLs by Customer Segment

% Very/ Somewhat Familiar*	PY3 Total (n=685)	Program Purchasers (n=305) A	Non-Program Purchasers (n=66) B	Purchased Prior to June 2009 (n=169) C	Never Purchased CFLs (n=157) D
Familiar with CFLs in general	86%	94%	89%	88%	62%[ABC]

Source: ComEd General Population Survey (PY3)
**Respondents were classified as familiar with specialty CFLs if they said they were very or somewhat familiar with at least one specialty CFL type.*

CFL Usage and Purchases

Penetration of CFLs in ComEd territory increased between PY2 and PY3. At the end of PY3, 70% of ComEd customers had at least one CFL installed in their homes compared to 62% in PY2. In PY1, 64% of customers had at least one CFL installed, which is not statistically different from PY2 and PY3 due to a smaller PY1 survey sample size.

Among ComEd customers with CFLs installed, the number of CFLs in use has varied significantly year to year. The average number of CFLs installed in PY1 was 9, in PY2 it was 13, and in PY3 was 10. Taken together, these two measures suggest that while the number of homes with at least one CFL installed is increasing, new adopters may be installing fewer CFLs possibly impacting the CFL saturation rate. Possibly this may be due to the impact of the economy and related increased sensitivity to the price of CFLs, as discussed earlier in this report.

Table 3-40. Change in CFL Usage Across Program Years

	CFLs		
	PY1 Total (n=231) A	PY2 Total (n=499) B	PY3 Total (n=746) C
Have at least one bulb installed in home	64%	62%	70%[B][70]
	(n=147)	(n=308)	(n=552)
Average number of bulbs installed at home	8.9[C]	13.3[AC]	9.8

Source: ComEd General Population Surveys (PY1, PY2 and PY3)

[70] Significant differences are indicated by the presence of superscripts next to the value in the table. For example, if a value in column A has a superscript "B" next to it, the value in A is significantly different from the value in B at the .10 level.

Though penetration of CFLs has increased since the ComEd program began, 30% of customers still do not have any CFLs installed. As we found in PY2, CFL non-users on average have less education, lower incomes, and are more likely to rent their homes compared to CFL users. Non-users are also more likely than CFL users to live by themselves. In essence, they tend to be from traditional hard-to-reach (HTR) populations. Reaching these customers is typically more difficult and usually requires targeted marketing and educational outreach efforts.

The average number of CFLs installed varies by customer type. ComEd customers who purchased CFLs in PY3 have nearly twice the number of CFLs installed on average than those whose last CFL purchase was prior to June 2010. A small number of ComEd customers reported they have never purchased a CFL, and yet they also reported that they have an average of 4 CFLs installed in their homes. These customers might have been given CFLs or might have moved to a residence where CFLs were already installed.

Table 3-41. Average Number of CFLs Installed by Customer Type

	PY3 Total (n=552)	Program Purchasers (n=295)	Non-Program Purchasers (n=60)	Purchased Prior to June 2010 (n=162)	Never Purchased CFLs (n=35)
		A	B	C	D
Average number of CFLs installed at home	9.8	11.3[CD]	14.6[CD]	6.4	4.3

Source: ComEd General Population Surveys (PY3)

Just over 70% of surveyed ComEd customers have *ever* purchased a CFL for use in their home. This number is unchanged since PY1. Roughly half of ComEd customers bought CFLs in PY3 (50%), which is statistically unchanged from PY1 and PY2.

Table 3-42 Past CFL Purchases by Program Year

	PY1 Total (n=231)	PY2 Total (n=499)	PY3 Total (n=746)
	A	B	C
Purchased CFLs at some point in the past	72%	70%	72%
Purchased any CFLs in Program Year	52%	55%	50%

Source: ComEd General Population Surveys (PY1, PY2 and PY3)

When all the lighting purchased by ComEd Customers is examined, 28% bought *only* CFLs in PY3, while 21% bought CFLs as well as incandescent bulbs. One in four bought *only* incandescent bulbs (24%). More than a quarter of ComEd customers did not buy either bulb type in PY3. As seen in Table 3-34, there has been little significant shift in the bulb mix purchased across the three program years.

Table 3-43. Lighting Purchases by Program Year

	PY1 Total (n=231) A	PY2 Total (n=498) B	PY3 Total (n=734) C
CFLs only	32%	31%	28%
Incandescent only	24%	19%	24%[B]
Both CFL and incandescent	19%	24%	21%
Neither CFL nor incandescent	24%	26%	27%

Source: ComEd General Population Surveys (PY1, PY2 and PY3)

The average ComEd customer purchased fewer CFLs in PY3 compared to PY2. ComEd customers who purchased CFLs in PY3 reported purchasing an average of 10 bulbs, which is a significant decrease from the average purchased in PY2 (14 bulbs) but roughly the same as in PY1 (11 bulbs). When we compare program versus non-program purchasers in PY3, we find no difference in the number of bulbs purchased. The percentage of customers purchasing incandescent bulbs in the past year has not changed since PY1 (approximately 44%).

Table 3-44. Change in Purchases of Various Bulb Types

	CFLs			Incandescents		
	PY1 Total (n=231) A	PY2 Total (n=499) B	PY3 Total (n=746) C	PY1 Total (n=231) D	PY2 Total (n=500) E	PY3 Total (n=746) F
Purchased at least one bulb	52%	55%	50%	44%	43%	44%
	(n=107)	(n=246)	(n=359)	(n=94)	(n=180)	(n=0)*
Average number of bulbs purchased	10.8	14.2[ACD]	9.8	9.9	9.9	--

Source: ComEd General Population Surveys (PY1, PY2 and PY3)
**Number of incandescent bulbs purchased was not asked in PY3*

To determine if the ComEd program is reaching customers with low CFL socket saturation versus ones who already have CFLs installed in many of their sockets, we asked program purchasers to estimate the percentage of their light sockets that already contained CFLs prior to their purchase. The program reached a lower proportion of customers with no CFLs installed in PY3 compared to PY2 though (20% versus 31%). At the other extreme, we found fewer PY3 CFL purchasers had CFLs installed in more than 75% of their sockets compared to PY2 (15% versus 25%). As seen in Table 3-45, the program reached more customers with moderate prior usage of CFLs in PY3.

Table 3-45. CFL Saturation Prior to PY2 Purchase[71]

	PY2 Total (n=190)	PY3 Total (n=287)
	A	B
All of sockets	12%[B]	6%
More than 75% but not all of the sockets	13%	9%
More than 50% but less than 75% of the sockets	9%	13%
More than 25% but less than 50% of the sockets	9%	18%[A]
More than 5% but less than 25% of the sockets	15%	17%
Less than 5% of the sockets	10%	14%
None of the sockets	31%[B]	20%
Don't know	2%	2%

Source: ComEd General Population Survey (PY2 and PY3)

One-fifth of customers who purchased ComEd program CFLs in PY3 and installed them have removed at least some of them (21%), which is statistically the same as we found in PY2 (24%). Reasons for removal in PY3 were also similar to what we found in PY2. The most common reasons given for why they were removed are that the bulbs burned out, stopped working, or they broke (82%). The remaining reasons concerned the performance of the CFLs (see Table 3-46). Not surprisingly, the customers who removed their CFLs are less satisfied with them than those in kept them in place.[72] ComEd may want to further investigate these quality issues. Those who experienced these problems may not purchase CFLs in the future as a result.

[71] Does not sum to 100% due to rounding.
[72] For full results on satisfaction with CFLs, please refer to the *Barriers* section of this report.

Table 3-46. Reasons Why Customers Remove CFLs[73]

Reason for Removing CFL	PY2 Total (n=47)	PY3 Total (n=76)
Burned out/stopped working/broke	79%	85%
Not bright enough	9%	8%
Didn't like the way it looked	4%	3%
Moved	4%	0%
Did not like the color	2%	0%
Took too long to start up	2%	1%
Didn't fit in the fixture	2%	3%

Source: ComEd General Population Lighting Survey (PY2 and PY3)

Satisfaction with CFLs

Nearly three in four ComEd customers who purchased CFLs last year are satisfied with their purchase (74%). In fact, 41% of PY3 CFL purchasers gave a rating of 9 or 10 on a satisfaction scale that ranged from 0 to 10 where 0 means "not at all satisfied" and 10 means "very satisfied". Satisfaction levels of program versus non-program purchasers are the same. Though only 8% of CFL PY3 purchasers are dissatisfied with the CFLs they purchased, more are dissatisfied in PY3 compared to PY2 (8% versus 4%). Some of the reasons customers gave for being dissatisfied include problems with quality of the light, longevity, delay when the light turns on, brightness, and fitting in light sockets.

[73] Multiple response question, so answers add to more than 100%.

Table 3-47. Satisfaction with CFLs Purchased

Satisfaction with CFLs Purchased	PY1 Total (n=107)	PY2 Total (n=241)	PY3 Total (n=343)	Program Purchasers (n=303)	Non-Program Purchasers (n=39)
	A	B	C	D	E
Satisfied (7-10)	79%	78%	74%	73%	77%
Neither Satisfied Nor Dissatisfied (4-6)	13%	16%	17%	18%	13%
Dissatisfied (0-3)	7%	4%	8%[B]	8%	10%
Don't know	1%	1%	1%	1%	0%
Mean	8	8.1	7.5	7.5	7.7

Source: ComEd General Population Survey (PY1, PY2 and PY3)

In the previous section, it was reported that one-quarter of the customers who purchased ComEd discounted CFLs since June 2010 had removed some of the ones they had installed. As Table 3-48 shows, these customers are less satisfied with their purchases than those who have kept all of their CFLs installed.

Table 3-48. Satisfaction with CFLs Purchased by Removal of CFLs

Satisfaction with CFLs by CFL Removal Status	Kept all CFLs Installed (n=255)	Removed Some/All CFLs (n=76)
	A	B
Satisfied (7-10)	76%[B]	71%
Neither Satisfied Nor Dissatisfied (4-6)	18%	16%
Dissatisfied (0-3)	6%	13%[A]
Don't know	0%	0%
Mean	8.1	7.1

Source: ComEd PY3 General Population Survey

3.2.2 Effectiveness of Program Marketing

Awareness of Marketing Activities

This assessment of the ComEd Residential ES Lighting Program's PY3 marketing and outreach activities draws from a variety of evaluation research activities: the survey of the general ComEd customer

population, the store intercept survey with lighting customers, and the lighting product shelf survey. Findings from each of these evaluation tasks will be included where relevant.

According to the general population survey of ComEd customers, awareness of ComEd's "Smart Ideas" program has increased since PY1 and PY2. At the end of PY3, 27% of ComEd customers said they were aware of the program compared to 22% in PY1 and 19% in PY2.

Table 3-49. Awareness of ComEd's "Smart Ideas" Program

	PY1 Total (n=220) A	PY2 Total (n=450) B	PY3 Total (n=685) C
Aware	22%	19%	27%[B]
Unaware	75%	78%[C]	71%

Source: ComEd General Population Surveys (PY1, PY2 and PY3)

Awareness of the ComEd Smart Ideas program does not vary by customer type; ComEd customers who purchased ComEd discounted bulbs are not more likely to be aware of the Smart Ideas program than those who did not. Thirty percent are aware of the program, which is the same percentage as customers who last purchased CFLs prior to June 2010 (30%) or who have never purchased CFLs (30%). Almost one-quarter of customers who purchased non-program CFLs since June 2010 are aware of the program (24%), which is not statistically different from the other groups.

Table 3-50. Awareness of ComEd's Smart Ideas Program by Customer Segment

	PY3 Total (n=685)	Program Purchasers (n=305) A	Non-Program Purchasers (n=66) B	Purchased Prior to June 2010 (n=169) C	Never Purchased CFLs (n=145) D
Aware	27%	30%	24%	30%	30%
Unaware	71%	68%	74%	69%	78%

Source: ComEd General Population Survey (PY2 and PY3)

Less than half of program purchasers (40%) are aware that some or all of the CFLs they purchased were discounted. Further, among those who were aware of the discount, only 14% named ComEd as the sponsor of the discount, while over half (54%) could not identify the discount sponsor. These numbers are little changed from PY2, though fewer people mistakenly thought the retail outlet was the source of the discount in PY3 than did in PY2.

Table 3-51. Knowledge of ComEd Discount

Awareness of Discount	PY2 Total (n=197)	PY3 Total (n=256)
Aware	44%	40%
Perceived Discount Sponsor[74]	**PY2 Total (n=103) A**	**PY3 Total (n=112) B**
ComEd	12%	14%
Retail store	60%[B]	33%
Manufacturer	7%	4%
Don't know	39%	54%[A]

Source: ComEd General Population Survey (PY2 and PY3)

The few program participants who identified ComEd as the sponsor named a variety of information sources through which they first learned about ComEd's price discounts on CFLs. These sources range from mass media advertising to bill inserts and mailings and in-store marketing materials. However, the sample is too small (n=14) to identify the core information source.

The customer in-store intercept surveys also indicated that most ComEd customers were unaware that ComEd provided discounts on CFLs. Though 84% of customers purchasing ComEd discounted bulbs knew that the bulbs were discounted when asked in the store, only 29% knew ComEd was the source of the discount. Just 3% of customers came to the store because they wanted to buy CFLs that were discounted by ComEd.

Even if customers are unaware of the discount, they may have seen other ComEd materials promoting the use of CFLs. The general population survey asked ComEd customers who purchased program bulbs during PY3 and were aware of the discount if they had seen pamphlets or brochures from ComEd explaining the energy saving benefits of CFLs. Two of five program participants (40%) remember seeing or receiving these types of materials, which is somewhat lower than we found in PY2 (56%) but the same as PY1 (40%). When asked where they first saw this material, the most frequent response was a bill insert (71%) with smaller numbers recalling other types of mailings and the TV (7% each).

[74] Multiple response question.

Table 3-52. Recall of ComEd's Marketing Materials

	PY1 Total (n=77) A	PY2 Total (n=102) B	PY3 Total (n=106) C
Recall seeing ComEd's collateral	40%	56%[AC]	40%

Source: ComEd General Population Surveys (PY1, PY2, and PY3)

The customer in-store intercept surveys yielded similar results. Though less than half of customers (44%) saw in-store displays or material promoting CFLs, those who did see the material were influenced by it. CFL purchasers who said they saw the material were asked how much influence the information had on their purchase decisions. Among those who purchased CFLs discounted by ComEd, 89% reported that the in-store material influenced their decision to purchase the bulbs.[75] Three-quarters of respondents (75%) suggested that the in-store material was "extremely influential."

The influence of store marketing materials can also be seen by comparing customers' purchase plans against their eventual purchases. Slightly over half of the in-store intercept survey respondents (55%) were planning on buying light bulbs when they went to the store. Nearly two-thirds (68%) were set on buying solely CFLs, one in four (24%) planned to buy only non-CFLs, while another 1% planned to buy a combination of CFL and non-CFL bulbs. Nearly all who intended to purchase CFLs exclusively when they entered the store ended up following through on this plan (98%). This was less true of customers who intended to purchase other types of bulbs either exclusively (52%) or in combination with CFLs (67%). Most who changed plans ended up buying CFLs, suggesting that the in-store marketing materials may have influenced their purchase.

[75] Based on a given rating of 7 or greater on a scale from 0-10 asking how influential the in-store material was in the decision to buy CFLs, with 0 meaning not at all influential and 10 meaning extremely influential.

Table 3-53. CFL Purchase Intentions and Actual Purchases

	Intercept Participants PY3 (n=496)
Planned on purchasing light bulbs prior to entering the store	55%
Of them, planned on purchasing…	**(n=274)**
CFLs only	68%
CFLs and another type of bulb	1%
Bulbs other than CFLs	24%
Don't know	7%
Ended up purchasing what they intended…	**(n=274)**
CFLs Only	98%
CFLs and another type of bulb	67%
Bulbs other than CFLs	52%

Source: ComEd In-Store Intercept Survey (PY3)

Overall, ComEd's in-store marketing campaign appears to have had greater impact than the out-of-store materials. Given the considerable point of purchase materials that ComEd supplies to participating retailers, it is not surprising that the in-store materials appear to influence purchase behavior more than the out-of-store efforts.

Assessment of In-Store Marketing and Outreach Activities

As mentioned in previous sections of this report, in addition to the general population survey and in-store intercept survey, the evaluation team conducted shelf surveys of lighting products at a number of program retail stores. The shelf surveys the team conducted at program stores show that in-store ComEd marketing materials are present and highly visible. Shelf and wall signage tend to be the most widely used ComEd-sponsored in-store materials. Eight of nine program stores for which data was recorded had some sort of shelf or wall signage, while two stores had ComEd promotional brochures.

Several retailers also supplemented ComEd promotional materials with additional CFL promotional materials in the program stores. Five stores had non-ComEd shelf or wall signage in addition to the ComEd signage.

Table 3-54. Presence of In-Store Promotional Materials

	Stores
ComEd promotional materials	
Brochures	2 (n=9)
Floor sticker/clings	1 (n=9)
Shelf/wall signage	8 (n=9)
Sign hung from ceiling	0 (n=9)
Retailer promotional materials	
Brochures	0 (n=9)
Floor sticker/clings	0 (n=9)
Shelf/wall signage	5 (n=9)
Sign hung from ceiling	0 (n=9)

Source: ComEd Program Store Shelf Survey

Overall, the evaluation team rated the visibility of ComEd's point-of-purchase (POP) materials as "moderate" or "high".[76] Of the 9 program stores for which the data was collected, the visibility of program materials was high in four stores and moderate in an additional four stores. One store had these materials "hidden".

Despite having promotional materials, four of the five stores did not note the discount on or near the price tag and only showed the final discounted price. This might explain why some customers were unaware that they were purchasing discounted CFLs.

Table 3-55. Display of Discounted Prices

	Program Stores (n=9)
Only discounted price displayed	4
Original price and discounted price are displayed	5
Sometimes only discounted price is displayed, sometimes original and discounted prices are displayed	1
Price tag missing for discounted bulbs	1

Source: ComEd Program Store Shelf Survey

[76] High visibility means that POP materials could be easily located and/or seen right away, while low visibility means that shelf survey administrators had to search for POP materials.

3.2.3 Shelf Stocking Practices and Program Incentives

Program Incentives

Table 3-56 below provides the average retail price, incentive, discounted price and resulting discount percentage across five bulb types based on program tracking data.[77] As this exhibit shows, discounts for standard CFLs averaged around $1 per bulb, while discounts on specialty bulbs averaged around $1.50 per bulb, and those on fixtures were typically $10 per fixture. The average discount across all bulbs was approximately 60% off retail prices.

Comparing PY2 to PY3, incentives for standard CFLs and CFL fixtures remained about the same, while those for reflectors rose by approximately 15%. The average discount across all bulbs rose by 10%.

Table 3-56. Average Pre and Post Incentive Prices by Bulb Type from Program Tracking Data[78][79]

Bulb Type Category	Average Retail Price	Average Incentive	Average Discounted Price	% Discount
High Wattage[80]	$ 2.45	$ 1.05	$ 1.40	46%
Low Wattage	$ 1.60	$ 1.00	$ 0.60	65%
Reflector	$ 4.20	$ 1.46	$ 2.74	38%
Other Specialty	$ 3.96	$ 1.51	$ 2.45	44%
Fixtures	$ 21.71	$ 9.66	$ 12.05	57%
All Bulbs	**$ 2.10**	**$ 1.12**	**$ 0.98**	**61%**

Source: Evaluation team analysis of ComEd Goals Tracking spreadsheet

Table 3-57 is based on program tracking data (similar to Table 3-56 above) but is broken down by store type rather than bulb type. This table is focused solely on bulbs (standard and specialty) and thus excludes fixtures. As this table shows, discounts as a percentage of the original retail price were lowest at grocery stores and were highest among DIY home improvement stores and warehouse stores. The average incentive across all standard and specialty program bulbs was $1.06.

[77] Program tracking data reflects the APT negotiated MOU agreements, according to which the program incentive must remain constant, although the original retail price and the discounted retail price can fluctuate in either direction.
[78] Excludes coupon bulbs
[79] 406 upstream markdown bulbs were dropped from pricing analysis as their retail prices were not included in the tracking data.
[80] The high wattage bulb category contained all standard spiral bulb CFLs with wattages greater than or equal to 23 watts.

Table 3-57. Average Pre and Post Incentive Prices for Standard and Specialty Bulbs by Store Type[81]

Retailer Category	Average Retail Price per bulb	Average Incentive per bulb	Average Discounted Price per bulb	% Discount
Big Box	$2.44	$1.04	$1.41	45%
DIY	$1.83	$1.03	$0.80	63%
Grocery/Drug	$3.68	$1.05	$2.63	33%
Small Hardware	$2.44	$1.26	$1.19	58%
Warehouse	$1.84	$1.07	$0.76	62%
Program Total	**$1.95**	**$1.06**	**$0.89**	**61%**

Source: Evaluation team analysis of ComEd's "Goals Tracking" spreadsheet

According to the tracking data and goals tracker spreadsheets, average pre-incentive retail prices for standard CFLs ranged from approximately $1.60 to $3.20 per bulb and averaged $1.68 per bulb across retail categories, while retail prices for specialty bulbs ranged from approximately $3.40 to $8 and averaged $4.11 per bulb across retail categories (as shown below in Table 3-58). This represents a small decrease from PY2 for standard CFLs, which had ranged from $1.50 to $5.50 per bulb and averaged $1.71 in PY2, and a relatively large decrease for specialty bulbs, which had ranged from approximately $5 to $12 and averaged $4.53 in PY2. The grocery/drug retail channel had the highest average retail prices for both standard and specialty CFLs, by a margin of almost 55% above the next highest retail channel in the case of standard CFLs. This is in contrast to PY2, during which small hardware stores had the highest average retail prices for both standard and specialty CFLs by a significant margin. Small hardware stores had the largest incentives, consistent with PY2, averaging $1.20 per standard CFL and $1.90 per specialty CFL.

[81] Excludes Fixtures

Table 3-58. Average Pre and Post Incentive Prices per Bulb by Store Type[82]

Retailer Category	Standard Bulbs				Specialty Bulbs			
	Average Retail Price	Average Incentive	Average Discounted Price	% Discount	Average Retail Price	Average Incentive	Average Discounted Price	% Discount
Big Box	$2.13	$0.95	$1.18	46%	$4.18	$1.52	$2.66	40%
DIY	$1.59	$0.99	$0.60	66%	$4.39	$1.42	$2.97	35%
Grocery/Drug	$3.29	$1.01	$2.28	34%	$7.96	$1.50	$6.46	21%
Small Hardware	$2.02	$1.20	$0.81	61%	$7.61	$1.89	$5.72	26%
Warehouse	$1.58	$1.00	$0.57	65%	$3.43	$1.50	$1.93	48%
Program Total	$1.68	$1.00	$0.68	63%	$4.11	$1.48	$2.63	40%

Source: Evaluation team analysis of ComEd's "Goals Tracking" spreadsheet

Table 3-59 below shows program bulb discount prices and percentage discounts as a function of both bulb type and retailer category. Within standard CFLs, average discounted price per bulb varies from $0.57 at warehouse stores to $2.28 at grocery/drug stores. This reflects a range in average discount percentages from 65% at warehouse stores to 34% at grocery stores. A similar pattern is seen with specialty CFLs, with average discount prices ranging from $1.93 at warehouse stores to $6.46 at grocery stores and the corresponding discount percentages ranging from 48% to 21%. For both standard and specialty CFLs, average discount prices are approximately 15% higher than they were in PY2, and discount percentages are slightly lower. For CFL fixtures, the lowest discount prices are observed at small hardware stores and grocery stores, while the highest are found at warehouse stores. Because the discount for fixtures was typically $10 per fixture for all channels, this result illustrates that grocery stores were selling fixtures with lower average retail prices to begin with, so the $10 incentive per fixture represented a deeper discount from the average regular retail price.

[82] Excludes Fixtures

Table 3-59. Average Discount Price per Bulb by Store and Bulb Type[83]

Retailer Category	Standard CFLs		Specialty CFLs		CFL Fixtures		All Bulbs
	Discount Price/bulb	% Discount	Discount Price/bulb	% Discount	Discount Price/bulb	% Discount	% Discount
Big Box	$ 1.18	46%	$ 2.66	40%	$ 10.39	49%	45%
DIY	$ 0.60	66%	$ 2.97	35%	$ 18.43	48%	63%
Grocery/Drug	$ 2.28	34%	$ 6.46	21%	$ 5.25	64%	38%
Small Hardware	$ 0.81	61%	$ 5.72	26%	$ 4.38	70%	59%
Warehouse	$ 0.57	65%	$ 1.93	48%	$ 32.52	37%	62%
Program Total	$ 0.68	63%	$ 2.63	40%	$ 12.05	57%	61%

Source: Evaluation team analysis of ComEd's "Goals Tracking" spreadsheet

Table 3-60 shows the average incentive per bulb by store and bulb type. Average incentives for standard bulbs are close to $1 at all store types except small hardware stores, where they average $1.20. Average incentives for specialty bulbs are between $1.40 and $1.90 per bulb at all store types.

Comparing with PY2, average incentives for standard CFLs remained steady at close to $1 at all store types except small hardware stores, where they dropped nearly 10%. Average incentives for specialty bulbs also remained generally steady. Incentives for CFL fixtures also stayed at their PY2 value of $10.

Table 3-60. Average Incentive per Bulb by Store and Bulb Type

Retailer Category	Standard Bulbs		Specialty Bulbs		Fixtures		All Bulbs
	Incentive per bulb	% Discount	Incentive per bulb	% Discount	Incentive per bulb	% Discount	% Discount
Big Box	$ 0.95	46%	$ 1.52	40%	$ 10.00	49%	45%
DIY	$ 0.99	66%	$ 1.42	35%	$ 10.00	48%	63%
Grocery/Drug	$ 1.01	34%	$ 1.50	21%	$ 9.46	64%	38%
Small Hardware	$ 1.20	61%	$ 1.89	26%	$ 10.11	70%	59%
Warehouse	$ 1.00	65%	$ 1.50	48%	$ 8.62	37%	62%
Program Total	$ 1.00	63%	$ 1.48	40%	$ 9.66	57%	61%

Source: Evaluation team analysis of ComEd's "Goals Tracking" spreadsheet

[83] This excludes coupon bulb sales for which we have no retail price data.

On a per bulb basis, average discounts also varied depending on whether bulbs were sold in single packs or multi packs. For all bulb types, the average retail price per bulb was lower in multi packs than single packs, as shown in Table 3-61 below. The average retail price per CFL in multipacks was 30%-40% lower than in single packs for both standard and specialty CFLs.

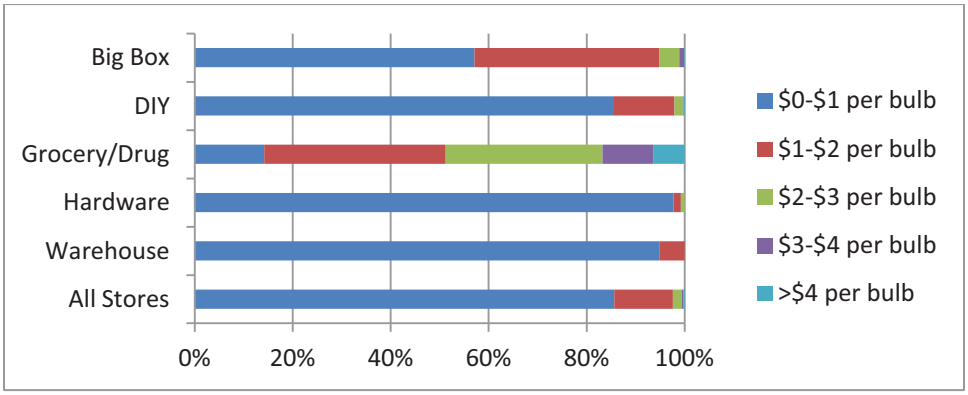
Table 3-61. Average Pre and Post Incentive Prices for Bulbs Sold In Single and Multi Packs

Bulb Type	Single Packs				Multi Packs			
	Retail Price/ Bulb	Incentive Per Bulb	Discount Price/ Bulb	% Discount	Retail Price/ Bulb	Incentive Per Bulb	Discount Price/ Bulb	% Discount
Standard Bulbs	$ 2.35	$ 1.12	$ 1.22	52%	$ 1.63	$ 1.00	$ 0.63	64%
Specialty Bulbs	$ 6.10	$ 1.60	$ 4.49	34%	$ 3.80	$ 1.46	$ 2.34	41%
Std & Spec Bulbs	**$ 3.06**	**$ 1.21**	**$ 1.84**	**48%**	**$ 1.85**	**$ 1.04**	**$ 0.81**	**62%**

Source: Evaluation team analysis of ComEd's "Goals Tracking" spreadsheet

Figure 3-2 below shows the percentage of standard CFL program bulbs that were sold within various price ranges based on the tracking data. As this figure shows, across all program retailers, approximately 85% of standard program CFLs were priced at less than $1 per bulb. This was driven primarily by warehouse stores, DIY stores, and small hardware stores. Grocery stores had by far the largest percentage of higher priced CFLs, with over 80% sold for more than $1 per CFL and approximately 50% sold for more than $2 per CFL. Compared with PY2, there was a large increase in the proportion of standard CFLs sold for under $1.

Figure 3-2. Distribution of Average Discounted Price per Standard CFL across Store Types



Source: Evaluation team analysis

3.2.4 Barriers to CFL Use

Earlier, we broke the general population survey down by customer type. We showed that 50% of ComEd customers surveyed had purchased CFLs since June 2010. We asked the 42% who were aware of CFLs, yet had not bought any since June 2010, to evaluate several reasons why they had not purchased any

CFLs. This group could contain people who had never purchased CFLs (19%) as well as previous purchasers (23%).

The most widely cited reason was a lack of need for CFLs in the past year, which was more likely to be cited by previous purchasers than non-purchasers. Lack of need does not translate into waiting for existing incandescent bulbs to burn out before purchasing CFLs. Fewer ComEd customers said still functioning incandescent bulbs were an important reason for not purchasing CFLs recently.

The presence of mercury in CFLs was a frequently cited reason for not purchasing CFLs more recently. Non-purchasers were more likely to voice mercury concerns than previous purchasers, which suggests mercury could be a barrier in converting non-users to users.

Another top reason for not purchasing CFLs since June 2010 was light quality, either in general or more specifically that CFLs are not bright enough. Brightness was more likely to be an issue for previous purchasers who have had more experience with CFLs than non-purchasers.

Cost is less of a concern compared to some issues mentioned previously, though cost is still a very important reason for one-quarter of respondents who had not purchased CFLs recently. Previous purchasers and non-purchasers were equally likely to cite the expense of CFLs as a reason.

The appearance of CFLs in some fixtures, previous bad experiences with CFLs, and uncertainty over the correct wattage to purchase are not important reasons for a large number of customers. Not surprisingly, previous purchasers are more likely to mention dissatisfaction with earlier CFLs as a reason for not purchasing CFLs more recently, while non-purchasers are less certain about the best wattage to buy.

Table 3-62. Reasons for Not Purchasing CFLs since June 2010

Barriers	Very Important	Somewhat Important	Not Important
Did not need any light bulbs in past year	38%	15%	40%
Don't like that CFLs contain mercury	35%	17%	40%
Don't like quality of light CFLs produce	32%	17%	43%
CFLs are not bright enough	29%	19%	45%
CFLs are too expensive	25%	31%	39%
Don't like the way CFLs look in fixture	23%	18%	53%
Waiting for an incandescent to burn out	20%	24%	53%
Dissatisfied with past CFLs	20%	15%	58%
Unsure of which wattage CFL to buy	17%	19%	55%

Source: ComEd General Population Survey (PY3)

Table 3-63. Barriers for Not Purchasing CFLs since June 2010 by Customer Type

Barriers	Previous Purchasers (A)	Never Purchased (B)
Did not need any light bulbs in past year	49%[B]	25%
Don't like that CFLs contain mercury	29% [B]	40%
Don't like quality of light CFLs produce	32%	31%
CFLs are not bright enough	40% [B]	29%
CFLs are too expensive	24%	26%
Don't like the way CFLs look in fixture	21%	24%
Waiting for an incandescent to burn out	25% [B]	14%
Dissatisfied with past CFLs	24% [B]	15%
Unsure of which wattage CFL to buy	14% [B]	22%

Source: ComEd General Population Survey (PY3)

3.2.5 The Future of CFL Programs

The Energy Independence and Security Act (EISA) raises the energy efficiency standards for incandescent lighting over time and is likely to impact consumer lighting purchase behavior, but exactly how the public will react has largely been a matter of speculation. We asked a series of questions on the general population survey that may shed some light on this question and could aid in planning for the future of ComEd's lighting program.

We first wanted to know how many ComEd customers were even aware of the law and the approaching regulations that will go into effect in January 2012. Only 35% said they were aware of the law. We then read all respondents an explanation of the law so we could ask them a series of questions about what they will likely purchase for the light sockets where they have used 100-watt incandescent bulbs.[84]

The most likely action is stockpiling existing 100-watt incandescent bulbs. On a 10-point scale where 0 is very unlikely and 10 is very likely, 45% gave a rating from 7 to 10 when asked if they would purchase extra 100-watt incandescent bulbs before the law goes into effect. Thirty-five percent said they would buy lower wattage incandescent bulbs, 26% would buy other bulb types such as LEDs or high-efficiency incandescent bulbs, while 25% would buy CFLs.

[84] Respondents were read the following description, "The new regulation will be phased in over 3 years and will start with the requirement in January 2012 that bulbs providing the brightness of a traditional 100-watt incandescent bulb provide that same light level using 72-watts or less, a 30% reduction in energy."

Table 3-64. Likely Actions Following EISA Implementation of 100-watt Incandescent Standards

Actions Following EISA Implementation	Likely (7-10)	Neither Likely nor Unlikely (4-6)	Unlikely (0–3)
Purchase extra 100-watt incandescent before law goes into effect	45%	19%	36%
Replace current 100-watt incandescent with lower wattage incandescent bulbs	35%	23%	42%
Replace current 100-watt incandescent with other bulb types	26%	27%	46%
Replace current 100-watt incandescent with CFLs	25%	20%	55%

Source: ComEd General Population Survey (PY3)

LEDs were often mentioned as the next alternative lighting technology and a potential direction for utility lighting programs. We asked some questions on the general population survey to gauge customer awareness and use of LEDs. Half of ComEd customers (51%) are familiar with LEDs that could be used in the home. Of these, 23% have used an LED.

3.2.6 Program Theory

Given modest changes in the program design this topic was not revisited. Please refer to the year 1 report.

3.3 Cost Effectiveness Review

This section addresses the cost effectiveness of the Residential Lighting program. Cost effectiveness is assessed through the use of the Illinois Total Resource Cost (TRC) test. The Illinois TRC test is defined in the Illinois Power Agency Act SB1592 as follows:

> *'Total resource cost test' or 'TRC test' means a standard that is met if, for an investment in energy efficiency or demand-response measures, the benefit-cost ratio is greater than one. The benefit-cost ratio is the ratio of the net present value of the total benefits of the program to the net present value of the total costs as calculated over the lifetime of the measures. A total resource cost test compares the sum of avoided electric utility costs, representing the benefits that accrue to the system and the participant in the delivery of those efficiency measures, to the sum of all incremental costs of end-use measures that are implemented due to the program (including both utility and participant contributions), plus costs to administer, deliver, and evaluate each demand-side program, to quantify the net savings obtained by substituting the demand-side program for supply resources. In calculating avoided costs of power and energy that an electric utility would otherwise have had to acquire, reasonable estimates shall be included of financial*

costs likely to be imposed by future regulations and legislation on emissions of greenhouse gases.[85]

ComEd uses DSMore™ software for the calculation of the Illinois TRC test.[86] The DSMore model accepts information on program parameters such as number of participants, gross savings, free ridership, program costs and CO_2 reductions. It then calculates a TRC that fits the requirements of the Illinois Legislation.

One important feature of the DSMore model is that it performs a probabilistic estimation of future avoided energy costs. It looks at the historical relationship between weather, electric use and prices in the PJM Northern Illinois region and forecasts a range of potential future electric energy prices. The range of future prices is correlated to the range of weather conditions that could occur, and the range of weather is based on weather patterns seen over the historical record. This method captures the impact that extreme weather has on electricity prices. Extreme weather generally results in electricity price spikes and creates a skewed price distribution. High prices are going to be much higher than the average price while low prices are going to be only moderately lower than the average. DSMore is able to quantify the weighted benefits of avoiding energy use across years which have this skewed price distribution.

Results

Table 3-65 summarizes the unique inputs used in the DSMore model to assess the TRC ratio for the Residential Lighting program in PY3. Most of the unique inputs come directly from the evaluation results presented previously in this report. Measure life estimates and program costs come directly from ComEd. All other inputs to the model, such as avoided costs, come from ComEd and are the same for this program and all programs in the ComEd portfolio.

Table 3-65. Inputs to DSMore Model for Residential Lighting Program

Item	Value Used
Measure Life	9
Utility Administration and Implementation Costs	$2,895,306
Utility Incentive Costs	$12,710,832
Net Participant Costs	$19,084,516

Based on these inputs, the Illinois societal TRC for this program is 4.85 and the program passes the Illinois TRC test.

[85] Illinois Power Agency Act SB1592, pages 7-8.
[86] Demand Side Management Option Risk Evaluator (DSMore) software is developed by Integral Analytics.

Section 4. Conclusions and Recommendations

This section highlights the findings and recommendations from the evaluation of ComEd's PY3 Residential ES Lighting Program. The primary objectives of this evaluation are to quantify the gross and net energy impacts resulting from this lighting program and to assess program participants' prior awareness of CFLs and satisfaction with the program. Below are the key conclusions and recommendations.

4.1 Conclusions

4.1.1 Program Gross and Net Impacts

PY3 gross Ex-Post energy savings surpassed both the revised PY3 energy savings target and PY3 program reported savings estimate (attainment rates of 165% and 129% in comparison to these two values, respectively[87]). These high gross savings rates were primarily driven by an increase in the PY3 estimated HOU (based on the PY3 metering study) and the program bulbs that are installed in non-residential locations (which have significantly higher HOU and CF estimates associated with them.)

The overall annual gross and net program savings increase further when the savings associated with the PY1 and PY2 late installs are included. The final net energy realization rate on the PY3 revised target with these additional savings incorporated is 192%.

4.1.2 Program Processes

At the end of PY3, 80% of customers said they were aware of CFLs without being offered a description of the bulbs. Another 12% said they had heard of CFLs once they were read a short description. Awareness of CFLs among ComEd customers is so high that it is not surprising that it has not increased between the beginning of the program in PY1 and PY3.

Being aware of CFLs is not the same as having knowledge about their properties or experience with them. ComEd customers who were "aware" of CFLs were asked to rate their "familiarity" with CFLs on a four point scale that ranged from "not at all familiar" to "very familiar". After PY1, 30% of customers said they were "not at all" or "not too familiar" with CFLs. At the end of both PY2 and PY3, half as many (15%) were unfamiliar with CFLs.

Nearly two-thirds of ComEd customers had at least one CFL installed at the end of PY1. Penetration remained largely the same in PY2 at 62% but increased to 70% at the end of PY3. The average number of CFLs installed per home has varied over the three program years from 8.9 at the end of PY1 to 13.3 at the end of PY2 and back down to 9.8 at the end of PY3.

[87] Excluding late installs, those increase the attainment rates to 192% and 149%, respectively.

Approximately half of ComEd customers purchased at least one CFL in each of the three program years (52% in PY1, 55% in PY2 and 50% in PY3). The percentage purchasing incandescent bulbs has also remained the same since PY1, at approximately 45%.

The ComEd lighting program is reaching customers with relatively low CFL socket saturation prior to purchasing the program bulbs, as well as those who already have a lot of CFLs installed. Twenty percent of customers who purchased bulbs discounted through the program did not have any CFLs installed prior to that purchase. Just over half (51%) had CFLs in less than 25% of their sockets prior to their purchase. Fifteen percent had CFLs in 75% or more of their sockets.

ComEd customers who have ComEd discounted CFLs installed report high levels of satisfaction with them. Program purchasers who removed CFLs that they purchased in PY3 mainly did so because the CFLs burnt out or broke (85%) rather than dissatisfaction with the performance of the bulbs (9%).

Nearly one in five ComEd customers has never purchased a CFL (19%). Barriers to CFL adoption for these customers are led by concerns about mercury (40% said very important reason for not purchasing in past year). Non-purchasers cite the light quality (31%) and brightness (29%) of CFLs as reasons for not purchasing. The price of CFLs is a very important reason for not purchasing for 26% of non-purchasers.

Awareness of ComEd's "Smart Ideas" program increased in PY3 to 27% from 19% in PY2. Still, 60% of program bulb purchasers are aware that they purchased discounted CFLs. Even fewer (14%) know that ComEd is the sponsor of the discount.

ComEd's in-store marketing campaign appears to be more effective than the out-of-store marketing. Three-quarters of the 44% of customers who recall the store marketing materials say the materials were very influential in their purchase decision.

4.2 Recommendations

Before offering recommendations for future program improvement, the evaluation team would like to first acknowledging the impressive and consistent success of the ComEd Residential ES Lighting Program. The program was successful in PY3 in meeting its goals in terms of number of bulbs sold, just as it was in PY1 and PY2. Spiral CFLs in particular are selling at very high rates. Manufacturers and retailers are almost universally pleased with the program and its implementation. ComEd successfully put plans in place to expand the program to discount stores in PY4, which was a specific recommendation in the PY2 evaluation report. The program has also been successful at getting CFLs into homes with lower socket saturation, another of the recommendations from the PY2 evaluation.

Because of this success, the recommendations below are more in the nature of fine-tuning. These recommendations are based on findings from the current evaluation and upcoming changes in the CFL market.

1. **Increase focus on using EISA 2007 to educate customers about proper CFL replacement.**

ComEd should consider using EISA 2007 to educate customers about CFLs and proper CFL replacement. Only 35% of ComEd customers are aware of the law, and all customers and are likely susceptible to much of the misinformation surrounding it. Forty five percent of the General Population Survey respondents in PY3 said they plan to purchase extra 100-watt incandescent bulbs before the law goes into effect, and only 25% of respondents said they are likely to replace their current 100-watt incandescent bulbs with CFLs at that time. The ComEd website already contains educating customers about EISA 2007. Since so few customers know about the law, and so many say they will buy extra 100 watt incandescent bulbs in advance, we could recommend more direct marketing. ComEd should consider a bill insert leading up to the change that promotes CFLs and lets customers know what replaces a 100 watt incandescent, as well as the variety of colors and styles of CFLs available for different applications. ComEd may also want to ensure they have incentives on a mix of 100 watt alternatives next year in preparation so that customers have options.

2. Consider language-based program outreach to non-English speaking households.

An embedded finding from the multi-state study is that there is a notably lower CFL saturation level within non-English speaking households. The evaluation team recommends that ComEd consider language-based lighting program outreach to these customers.

3. Improve recording and reporting of lumen output in the program tracking data.

Given the agreement in PY2 on a lumen output-based approach to calculating delta watts in the evaluation, ComEd should include lumen output for each record in the Residential Lighting Project Info Database. In PY4, we recommend that ComEd calculate the base wattage value for each record according to the evaluation-based lumen output ranges in the memo on this topic that accompanied the PY2 evaluation report.

4. Improve recording of retail price per package in the program tracking data.

We also recommend that ComEd include retail price per package in the Residential Lighting Project Info Database as well as in the Goals Tracker. This is presumably an easy step for ComEd and will minimize potential errors and analysis time invested in merging this onto the tracking data from the goals tracker for purposes of pricing analysis.

5. Screen key tracking data fields for incorrect or missing entries.

We recommend that ComEd screen the tracking data for incorrect or missing values by looking at a filtered list of the unique values found for each variable and making sure that these are consistent with expectations. The PY3 tracking data incorrectly attributed program sales to a non-program retailer which could have been identified through such a data screen.

6. Encourage retail participants to participate more actively in the program evaluation.

We recommend that ComEd encourage retail participants in the program to participate more actively in the evaluation. As noted earlier in this report, the upstream nature of the program makes it difficult to identify and communicate directly with program bulb users. The only "participants" we know for certain are manufactures, retailers and coupon participants (<1% of pgm). As such, greater retailer participation through the Supplier-Self Report interviews and through facilitating the in-store intercept and shelf survey data collection process would contribute materially to the evaluation. One respondent in the PY3 Supplier Self-Report interviews indicated that their company would provide additional sales data if this was a requirement made of all retail participants in the MOU.

7. Increase promotion of the CFL disposal program.

Lastly, the evaluation team recommends increased promotion of the expanded CFL disposal program. In the PY3 General Population Survey, respondents who have never purchased CFLs indicated that mercury is a barrier for them. We recommend the development of additional educational materials to explain the risks of mercury. Given the dramatic expansion in the disposal program, ComEd should increase their advertising and educational efforts surrounding where customers can safely dispose of CFLs to attempt lower this specific barrier.

8. Consider further improvements to the evaluation process.

Given the problems experienced in applying the regression-based revealed preference and multi-state approaches, we recommend reconsidering their use in the PY4 evaluation cycle.

Section 5. Appendices

5.1 Data Collection Instruments

The data collection instruments used in this evaluation consisted of in-depth interview guides for the ComEd program manager, the APT and EFI program implementers, Lighting Manufacturers and Corporate Retailers. Survey instruments were also developed for the in-store intercept surveys, the shelf surveys and the CATI general population telephone survey.

5.1.1 In-Depth Interview Guides for ComEd Staff and APT Program Implementers

ComEd PY3 Residential Lighting Interview Guide – ComEd and APT
April 26, 2011

PY3 Changes

1. I'd like to focus on any changes that were made to the Residential Lighting program for PY3.

    a. Has the allocation of program bulbs changed in PY3? (Overall quantity sold and mix of discounted products)

    b. Has the mix of bulbs being sold through the coupon channel versus the markdown channel changed for PY3?

    c. What has been the impact of bring new retailers such as Walgreens and CVS into the program in PY3?

    d. [For Alicia Interview] In reviewing the PY3 Goals Tracking workbook we noticed some changes from the PY2 goals tracker. We'd like to briefly discuss the ex ante assumptions included in this workbook and your understanding of what savings parameters are deemed for PY3.

        i. HOU – this parameter was again set equal to 2.34 HOU which comes from Val Jensen's testimony. Is it your understanding that this value is deemed for PY3 savings estimates despite the HOU estimates were are currently working on from the metering study?
        ii. CF – this parameter was not included in the workbook. Do you know if the ex ante estimate is again 0.081? Is this deemed as well?
        iii. Peak Hours – different between ComEd (1-5/6 pm?) and PJM (2-6 pm)– do we need to estimate CF for both definitions?
        iv. Delta Watts – the DW estimates in the PY3 goals tracker are now in line with Val Jensen's testimony – are these deemed for PY3?
        v. Realization rates – the RR applied to standard/specialty/fixtures for PY3 is 85%. This is an increase from last year when 65% was used for standard and specialty bulbs and 75% was used for fixtures. Do you know where this new RR estimate was from? Does it include estimates of leakage or interactive effects?
        vi. Res/Non-Res Split – last year we found ~ 10% of program bulbs were being installed in Non-Res locations. Have you made any changes to your savings estimates based to account for NR installations?
        vii. NTGR – The NTGR in the goals tracker was 58% from the PY2 eval. Is that deemed for PY3 net savings estimates?

e. Has the marketing of the program been changed at all in PY3? Do you know if APT is conducting the same number of in-store events as in PY1 and PY2?

f. Have you made any changes to your program data tracking system including sales and payment data?

g. Have you made any changes the quality control procedures used to monitor the APT field representatives' works?

PY3 Implementation

2. Can you please give me an idea of the timeline for the implementation of PY3? Was it a seamless transition from PY2 to PY3?

3. In your opinion, how effective has the third year of the Residential Lighting Program been thus far? What elements of the program are working best? What elements need improvement?

4. Is the program on track to meet its goals for PY3? Has participation in the program been greater than or less than expected?

5. Are you aware of any non-program retailers that are not participating in PY3 but are discounting their bulbs to stay competitive with the program bulbs?

6. Do you know of any other PY3 implementation issues that we should be aware of?

7. One Chicago based Navigant employee recently visited a Home Depot in ComEd service territory and found 4-packs of 14 watt spirals being sold for $0.97. The program pricing was $1.97. Are you aware of this further discount? Do you know if it was being paid for by the retailer or the manufacturer? Are you aware of any other additional discounts being offered? Do you have any information on the timing of these additional discounts? Unfortunately this was not the price on the shelf at the time at least 3 of the HD shelf surveys were conducted.

PY4 Changes

8. Do you have plans to expand the program to other retailers in PY4? When we talked last year you mentioned trying to expand the program into Blaine's Farm and Fleet and Dominick's – it seems as if neither of these are participating in PY3. Do you know why not? Are you still planning to try to include them in the program?

9. [For Alicia Interview] – We were told Dollar stores are not included in the program due to their inclusion in a state run lighting low income lighting program? Do you know if this program is still on-going? Can you tell us any more about this program?

10. Are you currently planning any changes to the program for next year (PY4)? Please detail these anticipated changes.

11. Are there any other items relevant to the program that we have not discussed that we should know about?

Thank you very much for taking the time in assisting us with this evaluation. Your contribution is a very important part of the process.

5.1.2 In-Depth Interview Guides for Lighting Manufacturers and Corporate Retailers

Net-to-Gross, Process and Spillover Interview Guide for High Level Retail Buyers Participating in the 2009-2011 ComEd Residential Lighting Program

Definitions

Spiral CFL Bulbs - CFL bulbs that DO NOT have special functions such as reflectors/floods, dimmability or 3-way light levels.

Specialty CFL Bulbs - CFL bulbs that HAVE special functions such as reflectors/floods, dimmability or 3-way light levels.

CFL Fixtures - Energy Star-qualified integrated CFL bulbs/fixtures.

Introduction

Hello. I'm calling from Itron on behalf of Commonwealth Edison as part of the evaluation of its Residential Lighting Program. For the remainder of this survey, I'm going to refer to Commonwealth Edison as "ComEd".

The purpose of the interview is to learn about your company's participation in ComEd's program, to understand your past promotion, sales and pricing of CFLs prior to the start of the program, and to learn how the program has affected your company's sales, pricing and promotion of CFLs. The interview will take approximately 30 minutes and any information that is provided will remain strictly confidential. We will not identify or attribute any of your comments or organization information.

The following are the appropriate representatives for this evaluation – Alicia Forrester of ComEd (630) 576-6917, David Nichols of ComEd (630) 437-2418

N1. First of all, what are your job title and major responsibilities?

N2. How long have you been performing that job?

N3. What is your role with respect to ComEd's program?

Reasons for Participation

P1. What were your primary reasons for getting involved with the ComEd Residential Lighting program?

PY1/PY2/PY3 CFL Product Sales and ComEd Residential Lighting Program Trends

My next questions concern the types and quantities of CFL bulbs or fixtures you sell in ComEd's service territory. Are you the correct person to talk to about this? [IF NOT, WHO?]

SPIRAL CFLS [IF THEY SELL SPIRAL CFL BULBS]

I'd like to start by asking you some questions about your sales of Spiral CFL bulbs in ComEd's service territory. [IF NEEDED: By Spiral CFL bulbs I mean CFL bulbs that DO NOT have special functions such as reflectors/floods, dimmability or 3-way light levels.]

Have you had a chance to fill in the table I emailed you earlier for program and non-program bulb sales? Can you email it to me now? [REPEAT ASSURANCES OF CONFIDENTIALITY]

[IF TABLE COMPLETED]

PS1. Why did you choose to sell the particular products and packages you sell through the ComEd Program?

[**IF TABLE INDICATES *SPIRAL ES CFLs* SOLD IN COMED'S SERVICE TERRITORY FROM JUNE 1, 2008 TO CURRENT DATE BUT NOT THROUGH COMED'S PROGRAM** ASK PS3]

PS2. I noticed that when you filled out the table you indicated that between START MONTH/YEAR and MOST RECENT MONTH/YEAR you sold spiral Energy Star CFLs in ComEd's service territory that were not rebated by the ComEd Residential Lighting Program. Why didn't you sell these CFL bulbs through the program? Were there advantages or disadvantages to selling the bulbs through the program?

[IF TABLE NOT COMPLETED]

PS3. From June 1, 2008 to CURRENT DATE did you sell spiral CFL bulbs in ComEd's service territory that **did not** receive discounts from the Residential Lighting Program?

IF Yes:

- Are the bulb types and packages different from those you sell through the ComEd Program? If Yes, How so?
- Why didn't you sell these bulbs through the ComEd Program?

PS4. When discounts from the Residential Lighting Program **were not** available, due to product allocations for discounted CFLs running out, did you sell spiral Energy Star CFL bulbs in ComEd's service territory?

IF Yes:

- Were the bulb types and packages different from those you sell through the ComEd Program? If Yes, How so?

PS5. Please provide your best estimate of the percentage breakdown of your spiral CFL bulb sales in ComEd's service territory From June 1, 2008 to CURRENT DATE by the following 3 categories:

a. Percentage of ES units sold that were discounted by the ComEd Residential Lighting Program ___%

b. Percentage of ES units sold that were not discounted by the program ___%

c. Percentage of units sold that were not ES ___%

[THESE MUST TOTAL 100 PERCENT]

PS6. ComEd has sales data for the CFL products that your company sold through the ComEd Residential Lighting Program. However, they are also very interested in learning about prices and sales volumes for CFL products that were **not** sold through the ComEd Residential Lighting Program. If we provided assurances to protect the confidentiality of these sales data, would you be willing to share these data? If yes, how could we get this data?

SPECIALTY CFLS *[*IF THEY SELL SPECIALTY CFL BULBS]

Now I'd like to ask you some similar questions about your sales of specialty CFL bulbs (reflectors/flood, dimmability, three-way lights)

[IF TABLE COMPLETED]

PS7. Why did you choose to sell the particular products and packages you sell through the ComEd Residential Lighting Program?

[IF TABLE INDICATES SPECIALTY *ES CFLs* SOLD IN COMED'S SERVICE TERRITORY FROM JUNE 1, 2008 TO CURRENT DATE BUT NOT THROUGH COMED'S PROGRAM, THEN ASK PS13]

PS8. I noticed that when you filled out the table you indicated that between START MONTH/YEAR and MOST RECENT MONTH/YEAR you sold Specialty Energy Star CFLs in ComEd's service territory that were not rebated by the ComEd Residential Lighting Program. Why didn't you sell these CFL bulbs through the program? Were there advantages or disadvantages to selling the bulbs through the program?

[IF TABLE NOT COMPLETED]

PS9. From June 1, 2008 to CURRENT DATE did you sell Specialty CFL bulbs in ComEd's service territory that **did not** receive discounts from the Residential Lighting Program?

IF Yes:

- Are the bulb types and packages different from those you sell through the ComEd Program? If Yes, How so?
- Why didn't you sell these bulbs through the ComEd Program?

PS10. [ASK ALL] When discounts from the Residential Lighting Program **were not** available, due to product allocations for discounted CFLs running out, did you sell Specialty Energy Star CFL bulbs in ComEd's service territory?

IF Yes:

- Were the bulb types and packages different from those you sell through the ComEd Program? If Yes, How so?

PS11. Please provide your best estimate of the percentage breakdown of your Specialty CFL bulb sales in ComEd's service territory from June 1, 2008 to CURRENT DATE by the following 3 categories:

a. Percentage of Specialty ES units sold that were discounted by the ComEd Residential Lighting Program ___%

b. Percentage of Specialty ES units sold that were not discounted by the program ___%

c. Percentage of Specialty units sold that were not ES ___%

[THESE MUST TOTAL 100 PERCENT.]

CFL FIXTURES [IF THEY SELL CFL FIXTURES]
Next I'm going to ask you some similar questions but this time about your sales of Energy Star-qualified CFL fixtures.

PS12. Why did you choose to sell the particular CFL fixtures you sell through the ComEd Residential Lighting Program?

[IF TABLE INDICATES *ES CFL FIXTURES* SOLD IN COMED'S SERVICE TERRITORY FROM JUNE 1, 2008 TO CURRENT DATE BUT NOT THROUGH COMED'S PROGRAM, THEN ASK, ELSE SKIP TO PS13]

PS13. I noticed that when you filled out the table you indicated that between START MONTH/YEAR and MOST RECENT MONTH/YEAR you sold Energy Star CFL fixtures in ComEd's service territory that were **not** rebated by the ComEd Residential Lighting Program. Why didn't you sell these CFL fixtures through the program? Were there advantages/disadvantages to selling the bulbs through the program?

[IF TABLE NOT COMPLETED]

PS14. From June 1, 2008 to CURRENT DATE did you sell ***Energy Star*** CFL fixtures in ComEd's service territory that **did not** receive discounts from the Residential Lighting Program?

IF Yes:

- Are the CFL fixtures different from those you sell through the ComEd Program? If Yes, How so?
- Why didn't you sell these CFL Fixtures through the ComEd Program?

PS15. When discounts from the Residential Lighting Program **were not** available, due to product allocations for discounted CFL fixtures running out, did you sell Energy Star CFL fixtures in ComEd's service territory?

IF Yes:

- Were the CFL fixtures different from those you sell through the ComEd Program? If Yes, How so?

PS16. Please provide your best estimate of the percentage breakdown of your CFL fixtures in ComEd's service territory from June 1, 2008 to CURRENT DATE by the following 3 categories:

a. Percentage of ES fixtures sold that were discounted by the ComEd Residential Lighting Program ___%

b. Percentage of ES fixtures sold that were not discounted by the program ___%

c. Percentage of fixtures sold that were not ES ___%

[THESE MUST TOTAL 100 PERCENT.]

Free Ridership and In-State Spillover for PY1/PY2/PY3 Residential Lighting Program

My next questions are about the impact that the ComEd Residential Lighting Program may have had on your CFL products sales within ComEd's service territory.

FR1. Do you think your company would have been selling any CFL products from June 1, 2008 to CURRENT DATE if the discounts from the program had not been available? Why do you say that?

Free Ridership

Spiral CFL bulbs [ASK ONLY IF THEY SELL SPIRAL CFL BULBS]

FR2. According to our records, from June 1, 2008 to CURRENT DATE you received ComEd Residential Lighting Program program discounts for the sale of spiral CFL bulbs. The program also provided promotional materials such as signage. If these discounts and program promotional materials had not been available during this June 1, 2008 to CURRENT DATE period, do you think your sales of these types of spiral ***Energy Star*** CFL bulbs in ComEd service territory would have been about the same, lower, or higher?

1 Same

2 Higher - Why do you say this?

3 Lower- By what % do you estimate your sales of spiral ES CFL bulbs have increased during this period due to the presence of the program incentives and promotional materials? **RECORD PERCENTAGE INCREASE:** __%

FR3. When the ComEd Residential Lighting Program was providing discounts for spiral bulbs, did your company ever provide any of its own price discounts in addition to those provided by the Residential Lighting Program?

IF No, why not?

IF Yes:

- What were your reasons for providing these additional price discounts?
- What was the typical range of these additional discounts on a $ per bulb basis?
- Were there particular types of bulbs that you offered these additional discounts on?
- What types of bulbs were these?
- Using a scale of 0 to 10 where 10 equals "very likely" and 0 equals "not likely at all," how likely were you to offer these additional price discounts if the program discounts had not also been available?

Specialty CFL bulbs [ASK ONLY IF THEY SELL SPECIALTY CFL BULBS]

FR4. According to our records, from June 1, 2008 to CURRENT DATE you received ComEd Residential Lighting Program program discounts for the sale of the following types of Specialty CFL bulbs [NAME TYPES: reflectors/floodlights, dimmable bulbs, globes, A-lamps, post bulbs, and 3-way light levels]. The program also provided promotional materials such as signage. If these discounts and program promotional materials had not been available during this June 1, 2008 to CURRENT DATE period, do you think your sales of these types of Specialty ***Energy Star*** CFL bulbs in ComEd service territory would have been about the same, lower, or higher?

1 Same [FR6]
2 Higher - Why do you say this?
3 Lower- By what % do you estimate your sales of Specialty ES CFL bulbs have increased during this period due to the presence of the program incentives and promotional materials? **RECORD PERCENTAGE INCREASE:** __%

FR5. When the ComEd Residential Lighting Program was providing program discounts for Specialty bulbs, did your company ever provide any of its own price discounts in addition to those provided by the Residential Lighting Program?

IF No, why not?
IF Yes:

- What were your reasons for providing these additional price discounts?
- What was the typical range of these additional discounts on a $ per bulb basis?
- Were there particular types of bulbs that you offered these additional discounts on?
- What types of bulbs were these?
- Using a scale of 0 to 10 where 10 equals "very likely" and 0 equals "not likely at all," how likely were you to offer these additional price discounts if the program discounts had not also been available?

CFL fixtures [ASK ONLY IF SOLD SPECIALTY CFL FIXTURES]

FR6. According to our records, from June 1, 2008 to CURRENT DATE you received a ComEd Residential Lighting Program program discounts for the sale of the following types of CFL fixtures [NAME TYPES]. The program also provided promotional materials such as signage. If these program discounts and program promotional materials had not been available during this

June 1, 2008 to CURRENT DATE period, do you think your sales of these types of ***Energy Star*** CFL fixtures in ComEd service territory would have been about the same, lower, or higher?

1 Same [FR3]
2 Higher - Why do you say this?
3 Lower- By what % do you estimate your sales of ES CFL fixtures have increased during this period due to the presence of the program incentives and promotional materials? **RECORD PERCENTAGE INCREASE:** __%

FR7. When the ComEd Residential Lighting Program was providing program discounts for ***Energy Star*** CFL fixtures sold through the [RETAIL CATEGORY] retail channel, did your company ever provide any of its own price discounts in addition to those provided by the Residential Lighting Program?

IF No, why not?
IF Yes:

- What were your reasons for providing these additional price discounts?
- What was the typical range of these additional discounts on a $ per fixture basis?
- Was there a particular type of fixture that you offered additional discounts on?
- What types of fixtures were these?
- Using a scale of 0 to 10 where 10 equals "very likely" and 0 equals "not likely at all," how likely were you to offer these additional price discounts if the program discounts had not also been available?

FR8. State or utility incentive programs are only some of the factors that may be encouraging sales of CFL bulbs and fixtures. How important are each of the following in affecting your company's sales of CFLs in ComEd's service territory? For each one please tell me how important it is for influencing your company's CFL product sales between June 1, 2008 and CURRENT DATE. Please use a 0 to 10 scale, where 0 is not at all significant and 10 is extremely significant.

FR8a. State or utility rebate and discount programs? Why?
FR8b. CFL promotion campaigns by some large retailers that are being done independently of any state or utility energy efficiency programs? Why?
FR8c. Media stories promoting the use of CFLs? Why?
FR8d. Growing consumer awareness about global warming? Why?
FR8e. Higher energy costs? Why?

Program Effects on Non-discounted CFLs Sold in ComEd Service Territory [IF THEY SOLD CFL BULBS AND FIXTURES IN COMED'S SERVICE TERRITORY FROM JUNE 1, 2008 TO CURRENT DATE OUTSIDE OF COMED'S PROGRAM, THEN ASK, ELSE SKIP TO SAT1]

PE1. You said earlier that you also sold CFL bulbs or fixtures in ComEd's service territory from June 1, 2008 to CURRENT DATE that did not receive discounts from the ComEd Residential Lighting Program. What effects, if any, do the program discounted CFL bulbs or fixtures have on

your sales levels and prices of these non-program-discounted CFL bulbs or fixtures? [IF MECHANISM FOR THESE EFFECTS IS NOT EXPLAINED, PROBE FOR MECHANISM]

PE1a. Do these effects vary depending on the type of CFL product? [IF YES] How so?

PE1b. Have these effects changed at all over this time period? [IF YES] How so and about what time period did these effects change?

PE2. Does your company ever sell program-discounted CFL bulbs or fixtures and non-program-discounted CFL bulbs or fixtures at the same time?

IF Yes:

- Would you say this happens always, very often, sometimes, or not very often?
- Do you promote these non-program-discounted CFL bulbs or fixtures differently than you do the program-discounted CFL bulbs or fixtures?
- How are your promotional efforts different?
- Do you think increased shopper foot traffic due to program-discounted CFL bulbs and fixtures has any impact on the sales of non-program discounted CFL bulbs or fixtures that are being sold at the same time? Why do you say this?

PE3. What effects do you think program-discounted CFL bulbs or fixtures have on consumer expectations regarding prices of non-discounted CFL bulbs or fixtures?

PE4. [IF THEY SOLD BOTH SPECIALTY AND SPIRAL CFLS] You said earlier that from June 1, 2008 to CURRENT DATE, you sold both spiral and specialty CFL bulbs through the ComEd Residential Lighting Program. What effects, if any, do the program-discounted spiral CFL bulbs have on your sales levels of program-discounted specialty CFL bulbs, such as dimmable bulbs, bulbs with reflectors, 3-way bulbs, and flood lights? [IF MECHANISM FOR THESE EFFECTS IS NOT EXPLAINED, PROBE FOR MECHANISM]

PE5. Earlier you said that your company was **not** selling CFL products in ComEd's service territory before getting involved with the ComEd Residential Lighting Program. How significant was the existence of the ComEd Residential Lighting Program and rebate in your company's decision to enter the ComEd lighting market? Please use a 0 to 10 scale, where 0 is not at all significant and 10 is extremely significant.

PE6. Earlier you said that your company sold CFL products in ComEd's service territory before getting involved with any of these ComEd lighting rebate or discount programs. Do you have ComEd service territory CFL product sales data for this period before you became involved with the ComEd lighting rebate or discount programs?

- If we provided assurances to protect the confidentiality of these sales data, would you be willing to share these data? If yes, how could we get this data?

Market Characterization

MC1. What actions is your company taking to assure the quality of CFL products it sells?

MC2. What actions has your own company taken to encourage environmentally safe recycling and disposal of CFL products?

Program Satisfaction

Finally I would like to find out your level of satisfaction with various elements of the ComEd Residential Lighting Program. For these questions we will be using a scale of 0 to 10 where 10 = very satisfied and 0 = very dissatisfied. Using this 0 to 10 scale…

Rebate Reservation, Program Verification Process

SAT1. How satisfied have you been with the enrollment process – that is, the process of discussing the program with the program implementer and agreeing to participate?

SAT2. How satisfied have you been with the incentive fund reservation process – that is, the process used by the program implementer to allocate a set amount of incentive dollars to participating stores?

SAT3. How satisfied have you been with the program tracking and verification process – that is, the process used by the utility to insure that the CFL products that they are providing discounts for are being sold by retailers and are properly labeled and promoted?

IF ANY RATING = 0 to 5 ASK: Why do you say that?

Incentive Levels and Coverage

CFL bulbs

SAT4. Using this same satisfaction scale, how satisfied have you been with the levels of manufacturer buydown incentives for CFL ***bulbs***?

[IF RATING = 0 to 5] Why do you say that? For which bulb types are you unsatisfied with the incentive levels?

CFL fixtures

SAT5. Using this same satisfaction scale, how satisfied have you been with the levels of manufacturer buydown incentives for CFL ***fixtures***?

[IF RATING = 0 to 5] Why do you say that? For which fixture types are you unsatisfied with the incentive levels?

Marketing and Coordination with Retailers

SAT6. Using the same satisfaction scale, how satisfied have you been with the program's efforts to coordinate with retailers on in-store product placement and promotions?

[IF RATING = 0 to 5] Why do you say that?

SAT7. What effects, if any, does the inclusion of the utility logos have on the sales of your CFL products?

Satisfaction with Program Staff and Program As a Whole

SAT8. Using the same satisfaction scale, how satisfied have you been with the program managers and other staff involved in the ComEd Residential Lighting Program?[IF RATING IN 0-5] Why do you say that?

SAT9. Using the same scale, how would you rate your level of satisfaction with the program in general? [IF RATING = 0 to 5] Why do you say that?

SAT10. In what ways could the program be improved?

SAT11. Can you estimate what percentage of the CFL products you sold through the ComEd Residential Lighting Program during 2009 were installed in residential vs. nonresidential fixtures?

Wattage

W1. In general, how would you say customers determine what wattage of CFLs to buy?

Non-Residential Installations

NR1. In your estimation, what percentage of bulbs sold through this program are being installed in commercial settings?

That concludes the survey. On behalf of ComEd, thank you very much for your time, and for the information you provided.

5.1.3 In-store Intercept Survey Instrument

INTERVIEWER NAME: _____
INTERVIEW NUMBER: _____

COMED INTERCEPT SURVEY

(Fielded in Stores Visited for PY3 ComEd Residential Lighting Evaluation)

Field Staff Name:	
Start Time of Interview:	Date:
Store name:	
Store street address:	
Store city:	Store zip code:

Customer Lighting Purchases							
Pkg #	CFL or Incand.	Brand Name	Watts	Bulbs in Pack	Price per pack	ComEd sticker?	# of Packs
1						Yes No	
2						Yes No	
3						Yes No	
4						Yes No	

1. Were you planning to purchase light bulbs when you entered the store today?
   a. Yes
   b. No (skip to 3)
   c. Don't know (skip to 3)
2. What type (or types) of bulbs were you planning to buy? (Circle all that apply)
   a. CFLs
   b. Incandescent
   c. Halogen
   d. Other: _____
   e. Don't know
3. I see that you are buying. . . (circle one based on observing cart). Is that correct?
   a. CFLs and non CFLs
   b. CFLs only (skip to 5)
   c. non CFLs only (skip to 6)

INTERVIEWER NAME: _____
INTERVIEW NUMBER: _____

4. Why are you buying a mix of both CFLs and nonCFLs? (Do Not Read - Accept Multiple)
    a. Use in different rooms
    b. Use in different fixture types
    c. Dislike CFL fit in fixtures
    d. Dislike CFL look in fixtures
    e. Need dimmable bulbs
    f. Need 3-way bulbs
    g. Other: _____
5. Have you ever purchased or been given any CFLs before today?
    a. Yes
    b. No
    c. Don't know
6. Where are you planning to install the bulbs you are buying today - in your home, a business, or both?
    a. Home (Skip to 10)
    b. Business
    c. Both
    d. Other: _____
    e. Don't know (Skip to 10)
7. (if business) What type of business is it?
    a. Office
    b. Restaurant
    c. Grocery/Liquor
    d. Retail
    e. Warehouse, refrigerated
    f. Warehouse, non-refrigerated
    g. Hospital
    h. Health care, other than hospital
    i. School, K-12
    j. College
    k. Hotel/Motel
    l. Public assemply, e.g. church/theater/conference
    m. Industrial/agriculture
    n. Other: _____

INTERVIEWER NAME: _____
INTERVIEW NUMBER: _____

8. Do you have any CFLs installed right now in your business?
    a. Yes
    b. No
    c. Don't know
9. Does ComEd provide electricity to your business?
    a. Yes
    b. No
    c. Don't know
10. Do you have any CFLs installed right now in your home?
    a. Yes
    b. No
    c. Don't know
11. Does ComEd provide electricity to your home?
    a. Yes
    b. No
    c. Don't know
12. (If purchasing any CFLs; else skip to 28) Why are you purchasing CFLs today instead of purchasing (only) some other type of light bulb such as incandescent?
    a. The price (CFLs are inexpensive/price is low) ……First mention ☐ Other mention ☐
    b. To save money (CFLs cost less to use) ……First mention ☐ Other mention ☐
    c. To save energy (PROBE: Why?) for lower utility bills ...First mention ☐ Other mention ☐
    d. To save energy (PROBE: Why?) for environmental reasons ..First ment. ☐ Other mention ☐
    e. CFLs are good for the environment ……First mention ☐ Other mention ☐
    f. Recommended by friends/family ……First mention ☐ Other mention ☐
    g. Saw CFL advertisement outside store ……First mention ☐ Other mention ☐
    h. Saw CFLs advertised in store/saw display in store ……First mention ☐ Other mention ☐
    i. Prior good experience with CFLs ……First mention ☐ Other mention ☐
    j. Don't know ……First mention ☐ Other mention ☐
    k. Other: _____ ……First mention ☐ Other mention ☐

    _____

    _____

INTERVIEWER NAME: _____
INTERVIEW NUMBER: _____

13. Using a scale of 0 to 10 where 0 means not at all influential and 10 means extremely influential, how influential was the price of CFLs in your decision to buy them today?
    a. 0 = Not at all influential
    b. 1
    c. 2
    d. 3
    e. 4
    f. 5
    g. 6
    h. 7
    i. 8
    j. 9
    k. 10 = Extremely influential
    l. Don't know
14. When you are purchasing light bulbs, how do you decide what wattage of bulbs to buy? [IF THEY ANSWER 'PRICE', CLARIFY THAT YOU ARE ASKING ABOUT WATTAGE NOT PRICE]
    a. Record answer: _____
15. Of the CFLs you are purchasing today, how many do you expect to install right away?
    a. Record answer: _____
16. How many do you expect to store for later use?
    a. Record answer: _____
17. Of the CFLs you are purchasing today, how many will you use to replace currently burned out or missing bulbs?
    a. Record answer: _____
18. Of the CFLs you are purchasing today, how many will you use to replace incandescent bulbs that still work?
    a. Record answer: _____ (If customer is purchasing at least 1 CFL discounted by ComEd skip to 21; else continue)
19. Do you know that THIS STORE is selling CFLs that are discounted through a program by ComEd?
    a. Yes
    b. No (skip to 21)
    c. Don't know (skip to 21)

INTERVIEWER NAME: _____
INTERVIEW NUMBER: _____

20. How did you first find out about ComEd's discounts on CFLs?
    a. ComEd sticker on the package
    b. Saw marketing materials in the store
    c. Read about it in my bill
    d. Discount was advertised in newspaper/tv/radio
    e. Store employee made me aware of the discount
    f. Saw a retail lighting demonstration
    g. Don't know
    h. Other: _____

       _____

21. (Ask only if there are non-discounted CFLs in the cart) The bulbs you are buying are NOT discounted by ComEd. Why did you choose these CFLs instead of the discounted ones? (DO NOT READ, CIRCLE ALL MENTIONED)
    a. Prefer this brand/manufacturer
    b. Prior experience with this model
    c. No discounted CFLs in this bulb category
    d. Didn't want to buy a multi-pack
    e. Full-price CFLs are higher quality
    f. Didn't know about the discount
    g. Other: _____

       _____

22. (If purchasing 1 or more CFLs discounted by ComEd; else skip to 28) Do you know that [the CFL/the CFLs/one of the CFLs] you are buying today [is/are] discounted?
    a. Yes
    b. No (skip to 25)
    c. Don't know (skip to 25)

23. Did you know that the discount on the price of these bulbs is provided by ComEd?
    a. Yes
    b. No (skip to 25)
    c. Don't know (skip to 25)

INTERVIEWER NAME: _____
INTERVIEW NUMBER: _____

24. How did you first find out about ComEd's discounts on CFLs?

    a. ComEd sticker on the package
    b. Saw marketing materials in the store
    c. Read about it in my bill
    d. Discount was advertised in newspaper/tv/radio
    e. Store employee made me aware of the discount
    f. Saw a retail lighting demonstration
    g. Don't know
    h. Other: _____

       _____

25. Did you come into the store today specifically to buy CFLs discounted by ComEd?

    a. Yes
    b. No
    c. Don't know

NOTE: REASSURE INTERVIEWEE THAT SURVEY IS ALMOST COMPLETE.

INTERVIEWER NAME: _____
INTERVIEW NUMBER: _____

26. (If purchasing 1 or more CFLs discounted by ComEd; else skip to 28) I see you are buying [INSERT NUMBER] CFLs that are discounted by ComEd. If the ComEd discount had not been offered and the CFL(s) had instead cost [INSERT AVERAGE DISCOUNT PER BULB, SEE CHART BELOW BASED ON SELECTED BULB TYPE] more per bulb, which would be [INSERT AVERAGE DISCOUNT PER PACK, SEE CHART BELOW] more per pack, would you still have purchased the same number of CFLs, fewer of them, or none of them?

Standard CFLs			**Specialty CFLs**		
Pack Size	Average discount per bulb	Average discount per pack	Pack Size	Average discount per bulb	Average discount per pack
1	$ 1.00	$1.00	1	$ 1.50	$1.50
2	$ 1.00	$2.00	2	$ 1.50	$3.00
3	$ 1.00	$3.00	3	$ 1.50	$4.50
4	$ 1.00	$4.00	4	$ 1.50	$6.00
5	$ 1.00	$5.00	5	$ 1.50	$7.50
6	$ 1.00	$6.00	6	$ 1.50	$9.00
7	$ 1.00	$7.00	7	$ 1.50	$10.50
8	$ 1.00	$8.00	8	$ 1.50	$12.00
9	$ 1.00	$9.00	9	$ 1.50	$13.50
10	$ 1.00	$10.00	10	$ 1.50	$15.00

a. Same number
b. Fewer
c. None
d. Don't know
e. Other:

_____

_____

_____

27. If the CFLs had not been discounted, would you have purchased incandescent bulbs instead of the CFLs?

a. Yes
b. No
c. Don't know

28. Did you see information or displays about CFLs in this store?

a. Yes
b. No (skip to 31)
c. Don't know (skip to 31)

INTERVIEWER NAME: _____
INTERVIEW NUMBER: _____

29. Who sponsored the information about CFLs that you saw? (DO NOT READ. CIRCLE ALL THAT APPLY)

a. ComEd
b. The store
c. Other: _____
d. Don't know

30. (If purchasing 1 or more CFLs discounted by ComEd; else skip to 31) 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 in your decision to buy CFLs? (CIRCLE ONE)

a. 0 = Not at all influential
b. 1
c. 2
d. 3
e. 4
f. 5
g. 6
h. 7
i. 8
j. 9
k. 10 = Extremely influential
l. Don't know

31. Thank you for your time today. May I have your contact information for our records? This information is strictly confidential and may only be used to verify your answers in a follow up call if necessary. It will not be sold or shared.

a. Name: _____
b. Zip: _____
c. Phone: _____

SURVEY ENDING TIME:_____.

5.1.4 In-store Shelf Survey Instrument

Schlesinger Associates Employee Name: _____
Shelf Survey Number: _____

COMED SHELF SURVEY – RETAILER XXXX

(Fielded in Stores Visited for PY3 ComEd Residential Lighting Evaluation)

Field Staff Name:	
Store name: **XXXX**	Date:
Store address:	
Store city:	Store zip code:

SS1. **What types of materials are present that promote CFLs? [CHECK ALL THAT APPLY.]**

Promotional Signage that mentions a Com Ed Discount or has Smart Ideas Logo		**Retailer signage that promotes CFLs**	
Brochures	☐ Yes ☐ No	Brochures	☐ Yes ☐ No
Floor sticker/cling	☐ Yes ☐ No	Floor sticker/cling	☐ Yes ☐ No
Sign on shelf/wall	☐ Yes ☐ No	Sign on shelf/wall	☐ Yes ☐ No
Sign hung from ceiling	☐ Yes ☐ No	Sign hung from ceiling	☐ Yes ☐ No
Other (such as display with working CFLs) – Describe: _____		Other (such as display with working CFLs) – Describe: _____	
☐ No ComEd materials present		☐ No Retailer materials present	

SS2. **Are there any end-cap lighting displays?** (If no, skip to SS3.)…… ….. **Yes** ☐ **No** ☐

a. Are CFL bulbs featured in the end-cap displays? …… …….. **Yes** ☐ **No** ☐

b. Are ENERGY STAR® CFL bulbs featured in the end-cap displays? ……. **Yes** ☐ **No** ☐

c. Are ComEd-discounted CFL bulbs featured in the end-cap displays?……. **Yes** ☐ **No** ☐

c1. How did you determine that the discounted bulbs were in the end-cap display? (Check 1.)

☐ By promotional materials on the end cap that showed ComEd as sponsor

☐ By consulting my shelf inventory sheet to see which bulbs were discounted

☐ Other (Please describe):_____

SS3. **How are the prices displayed for the ComEd discounted lighting?**

1 Discounted/sale price only displayed ..... **Yes** ☐ **No** ☐

2 Original price and discount price displayed ..... **Yes** ☐ **No** ☐

3 Price tag missing for discounted bulbs ..... **Yes** ☐ **No** ☐

5 Other (Describe) _____

SS4. **Is the retailer currently running other CFL promotions? (Discounted CFLs in addition to ComEd discount) If so, describe promotion:**

_____

_____

_____

_____

SS5. **Please rate the visibility of the ComEd Smart Ideas point-of-purchase materials.**

High _____ Moderate _____ Hidden _____ No Materials_____

SS6. **Approximately what percentage of all light bulbs displayed on the shelves are CFLs?**

0% _____ 1-25% _____ 26-50% _____ 51-75% _____ 76-99% _____ 100% _____

SS7. **Approximately what percentage of all CFLs displayed on the shelves are ENERGY STAR CFLs?**

0% _____ 1-25% _____ 26-50% _____ 51-75% _____ 76-99% _____ 100% _____

SS8. **Approximately what percentage of all CFLs displayed on the shelves are ComEd Program CFLs?**

0% _____ 1-25% _____ 26-50% _____ 51-75% _____ 76-99% _____ 100% _____

[IF STORE SELLS CFLs AND OTHER TYPES OF LIGHT BULBS]

SS9. **Are the CFLs located in the same aisle/location in the store as the rest of the light bulbs? [CIRCLE ONE]**

1 CFLs always located with other types of bulbs near them
2 Some of the CFLs are located near other bulbs, and some CFLs are located on their own
3 All of the CFLs are located on their own with no other bulbs near them
4 Store sells no other types of light bulbs (store sells only CFLs)

SS10. **Where are the ComEd-discounted CFLs located? [CIRCLE ALL THAT APPLY.]**

1 In the same aisle with other CFLs
2 In the same aisle with other light bulbs
3 In a different aisle or location from all other bulbs (e.g., display near cash register)
Describe: _____
4 Other location
Describe: _____

SS11. **Does one particular CFL model (such as a 4-pack of GE Spiral bulbs) or a couple of CFL models dominate inventory (i.e. make up more than 50% of total inventory)?**

1 Yes
2 No

If yes, provide manufacturer, style and wattage:

Manufacturer _____ Style_____ EStar?_____ #Bulbs_____ Watts_____

Manufacturer _____ Style_____ EStar?_____ #Bulbs_____ Watts_____

Also describe degree of dominance (e.g., 100+ packages of this model, 4 or 5 packages of each other model)**:**

_____

_____

_____

_____

SS12. **Are the following types of products sold? [CHECK YES OR NO FOR EACH]**

ComEd Program CFLs*	*Spiral:* **Yes** ☐ **No**☐	Specialty: **Yes** ☐ **No**☐
Non Program Energy Star CFLs	*Spiral:* **Yes** ☐ **No**☐	Specialty: **Yes** ☐ **No**☐
Non-Energy Star CFLs	*Spiral:* **Yes** ☐ **No**☐	Specialty: **Yes** ☐ **No**☐
Incandescent Bulbs	*Standard (A-lamp):* **Yes** ☐**No**☐	*Specialty (Other):* **Yes** ☐**No**☐
Halogen bulbs	*Any Halogen bulb:* **Yes** ☐ **No**☐	
LED bulbs	*Any LED bulb:* **Yes** ☐ **No**☐	

*"Program bulbs" are those bulbs that are discounted by ComEd specifically

Comparable Products:

ComEd CFL Inventory (C)

- **(CS) Spiral Bulbs –** Please inventory all ComEd standard spiral CFLs
- **(CG) Globe Bulbs –** Please inventory all ComEd globe CFLs sold in the store
- **(CP) Post Lamp Bulbs** – Please inventory all ComEd post lamp CFLs sold in the store
- **(CA) A-Lamp Bulbs –** Please inventory all all ComEd a-lamp CFLs sold in the store
- **(CR) Reflectors/Floodlights** – Please inventory all ComEd CFL reflectors or floodlights sold in the store
- **(CC) Ceiling Fixtures and Desk Lamps**– It is NOT necessary to inventory any additional CFL ceiling fixtures or desk lamps

Non-ComEd CFL Inventory (N)

- **(NS) Spiral Bulbs –** Please inventory all non-ComEd standard spiral CFLs
- **(NG) Globe Bulbs –** Please inventory all non-ComEd globe CFLs sold in the store
- **(NP) Post Lamp Bulbs** – Please inventory all non-ComEd post lamp CFLs sold in the store
- **(NA) A-Lamp Bulbs –** Please inventory all non-ComEd a-lamp CFLs sold in the store
- **(NR) Reflectors/Floodlights** – Please inventory all non-ComEd CFL reflectors or floodlights sold in the store
- **(NC) Ceiling Fixtures and Desk Lamps**– It is NOT necessary to inventory any additional CFL ceiling fixtures or desk lamps

Incandescent Inventory (I)

- **(IS) Standard Incandescent Bulbs –** Please inventory all 40,60, 75, 100 and 150 watt incandescent bulbs
- **(IG) Globe Bulbs** – Please inventory any incandescent globe bulbs sold in the store
- **(IP) Post Lamp Bulbs** – Please inventory any incandescent post bulbs sold in the store
- **(IA) A-Lamp Bulbs** – Incandescent equivalents to A-lamps are the same as for Spiral bulbs above
- **(IR) Reflectors/Floodlights** – Please inventory any other reflectors or floodlights sold in the store
- **(IC) Ceiling Fixtures and Desk Lamps** – It is NOT necessary to inventory any incandescent ceiling fixtures or desk lamps

Halogen Bulb Inventory

- **(H) Halogen Bulbs –** Please inventory all Halogen bulbs that are equivalents to the standard incandescent or reflector bulbs

Bulb Inventory:

Model Number	SKU	Manufacturer	Type	Wattage	Location A=Aisle E=End-cap O=Other	Qty in Pack	Approx # of Packages [1-10, 11-25, 26+]	Price(s) – if more than one, list in descending order.	3-waX?	Dimmable?	Energy Star?
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X
											X

5.1.5 General Population Survey Instrument

PY3 COMED GENERAL POPULATION LIGHTING SURVEY – FINAL

Respondent Type	USER	Description	Definition	QUOTA
Unaware	NAWAR	Respondents who are Unaware of CFLs, even after prompting	S1<>1 & S2<>1	
Non-Purchasers (CFLs)	NCFL	Households who have never purchased any CFLs	Q1aa=2,98,99	
Non-Users (CFLs)	NUSER	Respondents who are currently not using or storing CFLs at their home	Q2 = 0,98,99 & Q3<>1	
PY3 CFL Purchaser	PY3	Respondents who purchased CFLs in the past year (PY3)	Q1 = 1 & Q1yr=1	
Previous CFL Purchaser	PREVP	Respondents whose last CFL purchase was prior to June 2010	Q1 = 1 & Q1yr ne 1	
1 Yr Incand Purchaser	I_1YR	Respondents who purchased incandescents within the last year	OT1=1	

Screener Section

INTRO 1:
Hello, this is [SURVEYOR NAME] from Opinion Dynamics calling on behalf of Commonwealth Edison. We are not selling anything. We're conducting a study of households to better understand how residential customers like you choose light bulbs and fixtures to buy for your home.

May I speak with [CONTACT] or the person in your household that is most knowledgeable about your household lighting purchases? [EXPLAIN IF THERE IS MORE THAN ONE DECISION-MAKER WE ONLY NEED TO TALK TO ONE PERSON. ARRANGE CALL BACK IF RESPONDENT NOT AVAILABLE]

This call may be recorded or monitored for quality assurance purposes.

C1 According to our records ComEd is your electrical service provider, is this still correct?
1 Yes, ComEd
2 No, Someone Else [TERMINATE]
98. (Don't know) [TERMINATE]
99. (Refused) [TERMINATE]

S1 I'd like to start by asking you a few questions about your awareness of different types of light bulbs. Before this call today, had you ever heard of compact fluorescent bulbs, or CFLs?
1 Yes (SKIP TO S3)
2 No
8. (Don't know)
9. (Refused)

S2 Compact fluorescent light bulbs – also known as CFLs – usually do not look like regular incandescent light bulbs. The most common type of CFL is made with a glass tube bent into a spiral, resembling soft-serve ice cream, and it fits in a regular light bulb socket. Before today, were you familiar with CFLs?

1 Yes
2 No (SKIP TO OT1)
8. (Don't know) (SKIP TO OT1)
9. (Refused) (SKIP TO OT1)

[If S1 <> 1 and S2 <> 1 then NAWAR = 1, Else NAWAR = 0]

S3 How familiar are you with CFLs? Would you say that you are …

1 Very familiar
2 Somewhat familiar
3 Not too familiar
4 Not at all familiar
8. (Don't know) (SKIP TO OT1)
9. (Refused) (SKIP TO OT1)

S4 Have you heard of the "Smart Ideas" Program offered by ComEd, which provides discounts for installing energy efficiency lighting in your home?

1 Yes
2 No
8. (Don't know)
9. (Refused)

[If S4 = 2 or 8 then ask S5]

S5 Were you aware that ComEd provides discounts on CFLs for your home?

1 Yes
2 No
8. (Don't know)
9. (Refused)

Q1 Have you ever purchased any CFLs to use in your home?

1 Yes (SKIP TO Q1yr)
2 No
8 (Don't know)
9 (Refused)

Q1aa Has anyone else in your household ever purchased any CFLs to use in your home?

1 Yes, (ASK TO SPEAK TO THAT PERSON & REPEAT INTRO, If they are not available schedule a call-back)
2 No (SKIP TO OT1)
8 (Don't know) (SKIP TO OT1)
9 (Refused) (SKIP TO OT1)

[If Q1aa = 2,8,9 then NCFL=1, Else NCFL = 0]

Q1yr Since June 2010, have you purchased any CFLs to use in your home?

1 Yes

2 No
8 (Don't know)
9 (Refused)

[If Q1 = 1 and Q1yr <> 1 then PREVP = 1, Else PREVP = 0]
[If Q1 = 1 and Q1yr = 1 then PY3 = 1, Else PY3 = 0]

[If Q1yr = 1 then ASK Q6]

Q6 Approximately, how many CFLs have you purchased since June 2010 to use in your home, including both CFLs used for standard applications and specialty CFLs? If a package contained multiple CFLs, please count each CFL bulb separately. [IF NEEDED READ: "Specialty CFLs are bulbs such as flood lights, reflectors, globe bulbs (typically used in bathroom vanities) that are typically used in non-standard lamp applications"] [ASK THEM TO GIVE THEIR BEST GUESS EVEN IF NUMBER ISN'T PERFECT]

__ Enter #
0 None (SKIP to USE1)
998 (Don't know) (IF NONE GIVEN, SKIP TO OT1)
999 (Refused) (IF NONE GIVEN, SKIP TO P2_now)

Participant Screener – 1 YR Bulb Purchases

[If PY3 = 1 Then Go Through This Participant Screener Section; Otherwise Skip to OT1]

Store. Thinking back about your CFL purchases since June 2010, at what store were these bulbs purchased? (ACCEPT MULTIPLE)

1 Lowes
2 Home Depot
3 Sam's Club
4 Ace Hardware
5 CostCo
6 Menards
7 Jewel-Osco
8 Food4Less
9 Best Buy
10 DoItBest (Also known as Crafty Beaver)
11 TrueValue Hardware
12 Target
13 Walgreens
14 Wal-Mart
15 7-Eleven
16 Dominick's
17 CVS Pharmacy
18 Dollar Store
19 Family Dollar
20 Meijer
21 IKEA
97. Other [SPECIFY] _____
98. (Don't know)

99. (Refused)

State. Were any of these stores located outside of Illinois?
1 Yes – some were located outside Illinois
2 Yes – All were located outside Illinois (SKIP to USE1)
3 No
98. (Don't know)
99. (Refused)

[IF State = 1 then READ: For the following questions please consider only the bulbs purchased within Illinois]

TYPE What type of CFLs have you purchased since June 2010? [ACCEPT MULTIPLE]
1 Spiral CFLs
2 Reflector CFLs – typically used in indoor/outdoor flood light applications
3 Globe CFLs – typically used in bathroom vanity mirrors
4 CFL Flood Lights – used in recessed and track lighting and flood lamp applications
5 A-lamp CFLs – these have a dome cover designed to look like a traditional bulb
6 Dimmable CFLs – these can be used in lamps with dimmer settings
7 3-way CFLs – used in lamps with 3 light output settings
8 Post CFLs – for driveway and post lights
9 Candelabra CFLs – with small Candelabra base
10 CFL Fixtures – flush mounted ceiling fixture, desk lamp, outdoor wall light, bathroom vanity that only takes a pin-based CFLs
00 Other_____
98 (Don't know)
99 (Refused)

TYPE_Fixture Have you purchased any fixtures that only take CFLs since June 2010?
1 Yes
2 No

Create Spiral, A-lamp and Specialty Flags
If Type_01 = 1 then Spiral = 1; Else Spiral = 0;
If Type_05 = 1 then alamp = 1; Else alamp = 0;
If (Type_02 + Type_03 + Type_04 + Type_06 + Type_07 + Type_08 + Type_09) >=1 then Specialty = 1; Else Specialty = 0;

[T=Type and takes values from 1 to 10 based on responses to Type above – ASK ABOUT UP TO THREE TYPES]

BP1_T Approximately how many <TYPE – i.e. "Spiral CFLs"> you have purchased since June 2010?
00 Enter number of bulbs purchased
98 (Don't know)
99 (Refused)

BP2_T Were these <TYPE> discounted or on sale? There might have been a sign on the shelf or display in the store.
1 Yes – they were discounted
2 No – they were not discounted (SKIP TO BP4_T)

3 Some were discounted
8 (Don't know) (SKIP TO BP4_T)
9 (Refused) (SKIP TO BP4_T)

BP3_T Do you know who sponsored this discount?
1 ComEd
2 Retail Store
3 Manufacturer
00 OTHER, Specify
98 (Don't Know)
99 (Refused)

[IF TYPE = 10 OR BP1_T =1 SKIP BP4_T]
BP4_T Did the <TYPE> come in single or multi-packs?
1 Single
2 Multi-Pack
3 Some Single and some multi-packs
8 (Don't know)
9 (Refused)

Create Spiral_multi. Alamp_multi and Specialty_multi Flags
If BP4_1 = 2 then Spiral_multi = 1; Else spiral_multi = 0;
If BP4_5 = 2 then alamp_multi = 1; Else alamp_multi = 0;
If BP4_2 = 2 or BP4_3 = 2 or BP4_4 = 2 or BP4_6 = 2 or BP4_7 = 2 or BP4_8 = 2 or BP4_9 = 2 then Specialty_multi = 1; Else Specialty_multi = 0;

If PY3 = 1 and ANY BP2_T = 1 then DISCOUNT = 1 (Flag for parts who remember at least one package was discounted)
If PY3 = 1 and ANY BP3_T = 1 then ComEd = 1 (Flag for parts who remember at least one package was discounted by ComEd)

Calculate TOTAL_BULBS = Sum of (BP1_T) where T = 1 to 9

[SKIP TO P1 IF TOTAL_BULBS = Q6 or TOTAL_BULBS = missing OR TYPES>3 OR TYPE=00]

[ASK IF Total_bulbs > Q6]
Q6CH1 We just discussed a total of *[TOTAL_BULBS]* CFLs that you purchased at various stores since June 2010. Earlier you said that you purchased a total of *[Q6]* CFLs during this time period. Which do you think would be the better estimate for the number of bulbs you have purchased since June 2010?
1 [Q6] bulbs – the original estimate
2 [Total_Bulbs] The itemized total
3 Other Number of Bulbs
8 (Don't know)
9 (Refused)

[ASK IF Q6CH1=3]
Q6C1A What is a better estimate of the number of bulbs you have purchased since June 2010?
00 Enter number of bulbs purchased
998 (Don't know)
999 (Refused)

[ASK IF if Q6 > Total_bulbs]
Q6CH2 We just discussed a total of *[TOTAL_BULBS]* CFLs that you purchased at various stores since June 2010. Earlier you said that you purchased a total of *[Q6]* CFLs during this time period. Which do you think would be the better estimate for the number of bulbs you have purchased since June 2010?]

1 [Q6] bulbs – the original estimate
2 [Total_Bulbs] The itemized total
3 Other Number of Bulbs
8 (Don't know)
9 (Refused)

[ASK IF Q6CH2=00]
Q6C2A What is a better estimate of the number of bulbs you have purchased since June 2010?

00 Enter number of bulbs purchased
998 (Don't know)
999 (Refused)

[IF TOTAL_BULBS > Q6 AND Q6CH1 = 1 THEN B_1YR =Q6
IF TOTAL_BULBS > Q6 AND Q6CH1 = 2 THEN B_1YR =TOTAL_BULBS
IF Q6 > TOTAL_BULBS AND Q6CH2 = 1 THEN B_1YR =Q6
IF Q6 > TOTAL_BULBS AND Q6CH2 = 2 THEN B_1YR =TOTAL_BULBS
IF Q6CH1 = 00 then B_1YR = Other Bulbs recorded into Q6CH1 (00)
IF Q6CH2 = 00 then B_1YR = Other Bulbs recorded into Q6CH2 (00)
OTHERWISE B_1YR=Q6]

Self-Report Free-Ridership

[IF PY3 = 1 and DISCOUNT = 1 AND STORE IS 2-11,14,20 THEN ASK FREE-RIDERSHIP QUESTIONS]

[IF ComED = 1 ASK FR1]
FR1. How did you first find out about ComEd's price discounts on Compact Fluorescent Light bulbs? (DO NOT READ) (IF "SAW MARKETING MATERIAL IN STORE" PROBE FOR WHERE IN STORE)

1. (Saw coupon/marketing materials on shelf with bulbs)
2. (Saw coupon/marketing materials on display in aisle)
3. (Discount was advertised in mailing)
4. (Discount was advertised on radio)
5. (Discount was advertised in newspaper)
6. (A store employee made me aware of the discounted bulbs)
7. (Saw a ComEd table/display)
00. (Other, Specify)
98. (Don't know)
99. (Refused)

FR1a. In the past year have you come across any pamphlets or brochures from ComEd explaining the energy saving benefits of Compact Fluorescent Light bulbs?

1. Yes
2. No

8. (Don't know)
9. (Refused)

[Ask FR1b if FR1a = 1, Else SKIP to FR2]

FR1b. Where did you first see this material? (DO NOT READ) (IF "SAW MATERIALS IN STORE" PROBE FOR WHERE IN STORE)

1. (On shelf with bulbs)
2. (On display in aisle)
3. (ComEd table/display in aisle)
4. (On flyer they included in the bag with my purchase)
5. (In newspaper)
6. (A store employee made me aware of the energy savings benefits of CFLs)
7. (Bill insert)
8. (Mailing – non-specific)
9. (Brochure)
97. (Other, Specify)
98. (Don't know)
99. (Refused)

[ASK IF DISCOUNT=1 OR FR1A=1]

FR2. At the time that you learned about the [IF FR1A = 1 READ "energy savings benefits of CFLs", EVERYONE ELSE READ ""price discounted CFLs"] were you already planning on purchasing light bulbs?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF FR2=1]

FR2A. Had you already decided to purchase CFLs or were you considering purchasing a different type of bulb?

1. Already decided to buy CFLs
2. Considering purchasing different type of bulb
3. (Other)
8. (Don't know)
9. (Refused)

If Spiral = 1 and Spiral_multi = 0 then ask FR3a

FR3a. If the spiral CFL you purchased since June 2010 had cost $1.00 more would you still have purchased it or would you have purchased an incandescent light bulb?

1. Yes – Still CFL
2. No - Incandescent
99. (Don't know)
88. (Refused)

If Spiral = 1 and Spiral_multi = 1 then ask FR3b

FR3b. If the spiral CFLs you purchased since June 2010 had been $1.00 more per bulb, so a 4-pack of bulbs would have been $4 more for the multi-pack, would you still have purchased the CFLs or would you have purchased incandescent light bulbs?

1. Yes – Still CFLS
2. No - Incandescents
99. (Don't know)
88. (Refused)

If alamp = 1 and alamp _multi = 0 then ask FR3c
FR3c. If the standard application CFL you purchased since June 2010 had cost $1.50 more would you still have purchased it or would you have purchased an incandescent light bulb?
1. Yes – Still CFL
2. No - Incandescent
99. (Don't know)
88. (Refused)

If alamp = 1 and alamp _multi = 1 then ask FR3d
FR3d. If the standard application CFLs you purchased since June 2010 had been $1.50 more per bulb, so a 4-pack of bulbs would have been $6 more for the multi-pack, would you still have purchased the CFLs or would you have purchased incandescent light bulbs?
1. Yes – Still CFLS
2. No - Incandescents
99. (Don't know)
88. (Refused)

If Specialty = 1 and Specialty _multi = 0 then ask FR3e
FR3e. If the specialty CFL you purchased since June 2010 had cost $1.50 more would you still have purchased it or would you have purchased an incandescent light bulb?
3. Yes – Still CFL
4. No - Incandescent
99. (Don't know)
88. (Refused)

If Specialty = 1 and Specialty _multi = 1 then ask FR3f
FR3f. If the specialty CFLs you purchased since June 2010 had been $1.50 more per bulb, so a 4-pack of bulbs would have been $6 more for the multi-pack, would you still have purchased the CFLs or would you have purchased incandescent light bulbs?
3. Yes – Still CFLS
4. No - Incandescents
99. (Don't know)
88. (Refused)

[IF FR3a = 1 or FR3b = 1 or FR3c = 1 or FR3d = 1 or FR3e = 1 or FR3f = 1 THEN ASK FR6-FR10, ELSE SKIP TO FR12a]

FR6. Would you have purchased them …
1. At the same time,
2. Within a few months,
3. Within a year, or
4. More than a year later.
8. (Don't know)
9. (Refused)

FR9. Would you have purchased…

1. The same number of CFLs or
2. Fewer CFLs
00. (Other, Specify)
98. (Don't know)
99. (Refused)

[ASK FR10 IF FR9=2]
FR10. How many do you think you would have purchased?
___ [NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

If Spiral = 1 then ask FR12a

FR12a. Using a 0 to 10 scale, with 0 being not at all likely and 10 being very likely, how likely is it that you would have bought the same spiral CFLs if they were $1 more per bulb?
0. -0- Not at all likely
1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-
10. -10- Very likely
99. (Don't know)
88. (Refused)

If alamp = 1 then ask FR12b

FR12b. Using a 0 to 10 scale, with 0 being not at all likely and 10 being very likely, how likely is it that you would have bought the same standard application CFLs if they were $1.50 more per bulb?
0. -0- Not at all likely
1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-
10. -10- Very likely
99. (Don't know)
88. (Refused)

If Specialty = 1 then ask FR12c

FR12c. Using a 0 to 10 scale, with 0 being not at all likely and 10 being very likely, how likely is it that you would have bought the same specialty CFLs if they were $1.50 more per bulb?

0. -0- Not at all likely
1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-
10. -10- Very likely
99. (Don't know)
88. (Refused)

On a 0 to 10 scale, with 0 being strongly disagree and 10 being strongly agree, how much do you agree with the following statements?

FR14. There may have been several reasons for my purchase decision. But the price was a critical factor in my decision to purchase the compact fluorescent light bulbs.

0. -0- Strongly disagree
1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-
10. -10- Strongly agree
98. (Don't know)
99. (Refused)

[If FR1a = 1 then ASK FR15]

FR15. The pamphlets and brochures explaining the benefits of CFLs played a significant role in my decision to purchase the compact fluorescent light bulbs.

0. -0- Strongly disagree
1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-
10. -10- Strongly agree
98. (Don't know)
99. (Refused)

CONSISTENCY CHECK

{IF (FR3A = 1 OR FR3B = 1) AND (FR12A = 0,1}, ASK INC1. INCONSISTENCY1 = 'YOU WOULD HAVE PURCHASED THE SPIRAL CFLS EVEN IF THEY WERE $1 MORE PER BULB}

{IF (FR3A = 2 OR FR3B = 2) AND FR12A = 9,10 }, ASK INC1. INCONSISTENCY1 = 'YOU WOULD **NOT** HAVE PURCHASED THE SPIRAL CFLS IF THEY WERE $1 MORE PER BULB}

INC1. Let me make sure I understand you. Earlier, you said [INCONSISTENCY1], but that differs from some of your other responses. Please tell me in your own words what influence, if any, the price of the bulb had on your decision to purchase the SPIRAL CFLs at the time you did?

77 [OPEN END]
99 (Don't know)
88 (Refused)

{IF (FR3C = 1 OR FR3D = 1) AND (FR12B = 0,1}, ASK INC2. INCONSISTENCY2 = 'YOU WOULD HAVE PURCHASED THE STANDARD APPLICATION CFLS EVEN IF THEY WERE $1.50 MORE PER BULB}

{IF (FR3C = 2 OR FR3D = 2) AND FR12B = 9,10 }, ASK INC2. INCONSISTENCY2 = 'YOU WOULD **NOT** HAVE PURCHASED THE STANDARD APPLICATION CFLS IF THEY WERE $1.50 MORE PER BULB}

INC2. Let me make sure I understand you. Earlier, you said [INCONSISTENCY2], but that differs from some of your other responses. Please tell me in your own words what influence, if any, the price of the bulb had on your decision to purchase the Standard Application CFLs at the time you did?

77 [OPEN END]
99 (Don't know)
88 (Refused)

{IF (FR3E = 1 OR FR3F = 1) AND (FR12C = 0,1}, ASK INC2. INCONSISTENCY2 = 'YOU WOULD HAVE PURCHASED THE SPECIALTY CFLS EVEN IF THEY WERE $1.50 MORE PER BULB}

{IF (FR3E = 2 OR FR3F = 2) AND FR12C = 9,10 }, ASK INC2. INCONSISTENCY2 = 'YOU WOULD **NOT** HAVE PURCHASED THE SPECIALTY CFLS IF THEY WERE $1.50 MORE PER BULB}

INC2. Let me make sure I understand you. Earlier, you said [INCONSISTENCY2], but that differs from some of your other responses. Please tell me in your own words what influence, if any, the price of the bulb had on your decision to purchase the SPECIALTY CFLs at the time you did?

77 [OPEN END]
99 (Don't know)
88 (Refused)

YR3 Install Rate Battery

[IF PY3 = 1 and State <>2 then ask YR2 Install Rate Battery – this includes all who purchased bulbs during PY3 and those who purchased them in Illinois Stores]

For the next set of questions I'd like you to think about these <*b_1yr*> CFLs that you purchased since June 2010.

P1. Prior to purchasing these < *b_1yr* > CFLs, were you … (READ LIST)
1. Very familiar
2. Somewhat familiar
3. Not too familiar or
4. Not at all familiar with CFLs
8. (Don't know)
9. (Refused)

[IF P1=4 SKIP P2]
P2. Prior to purchasing these < *b_1yr* > bulbs, approximately how many of the screw-in lighting sockets in your home contained CFLs?
1. None of the sockets
2. Less than 5% of the sockets
3. More than 5% but less than 25% of the sockets
4. More than 25% but less than 50% of the sockets
5. More than 50% but less than 75% of the sockets
6. More than 75% of the sockets, but not all of the sockets
7. All of the sockets
8 (Don't know)
9 (Refused)

G1. Of the <b_1yr> CFLs purchased since June 2010, have you installed …
1. All of these.
2. Some of these,
3. None of these inside or outside your home?
0. (Other Specify)
98. (Don't know)
99. (Refused)

[SKIP IF G1 = 1 or 3]
G2. How many of these <b_1yr> CFLs have you installed in or around your home? (Should be equal to or less than <*b_1yr*>)
00. [NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[IF G1 in 2 or 3 ASK G2a]
G2a. Where are the CFLs that you did not install in your home? (DO NOT READ) [ACCEPT UP TO 4 RESPONSES]
1. (In Storage)
2. (Gave Away)
3. (Lost)
4. (Broken)
5. (Installed in another home)
6. (Installed at work)

7. (Returned to store)
8. (Installed but later removed)
00. (Other, Specify)
98. (Don't know)
99. (Refused)

[ASK IF G2A = 1 OTHERWISE SKIP TO G3]
G2b. How many are in storage?
[NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

G2c. What are you planning to do with the CFLs you have in storage? (DO NOT READ) [ALLOW MULTIPLE RESPONSES]
1. (Waiting until an incandescent bulb burns out before replacing it)
2. (Waiting until a CFL burns out before replacing it)
3. (Waiting until a bulb (NO TYPE SPECIFIED) burns out before replacing it)
4. (Not planning to use them)
5. (Haven't decided)
00. (Other, Specify)
98. (Don't know)
99. (Refused)

[IF G2c in (1,2,3) THEN ASK QG2D]
QG2D. How many of the bulbs in storage do you expect to install within the next year …
1. All
2. Half, or
3. None of the stored bulbs
98. (Don't know)
99. (Refused)

YR3 Purchase Battery

[IF PY3 = 1 and Store is 2-11,14,20 then ask YR3 Purchase Battery – this excludes those who purchased bulbs during PY3 but only at merchants not included in ComEd's program]

[SKIP TO SO1 IF G1 NOT = 1 or 2]
G3. In what rooms in your home did you install the <QG2> CFLs you purchased in the last year? (DO NOT READ) [ACCEPT MULTIPLES] (PROBE: DID YOU INSTALL THE CFLS IN ANY OTHER ROOMS?)
1. (Bedroom)
2. (Bathroom)
3. (Family room / den)
4. (Garage)
5. (Hallway, staircase, foyer or entry)
6. (Kitchen)
7. (Living Room)
8. (Laundry room)
9. (Attic)
10. (Basement)
11. (Dining room)
12. (Office)

13. (Outside)
14. (Spare room)
15. (Closet)
00. (Other, Specify)
98. (Don't know)
99. (Refused)

[FOR QUESTION G4a-p, READ FOR EACH AREA WHERE CFLS ARE INSTALLED FROM QUESTION G3]

G4a-p. How many of the <QG2> CFLs did you install in the [LOCATION NAME]?

1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10
11. 11
12. 12 or more
98. (Don't know)
99. (Refused)

G5. In the majority of instances, what type of bulbs did the new CFL(s) replace, incandescent or CFLs? Would you say…

1. All Incandescents
2. Mostly Incandescents
3. All CFLs
4. Mostly CFLs
5. Half Incandescents and Half CFLs
6. Halogens
7. Mixture of bulbs
00. (Other, Specify)
98. (Don't know)
99. (Refused)

G8. Are all of the CFLs you installed since June 2010 still in place or have you removed some?

1. All still in place
2. Removed some
3. Removed all
8. (Don't know)
9. (Refused)

[IF G8 =2 Ask G9]

G9. How many have been removed?

1. 1
2. 2
3. 3

4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10 or more
98. (Don't know)
99. (Refused)

[IF G8 =2 or 3 Ask G10 and G12, ELSE SKIP TO FR1]

G10. Why did you remove the CFL(s)? (DO NOT READ)(ACCEPT MULTIPLE)

1. (Burned out/stopped working/broke)
2. (Did not like the color)
3. (Took too long to start up)
4. (Not bright enough)
5. (Didn't like the way it looked)
6. (Didn't fit in the fixture)
7. (Moved)
00. (Other, Specify)
98. (Don't know)
99. (Refused)

G12. What did you do with the CFL bulb(s) that were removed? (DO NOT READ) [ACCEPT MULTIPLE]

1. (Moved it to a different location)
2. (Gave it away)
3. (Threw it away)
4. (Recycled it)
5. (Saved it for future use)
6. (Returned it to the store for a refund)
00. (Other, Specify)
98. (Don't know)
99. (Refused)

Self-Report Spillover

PARTICIPANT SPILLOVER

[IF PY3 = 1 and DISCOUNT = 1 AND STORE IS 2-11,14,20 THEN ASK PARTICIPANT SPILLOVER QUESTIONS]

SO1. In the time since you purchased the (if ComEd = 1 READ: "ComEd") discounted CFLs have you purchased and installed any efficient lighting products on your own at regular retail price, without any discounts (this includes both coupons and instant rebates)?

1. Yes
2. No
8. (Don't know)

9. (Refused)

[ASK If SO1 = 1; ELSE SKIP TO P4]
SO1a. What type of efficient lighting products have you purchased?
1 Spiral CFLs
2 Reflector CFLs
3 Globe CFLs
4 Flood Light CFLs
5 A-lamps CFLs
6 Dimmable CFLs
7 3-way CFLs
8 Post CFLs
9 Candelabra CFLs
10 CFL Fixture
11 U-Shaped
0 Other (Record Verbatim)
98. (Don't know)
99. (Refused)

[ASK SO2a IF SO1a=1]
SO2a. How many Spiral CFLs did you purchase and install on your own?
[NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[ASK SO2b IF SO1a=5]
SO2b. How many Standard Application CFLs did you purchase and install on your own?
[NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[ASK SO2d IF SO1a in (2,3,4,6,7,8,9), ELSE SO2g]
SO2d. How many Specialty CFLs did you purchase and install on your own?
[NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[ASK SO2g IF SO1a =10]
SO2g. How many CFL Fixtures did you purchase and install on your own?
[NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[ASK SO3 and SO4 IF SO1 = 1]
On a scale from 0-10, with 0 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statement.

SO3. My experience with the CFLs purchased at a discounted price influenced my decision to install more efficient lighting products on my own.
0. -0- Strongly disagree

1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-
10. -10- Strongly agree
98. (Don't know)
99. (Refused)

SO4. Why did you purchase these lighting products at regular retail price and not at the discounted price? (DO NOT READ) [ACCEPT MULTIPLE]

1. (The price discounts had ended, so I purchased the same lights at regular retail price)
2. (Although there were discounted CFLs available, the additional CFLs I purchased were not discounted)
3. (The price difference wasn't great enough)
4. (I bought the lighting at a store that did not have the price discounted bulbs)
5. (The price discounted CFLs had sold out)
6. (Needed/wanted them)
7. (Energy efficient/would save money on bill)
8. (Good value)
0. (Other, Specify)
98. (Don't know)
99. (Refused)

NONPARTICIPANT SPILLOVER

[ASK IF PY3 = 1 AND (S4 = 1 or S5 = 1) AND DISCOUNT = 0 ASK NP Spillover battery; OTHERWISE SKIP TO P4]

NS1. In the time since you first heard about the (if S4 = 1 Read:"Smart Ideas" Program, if S5 = 1 Read: CFL discounts) offered by ComEd have you purchased and installed any efficient lighting products for your home at regular retail price?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[If NS1 = 1 ASK NS1a]

NS1a. What type of efficient lighting products have you purchased?

1 Spiral CFLs
2 Reflector CFLs
3 Globe CFLs
4 Flood Light CFLs s
5 A-lamp CFLs s
6 Dimmable CFLs s
7 3-way CFLs
8 Post CFLs

9 Candleabra CFLs
10 CFL Fixture
0 Other (Record Verbatim)
98. (Don't know)
99. (Refused)

[ASK NS2a IF NS1a=1]
NS2a. How many Spiral CFLs did you purchase?
[NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[ASK NS2b IF NS1a=5]
NS2b. How many Standard Application CFLs did you purchase?
[NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[ASK NS2d IF NS1a in (2,3,4,6,7,8,9)]
NS2d. How many Specialty CFLs did you purchase?
00. [NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[ASK NS2g IF NS1a =10, ELSE NS2i]
NS2g. How many CFL Fixtures did you purchase?
00. [NUMERIC OPEN END]
98. (Don't know)
99. (Refused)

[IF NS1 = 1 and S4 = 1 then Ask NS3a]
On a scale from 0-10, with 0 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statement.

NS3a. ComEd's "Smart Ideas" Program influenced my decision to install energy efficient lighting products in my home.
0. -0- Strongly disagree
1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-
10. -10- Strongly agree
98. (Don't know)
99. (Refused)

[IF NS1 = 1 and S5 = 1 then Ask NS3b]

On a scale from 0-10, with 0 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statement.

NS3b. ComEd's price discounted CFLs influenced my decision to install energy efficient lighting products in my home.

0. -0- Strongly disagree
1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-
10. -10- Strongly agree
98. (Don't know)
99. (Refused)

NS4. Why did you purchase these lighting products at regular retail price and not at the discounted rate? (DO NOT READ) [ACCEPT MULTIPLE]

1. (The price discounts had ended, so I purchased the same lights at regular retail price)
2. (Although there were discounted CFLs available, the additional CFLs I purchased were not discounted)
3. (The price difference wasn't great enough)
4. (I bought the lighting at a store that did not have the price discounted bulbs)
5. (The price discounted CFLs had sold out)
6. (Needed them)
7. (Longevity)
0. (Other, Specify)
98. (Don't know)
99. (Refused)

Process and CFL User Section

[ASK IF PY3 = 1, else skip to P2 now]

P4. On a scale of 0 to 10 where 0 means you were "not at all satisfied" and 10 means "very satisfied", how satisfied are you with the compact fluorescent light bulbs you bought since June 2010?

0. -0- Not at all satisfied
1. -1-
2. -2-
3. -3-
4. -4-
5. -5-
6. -6-
7. -7-
8. -8-
9. -9-

10. -10- Very satisfied
98. (Don't know)
99. (Refused)

[SKIP IF P4 >= 5]
P5. Why aren't you satisfied?
1. Delay when the lights turn on
2. Had to replace because it burnt out
3. Do not like light
4. Dim/not bright enough
5. Do not last long
6. Do not fit socket
00. (Other – specify)
98. (Don't know)
99. (Refused)

[If P2 = . and (Q1 = 1 or Q1aa = 1) then ASK P2_now]
P2_Now. Approximately what percentage of the screw-in lighting sockets in your home currently contain CFLs?
1. None of the sockets
2. Less than 5% of the sockets
3. More than 5% but less than 25% of the sockets
4. More than 25% but less than 50% of the sockets
5. More than 50% but less than 75% of the sockets
6. More than 75% of the sockets, but not all of the sockets
7. All of the sockets
8. (Don't know)
9. (Refused)

[IF G2b = . ASK Q3]
Q3 Are you currently storing any CFLs at your home? This could be in your closet, your pantry, your garage, or anywhere at your home.

1	Yes	
2	No	(SKIP TO SAT1)
8	(Don't know)	(SKIP TO SAT1)
9	(Refused)	(SKIP TO SAT1)

[If Q2 = 0,998,999 and Q3 <> 1 then NUSER = 1, Else NUSER = 0]

All Respondents Section

[ASK THIS SECTION OF ALL SURVEYED]

OT1. Have you purchased any incandescent light bulbs in the past year for use in your home?
1 Yes
2 No
99 (Don't know)
88 (Refused)

Purch1. When you are purchasing light bulbs, how do you decide which bulbs to buy? [DO NOT READ LIST, ACCEPT MULTIPLE RESPONSES]

1 I typically buy CFLs
2 I typically buy incandescents
3 Based on what I need (type, wattage)
4 Based on price
5 Based on what is on Sale
6 Based on availability in the store
77 RECORD VERBATIM
99 (Don't know)
88 (Refused)

[IF Q1 = 1 (CFL purchaser) then ASK Watt1a-d]

WATT1a-d. When you are deciding which CFLs to purchase have you considered…

Watt1a - The incandescent equivalent wattage printed on the CFL package?
3 Yes
4 No
99 (Don't know)
88 (Refused)

Watt1b – Have you considered The lumen output printed on the CFL package?
1 Yes
2 No
99 (Don't know)
88 (Refused)

Watt1c – Have you considered The Price of the CFL package?
1 Yes
2 No
99 (Don't know)
88 (Refused)

Watt1d – Have you considered The wattage of the CFL?
1 Yes
2 No
99 (Don't know)
88 (Refused)

Watt2 – [IF Watt1a = yes AND Watt1b = yes] Which is more important to you when you selecting which package of CFLs to purchase, the incandescent equivalent wattage printed on the package or the lumen output printed on the package?

1 The incandescent equivalent wattage printed on the package
2 The lumen output printed on the package
3 OTHER
99 (Don't know)
88 (Refused)

Watt3 – [IF (Watt1a = yes OR Watt1b = yes) AND Watt1c = Yes] Has a discounted price caused you to buy CFLs of a different wattage than you otherwise would have purchased?

1 Yes
2 No
3 OTHER
99 (Don't know)
88 (Refused)

Watt4 – [IF Watt1a = yes] In general, do you feel the incandescent equivalent wattage printed on a CFL package gives an accurate assessment of the brightness you can expect from the CFL?

1 Yes
2 No
99 (Don't know)
88 (Refused)

Watt5 – [IF Watt4 = no] Do you feel the CFLs are generally brighter or dimmer than the equivalency suggests?

1 Brighter
2 Dimmer
99 (Don't know)
88 (Refused)

Watt6 – [IF Watt5 = 1 or 2] Have you ever purchased (Watt5 = 2 "Higher"/ Watt5 = 1 "Lower") wattage CFL to account for this difference?

1 Yes
2 No
99 (Don't know)
88 (Refused)

[ASK BARRIERS1-10 IF NAWAR =0 and PY3 = 0 (respondent is aware of CFLs but has not purchased one in the last year (or possibly ever)]

Barrier1-10. Using a scale of 0 to 10 where 10 equals "very significant" and 0 equals "not significant at all," please rank how significant the following factors are in preventing you from purchasing CFLs (if prevp = 1 then read "in the past year")(Rotate)

1. (Didn't need any light bulbs in the past year)
2. (Waiting for an incandescent to burn out)
3. (CFLs are too expensive)
4. (Unsatisfied with past CFLs)
5. (Prefer to buy American made products)
6. (Don't like the way CFLs look in a fixture)
7. (Don't like the quality of light CFLs produce)
8. (Unsure of which wattage CFL to buy)
9. (CFLs are not bright enough)
10. (Don't like that CFLs contain mercury)

Barrier11. Are there any other factors that were not mentioned that have kept you from purchasing CFLs (if prevp = 1 then read "in the past year")?

1 RECORD OPEN END
99 (Don't know)

88 (Refused)

LED1. Are you familiar with LED light bulbs that can be used to replace standard light bulbs in your home?

1 Yes
2 No
99 (Don't know)
88 (Refused)

LED2. Have you ever installed an LED bulb in your home?

1 Yes
2 No
99 (Don't know)
88 (Refused)

LED3. In what type or types of fixtures have you installed LED bulbs?[Accept multiple]

1 Ceiling fixture
2 Desk Lamp
3 Other
99 (Don't know)
88 (Refused)

LAW1. Are you aware of the change in federal light bulb regulations that will be phased in starting in January of 2012?

1 Yes
2 No
99 (Don't know)
88 (Refused)

[If LAW1 = No read "The new regulations will be phased in over 3 years and will start with the requirement in January of 2012 that bulbs providing the brightness of a traditional 100-watt incandescent bulb provide that same light level using 72-watts or less, a 30% reduction in energy)"

LAW2a-d –On a scale of 0 to 10 where 0 is very unlikely and 10 is very likely, please tell me how likely you are to take the following actions in response to these new lighting regulations.

Law2a – Prior to the implementation of the new lighting standards I will purchase extra 100-watt incandscent bulbs so that I will have them on hand when my current 100-watt bulbs burn out.

Law2b – I will replace my current 100-watt incandescent bulbs with lower wattage incandescent bulbs (70 watts or less) after the standards change.

Law2c – I will replace my current 100-watt incandescent bulbs with CFLs bulbs after the standards change.

Law2d – I will purchase other types of light bulbs (LEDs, High efficiency incandescent) to replace my current 100-watt incandescent bulbs after the standards change.

LAW3. Do you believe these new regulations will make incandescent bulbs as efficient as CFLs?

1 Yes

2 No
99 (Don't know)
88 (Refused)

Demographics

READ "I have just a few questions left for statistical purposes only"

AmD1(DEM1). What type of home do you live in? Is it a …?
1. Single family detached (no common walls)
2. Single family attached, townhouse, or duplex
3. Apartment building with 2-4 units
4. Apartment building with 5 or more units
5. A mobile home or trailer
6. Condominium

00. (Other, Specify)
98. (Don't know)
99. (Refused)

D1(DEM3). Do you or members of your household own this home or do you rent?
1. Own
2. Rent
3. Occupied without payment of rent
4. Other

8. (Don't know)
9. (Refused)

[SKIP D2 IF D1=1 AND AmD1=1]
D2 (DEM9). Do you pay your own electric bill?
1. Yes
2. No

8. (Don't know)
9. (Refused)

DEM7. Counting yourself, how many people live in your household year round?
[RECORD NUMBER PEOPLE]
98 (Don't know)
99 (Refused)

DEM7b. Are any of these individuals less than 18 years of age?
1 Yes
2 No
8 (Don't know)
9 (Refused)

D5 (DEM4). Approximately how many square feet is your home?
1 Less than 1,400
2 1,400 – 1,999
3 2,000 – 2,499
4 2,500 – 3,499
5 3,500 – 3,999
6 4,000 – 4,999
7 5,000 or more
8 (Don't know)
9 (Refused)

BED1. How bedrooms are in your home?
1 1 bedroom
2 2 bedrooms
3 3 bedrooms
4 4 or more bedrooms
5 None (Studio)
98 DON'T KNOW
99 REFUSED

BATH1. How bathrooms are in your home?
1 1 bathroom
2 2 bathrooms
3 3 bathrooms
4 4 or more bathrooms
98 DON'T KNOW
99 REFUSED

D7b. What is the highest level of education that the head of household has completed so far?
1. Less than 9th grade
2. 9th to 12th grade; Non-high school graduate
3. High school graduate or equivalent (e.g., GED)
4. Attended some college, no degree (includes junior/community college)
5. Associates degree.
6. Bachelors degree
5. Graduate or Professional degree
97. (Other, Specify)
98. (Don't know)
99. (Refused)

DEM10. Is your home…

1 All electric
2 Gas and electric
3 Some other combination of energy sources
8 Don't know
9 Refused

D6A(DEM13). Which category best describes your total household income in 2010 before taxes? Please stop me when I get to the appropriate category.

1 $14,999 or less
2 $15,000 to $19,999
3 $20,000 to $29,999
4 $30,000 to $39,999
5 $40,000 to $49,999
6 $50,000 to $74,999
7 $75,000 to $99,999
8 $100,000 to $149,999
9 $150,000 or more
98 (Don't know)
99 (Refused)

END1. That is all of the questions I have for you today. Thank you very much for your time.

5.2 *Lighting Logger Study Details*

This section provides details on the data collection and analysis activities that have taken place as part of the lighting logger study conducted during the PY3 evaluation.

Sampling and Data Collection

To estimate HOU and Peak CF for ComEd's Residential ES Lighting Program the evaluation team installed Dent Lighting Loggers (hereafter referred to as "loggers") in 67 households where CFLs were currently in use. These loggers allow for the calculation of the usage of a particular CFL by recording the exact date and time each light is switched on or off. The PY2 General Population survey served in part to prescreen ComEd households for inclusion in this logger study. All surveyed customers who had purchased a discounted CFL in the past year were asked if they would be willing to participate in the lighting logger study and 32 of the 122 queried agreed. In order to meet the study requirements of 67 participating households, CFL purchasers identified through the PY2 in-store intercept surveys and PY1 General Population and coupon survey respondents were also asked to participate in the study. All customers who agreed to participate in the logger study were called back within a few weeks of the initial prescreen call to schedule a time for a technician to come to their home to complete a lighting inventory and install lighting loggers on a sample of the CFLs the customer had installed inside or outside their home. All customers who participated in the logger study received two $50 gift cards (one at the time of logger installation and one and the time of logger removal) in appreciation for their participation in the study.

A total of 527 lighting loggers were installed across the final sample of 67 homes between June and August 2010. These loggers were left in place for approximately 7.5 months and were removed from the field between January and March, 2011.

Data Quality Inspection

A total of 515 of the initially installed 527 loggers were removed from the field (10 were lost due to home foreclosure and two others were missing when the technician returned to collect them). An additional 16 of the installed loggers had either been removed by the homeowner, had fallen off the light fixture, had malfunctioned, or had a dead battery and so were excluded from the analysis dataset. Data from an additional 8 loggers was not used in the analysis as a result of the logger being placed on an incorrect bulb type (a non-CFL), or the bulb being replaced by a non-CFL bulb or burning out during the metering period (this was noticed and recorded at the time of logger removal)[88]. Data from the remaining 491 loggers was downloaded and visually inspected for signs of unrealistic patterns of on/off switching that could be the result of the logger picking up ambient light or other mechanical or measurement problems.

[88] This number is higher than in the previously sent memo since the order in which the drops occur has been changed. Previously the problematic loggers were first dropped and then any remaining logger data coming from bulbs that had burned out or been replaced with non-CFLs were dropped.

The purpose of this individual/visual inspection of each logger's data was to ensure that the loggers had been installed correctly and had functioned properly throughout the monitoring period.. In all, 132 loggers were identified as problematic and were thus dropped from the analysis dataset based on this inspection.[89] This quality inspection of the logger data yielded a final sample of 359 loggers with good data from a total of 65 homes.

HOU Analysis

The evaluation team developed the HOU calculation using all logger data sufficient for use in the analysis,[90] which yielded a final analysis sample of 346 loggers. Total on-time for a given logger on a given day was calculated by summing the intervals during which the logger was detecting light in each 24-hour period.

HOU Weighting

In order to expand the collected lighting logger data to the entire ComEd customer population, two levels of weighting were applied to each logger. The first served to weight each individual logger up to the total number of CFLs controlled by the same light switch as the loggered CFL. The second weight was applied by room type and served to align the room-type distribution of the loggered CFLs used in the HOU analysis (from 65 homes, 346 loggers, and 557 lamps loggered) to the room type distribution of the installed CFLs found during the onsite lighting inventories (142 homes, 2,148 total lamps). This second weight was calculated as the ratio of the number of CFLs installed by room type over the number of CFLs loggered[91] by room type. Table 1 below shows the distribution of the installed CFLs from the onsite inventory population, the distribution of the loggered CFLs (weighted by lamps per logger) used in the HOU analysis, and the resulting room-based HOU weights that were applied. As the table below shows, the average room-based HOU weight applied was approximately 3.86.

[89] A typical reason that a logger was thrown out was that the logger was logging natural or ambient light, rather than the intended lamp. Often this was identified by the technician when they were extracting the logger and confirmed by the visual inspection of the data.

[90] Note the requirement for each logger to have at least 16 weeks of good data was removed and replaced with a detailed review of all documents (including all installation and removal technician comments, as well as homeowners self-reported HOU estimates) pertaining to each of the 14 loggers that were previously dropped. Based on this review a keep or drop decision was made on a logger by logger basis. This resulted in keeping nine loggers and dropping five.

[91] The number of loggered CFLs in this ratio was calculated after the first weight had been applied so that it was representative of all CFLs controlled by the same light switch as the single loggered CFL.

Table 1. Hours of Use Weights by Room Type

Room Type	Distribution of CFLs Installed from Onsite Inventory (n=142)		Distribution of Loggered CFLs (wt'd) used in Analysis (n=65)		Room-based HOU Weights
Basement	225	10%	77	14%	2.92
Bathroom	304	14%	79	14%	3.85
Bedroom	371	17%	107	19%	3.47
Dining	61	3%	13	2%	4.69
Foyer	51	2%	11	2%	4.64
Garage	68	3%	10	2%	6.8
Hallway	65	3%	33	6%	1.97
Kitchen	265	12%	45	8%	5.89
Laundry/Closet	150	7%	40	7%	3.75
Living Room	322	15%	93	17%	3.46
Office/Den	94	4%	40	7%	2.35
Other	24	1%	2	0%	12
Outdoor	148	7%	7	1%	21.14
Total	**2,148**	**100%**	**557**	**100%**	**3.86**

As the table above shows, the loggered CFLs in outdoor spaces were assigned unusually high weights. An in-depth review of the outdoor logger and inventory data found these high weights were assigned due to the limited usable outdoor lighting logger data (outdoor CFLs comprised 7% of the CFLs installed in a home but only 1% of the usable logger data). This limited data resulted from the fact that fewer loggers were installed on CFLs in outdoor spaces due to issues accessing the bulbs and difficulty getting quality data as a result of ambient light issues which are prevalent in outdoors locations. Across all room types, loggers were installed on approximately 42% of the CFL fixture groups found in a home compared to outdoor fixture groups where only 21% were loggered. And across all of the loggers installed, 65% of the data was deemed "good" and thus included in the analysis; whereas only 19% of the logger data from outdoor spaces was usable (4 of 21 loggers installed). As a result, the evaluation team recommends discarding the outdoor logger data from the HOU analysis and adjusting for that fact in the analysis, as described below.

Annualization

Because the logger data used in the analysis was collected over a portion of the year (roughly 7 1/2 months) it was necessary to annualize the logger data in order to generate an average HOU estimate representative of the entire year. Because the days when loggers were installed were more heavily weighted toward winter days when the shorter daylight hours typically lead to longer average HOU, it was anticipated that the annualization process would yield an average annual HOU lower than that of the raw logger data. To annualize the data a LengthOfDay variable was created for each day that was

included in the analysis dataset. This variable was created using a sinusoid curve and took a value between -1 (on the winter solstice) and 1 (on the summer solstice) and was equal to 0 on the spring equinox and fall equinox. The formula used in SAS to derive this variable was as follows:

LengthOfDay = sin(3.14159*('21sep2010'd - date)/182.5)

where ('21sep2010'd - date) is the number of days between the current date and the fall equinox.

A regression was then run in SAS for each of the loggers in the analysis dataset that generated a modeled sinusoid estimate of daily HOU across the entire year. The estimated annual hours of use for each logger could then be aggregated to generate an overall average HOU estimate across all loggers, by household, or by specific room type. In the previous version of the memo on input parameter values, we dropped all loggers having less than 113 days of data that could be included in the regression. Each of the 14 loggers dropped for this reason were individually re-inspected and a keep/drop decision was made for each based the logger data, comments from the technician removing the logger, and the homeowner's self-report of how many hours per day they estimated the CFL was in use. Based on this re-inspection the decision was made to keep 9 of these 14 loggers. However, due to the shorter time frame of available data, the evaluation team decided to use the raw observed HOU from these 9 loggers in the calculation of an overall average HOU value, as opposed to the modeled, annualized HOU used for the loggers with 113 or more days of collected data. The average difference between the observed HOU and the modeled HOU for these 9 loggers was 0.03 hours/day.

Interior HOU Results

The weights described above were applied to the individual logger HOU estimates to derive the average interior HOU estimate of 2.57 hours +/- 0.34 (13%). Table 2 below provides the HOU estimates by room type, the 90% (two-tailed) confidence intervals for each of these estimates, and the number of loggers each estimate is based on for each of the interior room types. As this table shows, the HOU estimates vary significantly by room type, from a low of 1.54 HOU/day in laundry/closet areas to a high of 7.16 HOU/day in foyers. It should be noted that some of these results (such as those for foyers, dining rooms and garages) are based on relatively small sample sizes and thus have high levels of uncertainty at the room type level. As one might expect, the CFLs found in the common living spaces have HOU estimates right around the mean (such as living rooms and dining rooms), while CFLs in kitchens typically have higher than average use and those in bedrooms and bathrooms have lower than average use.

Table 2: Average Daily Hours of Use by Room Type

Room Type	n	Average HOU	Lower 90% CL[92]	Upper 90% CL
Basement	41	2.24	1.5	2.98
Bathroom	34	1.70	1.03	2.36
Bedroom	74	1.69	1.12	2.25
Dining	7	2.94	0	6.66
Foyer	7	7.16	0.8	13.52
Garage	8	2.94	0	7.67
Hallway	21	4.39	2.23	6.54
Kitchen	18	4.09	2.7	5.49
Laundry/Closet	32	1.54	0.54	2.55
Living Room	69	2.61	1.96	3.26
Office/Den	29	2.59	1.01	4.16
Other	2	2.82	1.38	4.26
Mean HOU	**342**	**2.57**	**2.23**	**2.91**

Interior HOU Results by Month

Table 3 below shows the average daily HOU by month that resulted from the regression models and the percentage of the maximum monthly HOU each of these values represented. As this table shows, the longest regression based daily HOU estimate for the year was found in December (2.95 hours) and the shortest was found in June (2.22 hours and 75% of the December daily HOU estimate).

[92] Lower Confidence Limits were set equal to a minimum of 0.

Table 3: Average Daily Hours of Use by Month

Month	Regression HOU Estimate	% of Max HOU
June	2.22	75%
July	2.25	76%
August	2.37	80%
September	2.55	86%
October	2.74	93%
November	2.89	98%
December	2.95	100%
January	2.92	99%
February	2.8	95%
March	2.63	89%
April	2.44	82%
May	2.29	77%

Exterior and Overall HOU Results

As mentioned above, due to the very limited amount of outdoor loggered CFL data available (4 loggers) and the relatively large proportion of the CFLs installed outside the home (they represent 7% of total bulbs), the evaluation team recommends estimating HOU for exterior CFLs using secondary research rather than logger data collected as part of this study.[93] Table 4 below provides a listing of the studies found that included separate HOU estimates for exterior CFLs. This table also shows the percent of CFLs that were installed in exterior locations for each of these studies and the resulting overall, interior and exterior HOU estimates. Using this data, two ratios were calculated; the ratio of the overall HOU to the interior HOU and the ratio of the exterior HOU to the overall HOU. The average overall/interior ratio was 107%, and the average exterior/overall ratio was 180%. The distribution of CFLs installed in interior versus exterior locations was estimated for each study based on the interior, exterior and overall HOU results. As this table shows, the average percentage installed in outdoor locations across these four studies was found to be 7%, which matches the percentage installed in outdoor locations in ComEd's service territory. Applying these ratios to the ComEd Interior HOU estimate resulted in an exterior HOU estimate of 5.00 hours and an overall HOU estimate of 2.74 hours.

[93] The data from the four usable outdoor loggers had HOU estimates of 0, 3, 15, and 24 hours resulting in a weighted HOU estimate of 10.4 hours +/- 11.8 hours (133%).

Table 4: Exterior and Overall HOU Estimation

Study (Yr)	% Exterior[94]	Overall HOU Estimate	Interior HOU Estimate	Ratio of Overall/ Interior	Exterior HOU Estimate	Ratio of Exterior/Overall
Efficiency Maine ('05-'06)	7%	3.2	3.2	107%	5.5	172%
CA Metering Study ('06-'08)	10%	1.9	1.7	112%	3.8	200%
CA Metering Study ('05)	4%	2.3	2.3	103%	3.1	132%
EmPower Maryland ('10)	5%	2.9	2.7[95]	106%	6.2	217%
Average	**7%**			**107%**		**180%**
ComEd HOU Ratio Estimate		**2.74**	**2.57**	**107%**	**5.00**	**182%**

Snapback

A literature review was conducted to determine whether previous lighting evaluations had considered snapback resulting from the installation of CFLs,[96] and if so, what methods had been used to measure it. A few older studies (mostly pre-2002) were found that attempted to assess the level of snapback resulting from CFL installations. Each of these studies used customer self-reports of pre/post CFL-installation behavioral changes from telephone surveys, as opposed to physical measurements, to gauge the level of snapback. The results from each of these studies found evidence of a low to moderate level of snapback, however all but one of these went on to state that the data was not reliable enough to alter the resulting ex-post impact estimates.[97] Based on this review, we do not believe there is adequate data in the secondary literature around which to base a credible snapback estimate.

Peak CF Analysis

In order to estimate the Peak CF based on the lighting logger data, the evaluation team calculated the percentage of time a given logger was turned on during the peak time period. The results presented here are for the ComEd peak, defined as weekdays from 1 p.m. to 5 p.m.[98] Logger data from the period between June 24th and August 31st was used to estimate the Peak CF, and all loggers having at least 11

[94] Estimated based on Interior, Exterior, and Overall Results.
[95] Estimated based on distribution of interior and exterior bulbs. Report did not provide interior HOU estimate.
[96] Snapback refers to an increase in usage of energy efficient devices due to the lower cost associated with operating them.
[97] Studies reviewed that included an investigation into snapback included: 2002 evaluation of Cape Light's CFL program (ODC), 1999 evaluation of IFC/GEF Poland CFL program (Navigant), 1994/1995 Exeter and Hampton Electric evaluation (WECC conference paper), 1993 EPEC paper (Steven Nadel), 2007 Efficiency Maine Lighting Program (NMR). The Poland evaluation was the only that included snapback in their estimation of program impacts.
[98] This is also the PJM bidding "peak" (2 p.m. to 6 p.m. Eastern Standard Time).

days worth of data during this period were included in the analysis dataset (325 loggers, 536 lamps loggered).

Peak CF Weighting

Weights for the Peak CF analysis were developed in the same manner as for the HOU analysis. The HOU and Peak CF weights differ slightly due to the different population of loggers used in the two analyses. Table 5 below shows the distribution of the installed CFLs from the onsite inventory population, the distribution of the loggered CFLs (weighted) used in the Peak CF analysis, and the resulting room-based Peak CF weights that were applied. As the table below shows, the average room-based weight applied was approximately 4.01.

Table 5. Peak Coincidence Factor Weights By Room Type

Room Type	Distribution of CFLs Installed from Onsite Inventory (n=142)		Distribution of Loggered CFLs Installed used in Analysis (n=65)		Room-based Peak CF Weights
Basement	225	10%	85	16%	2.65
Bathroom	304	14%	76	14%	4.00
Bedroom	371	17%	102	19%	3.64
Dining	61	3%	12	2%	5.08
Foyer	51	2%	11	2%	4.64
Garage	68	3%	10	2%	6.8
Hallway	65	3%	28	5%	2.32
Kitchen	265	12%	43	8%	6.16
Laundry/Closet	150	7%	39	7%	3.85
Living Room	322	15%	83	15%	3.88
Office/Den	94	4%	38	7%	2.47
Other	24	1%	2	0%	12.00
Outdoor	148	7%	7	1%	21.14
Total	**2,148**	**100%**	**536**	**100%**	**4.01**

Similar to the HOU weights, the CF weights for outdoor spaces were unusually high, and thus the evaluation team recommends discarding the outdoor logger data from the Peak CF analysis and adjusting for that fact in the analysis, as described below.

Interior Peak CF Results

The weights described above were applied to the individual Peak CF estimates to come up with the average interior Peak CF estimate of 0.095 +/- 0.017(18%). Table 6 below provides the Peak CF estimates, the 90% confidence intervals for each of these estimates, and the number of loggers each estimate is based

on across all interior room types. As this table shows, the Peak CF estimates vary significantly by room type from a low of 0.043 in the bedroom to a high of 0.237 in foyers. Again it should be noted that some of these results (such as those for foyers, dining rooms and garages) are based on relatively small sample sizes and thus have high levels of uncertainty at the room type level.

Table 6: Peak Coincidence Factor Results by Room Type

Room Type	n	Average Peak CF	Lower 90% CL[99]	Upper 90% CL
Basement	41	0.128	0.068	0.189
Bathroom	31	0.072	0.032	0.111
Bedroom	69	0.043	0.026	0.059
Dining	6	0.134	0.010	0.258
Foyer	7	0.237	0	0.517
Garage	8	0.099	0	0.275
Hallway	19	0.095	0.047	0.143
Kitchen	17	0.149	0.055	0.243
Laundry/Closet	31	0.066	0.020	0.113
Living Room	62	0.094	0.053	0.136
Office/Den	28	0.105	0.032	0.178
Other	2	0.062	0	0.393
Mean CF	**321**	**0.095**	**0.079**	**0.112**

Exterior and Overall Peak CF Results

As mentioned above, due to the very limited amount of outdoor loggered CFL data available (4 loggers) and the relatively large proportion of the CFLs installed inside or outside a home (they represent 7%), the evaluation team recommends estimating Peak CF using the ratio estimation method employed within the

[99] Lower Confidence Limits were set equal to a minimum of 0.

HOU analysis for exterior CFLs rather than the data collected for this study.[100] This method resulted in an exterior Peak CF estimate of 0.184 and an overall Peak CF estimate of 0.102.

Ex-Ante versus Ex-Post Results

Table 7 below presents the Ex-Ante versus Ex-Post results based on the PY3 ComEd loggering study. As this table shows the Ex-Post result for HOU was 17% higher than the Ex-Ante estimate, and the 90% confidence interval on the Ex-Post estimate falls outside the Ex-Ante estimate. The Ex-Post result for Peak CF was 25% higher than the Ex-Ante estimate, and again the 90% confidence interval on this Ex-Post estimate falls outside the Ex-Ante estimate.

Table 7: Hours of Use and Coincidence Factor Ex-Ante versus Ex-Post Results

Estimate	Ex-Ante	Ex-Post	Lower 90% CL	Upper 90% CL	% Increase in Ex-Post
HOU	2.34	2.74	2.41	3.07	17%
Peak CF[101]	0.081	0.102	0.085	0.118	25%

[100] The data from the four usable outdoor loggers had Peak CF estimates of 0, 0.01, 0.99, and 1 resulting in a weighted Peak CF estimate of 0.570 +/- 0.663 (116%) which includes both 0 and 1 (the minimum and maximum Peak CF estimates).

[101] The precision associated with the one-tailed 90% CL on the Peak CF estimate is 12.5%.

5.3 *Interactive Effects Modeling Details Memo*

Compact Fluorescent Lamps (CFLs) use less energy than incandescent lamps to produce the same amount of useful light. As a result, CFLs produce less waste heat than incandescent lamps. During the cooling season, this reduction in heat produced by replacing incandescent bulbs with CFLs can provide the additional benefit of reducing cooling loads. Conversely, during the heating season, the reduced heat can result in net increases in heating requirements. These cooling benefits and heating penalties associated with the lighting retrofits are referred to as "interactive effects".

This memorandum presents the proposed model specification and model parameters used to estimate the cooling benefits resulting from the installation of efficient lighting sold through ComEd's Residential ES Lighting Program. To estimate these cooling benefits the evaluators have attempted to design a "typical" house that will emulate an average house within ComEd service territory. This memo provides ComEd an opportunity to review the proposed parameters estimates that will be used within the model) to define the "typical" house. These model parameters were derived from a number of data sources (detailed in the memo below) that the evaluation team believes most accurately represent ComEd's residential customer base, however, if ComEd believes any of these parameter estimates are sub-optimal and knows of alternative data sources that more accurately represent ComEd customers, the evaluation team is open to reviewing these additional data sources.

5.3.1 Introduction

The analysis presented here considers the interaction between the lighting and cooling loads in a "typical" house due to the installation of efficient lighting. A November 1993 ASHRAE article titled *Calculating Lighting and HVAC Interactions* presented an approach for estimating interactive effects from CFL lighting. The method provides equations for "determining the effects of energy efficient lighting designs on HVAC energy and installation costs"[102] for commercial buildings. This evaluation approaches the same issue of interactions between efficient lighting and cooling systems but within a residential building using eQUEST, a whole building energy modeling program.

The intent of this analysis is to determine the interactive factors (energy and demand) applicable to homes in the ComEd service territory based on a variety of model parameters derived from several data sources. To estimate these interactive factors, it is necessary to estimate the cooling energy and demand savings resulting from a hypothetical lighting retrofit, as well as the energy and demand savings resulting from the lighting retrofit itself. The interactive factors are then calculated as the ratio of the cooling savings divided by the lighting savings.

5.3.2 Methodology

A "typical" house model was designed in eQUEST (Quick Energy Simulation Tool), which is a whole building energy simulation program that provides a graphical user interface for the DOE2.2 simulation engine to estimate the overall building performance parameters. The tool can calculate hourly, monthly

[102] Calculating lighting and HVAC Interactions, Rundquist, Robert A.; Johnson K.F.; Aumann, Donald J.; ASHRAE Journal November 1993. P. 28-37.

and annual energy usage values for each end-use being modeled or evaluated, while considering the interactions between the end-uses and the changing seasonal climatic parameters using weather data for the modeled geographical location.

In order to determine lighting interactive effect factors for reduced cooling loads the "typical" home (a single family detached (SFD), three bedroom, two bath home[103]) was modeled using eQUEST[104]. Additional demographic and home design parameters for this "typical" house were estimated from the 2009 ComEd Residential Appliance Saturation Survey (RASS)[105]. If the design and demographic data were not found in the RASS, the eQUEST model default values (based on the prevailing 2009 International Energy Conservation Code (IECC 2009)) or the ASHRAE 90.1 stipulated minimum standards for Chicago, IL (the location of the "typical" house) were used. The codes and standards used for this analysis apply to new buildings and additions to/alterations of existing buildings. Climate zone 5B (Cool, Humid), for Chicago - Illinois, was used to represent the typical weather for this model.

Parameters concerning the average square footage of a SFD home, information on construction materials, HVAC system type, efficiency and sizing, and thermostat setpoints all were taken from the RASS. Estimates of *Delta Watts* (difference in connected wattages of the baseline and program incented efficient lamps) and the average interior residential hours of usage (HOU) values were taken from the PY3 Residential ES Lighting Program Impact Evaluation[106]. The pertinent values used for this simulation are described in detail in the Model *Parameters and Data Sources* section.

Once the "typical" home has been modeled, the interactive effects can be modeled by first running a simulation using the baseline lighting conditions and then rerunning the simulation with the efficient lighting condition and holding all other parameters fixed. These simulations produce estimates of the total annual whole building energy usage, as well as estimates of the individual annual lighting and cooling demand (kW) and energy (kWh), for both the baseline and efficient lighting conditions.

The difference between the cooling energy consumption for the baseline and efficient lighting conditions, as a ratio of the difference in the lighting energy consumption for the baseline and efficient conditions, yields an energy interactive factor; a similar ratio for baseline and efficient case cooling and lighting demand savings will be calculated to establish a demand interactive factor.

The interactive effects obtained from the simulated models will be for an 8,760 hours per year of building operation; the factors will be normalized to the average interior HOU value (2.57 hours per day) from the

[103] This generic or 'typical' home

[104] This "typical" home type was selected based on the results of the PY3 General Population survey conducted as part of the Residential Lighting Program evaluation. A total 746 randomly selected ComEd Residential customers were included in this survey and 57% reported living in a SFD home. On average these customers reported their homes had 3 bedrooms and 2 baths.

[105] 2009 Commonwealth Edison Residential Appliance Saturation Survey RASS, Final Residential Audit Data/ Data Dictionary

[106] Preliminary ComEd Res Lighting Impact Findings 2011-08-15; August, 2011

PY3 findings. The model also will be simulated for high and low A/C system efficiency values from the RASS.

The model is simplified to focus on the interaction and the effects of interest – the reduction in lighting waste heat vs. the reduced cooling energy. This isolated approach did not consider any other loads (large and small appliance loads, plug loads, water heating loads, etc,) in the house. While these other loads would impact the overall cooling load, they are presumed to be constant for both the baseline and the efficient cases.

It may be noted that heating "penalties" exist, due to reduced heating loads resulting from the replacement of existing lighting, which increases the furnace heating demand. However, these effects were considered minor and are not estimated as a part of this analysis.

5.3.3 Model Parameters and Data Sources

As mentioned above, the evaluation team designed a "typical" house to try to emulate building construction and physical parameters found within ComEd service territory. This "typical" house is described in the model in terms of a number of factors including the square footage of the home, the number of stories, the construction materials, the insulating properties within the roof, walls, floors, windows and doors, and the HVAC system. It also requires the number of light fixtures on a per room basis and information on seasonal weather patterns. The house modeled does not represent any specific building but an average house within ComEd service territory. As noted earlier, IECC 2009 and ASHRAE Standard 90.1 default values for new construction or recently remodeled homes were used in the absence of RASS data for the eQUEST model. Once the "typical" home design was completed, the home characteristics remain fixed between the simulations and the single variable changed between the baseline and efficient condition simulations is the lighting power density (LPD – watts per square foot).

The values used in the *eQUEST* model are described below.

eQUEST Input Data

The following lists the input data used in the eQUEST model and their sources:

- Building Type: Custom – Selected to allow modeling for residential type buildings
- Geographical location: All eQUEST Locations [*evaluator selected Chicago, Illinois*]
- Jurisdiction (baseline building codes): ASHRAE 90.1 [*evaluator selected*]
- Climate Zone: 5B - The model design input values selected parameters defined in 2009 IECC for the 5B climate zone[107] wherever applicable. [*evaluator selected*]
- Area (square feet): 1,927 sq.ft. [*2009 RASS –SFD average area, finished sub-grade floor*]
- Number of floors: 2 above grade, 1 below grade (finished space & garage) [*2009 RASS*]

[107] http://reca-codes.org/pages/iecc2009.html

- Analysis year: 2010 [*recent weather data – eQUEST*]
- Usage details: Hourly end use profile [*evaluator selected for 8760 usage analysis*]
- Roof: Standard wood frame, dark brown composition shingles, R-38 batt insulation no radiant barrier; ceiling insulation R-38 batt [*RASS / eQUEST default*]
- Walls: Standard wood frame, 16' (on-center), 1" polyurethane foam, exterior dark brown plywood, R-13 batt insulation [*RASS / eQUEST default*]
- Ground floor: Over garage, 1" underlayment, R-30 batt insulation, rubber padded carpet [*RASS / eQUEST default*]
- Below grade walls: 6" concrete, R-10 rigid board insulation [*RASS / eQUEST default*]
- Building tightness (air infiltration) exterior wall area: 0.038 CFM/sq foot [*IECC 2009 / ASHRAE 90.1*]
- Building tightness (air infiltration) interior core floor area: 0.001 CFM/sq foot [*IECC 2009 / ASHRAE 90.1*]
- All finished ceilings & walls: Drywall [*evaluator selected*]
- Exterior Doors: Wood, solid core, flush (1-north, 1-south, 1glass sliding door, aluminum frame, east side) [*eQUEST default*]
- Windows: 3 foot by 5 foot aluminum frame windows, 40 % per side, per floor [*eQUEST calculated value based on selected building type*]
- Season definitions: Typical throughout the year, no holidays Winter: Dec. 21 –Mar. 20, Spring shoulder: Mar.21-Jun.20, Summer: Jun.21-Sep. 20, Fall shoulder Sep. 21-Dec.20 [*evaluator selected*]
- Building operation schedule: 24 hour use - for low usage and high usage simulations[*evaluator selected*]
- Interior lighting loads/profiles: Calculated lighting power density (LPD) in watts/sq.ft.; LPD = {(number of lamps per room type x watts per lamp) / area of the room type}; [*based on* average *number of lamps per room type from 2009 ComEd RASS, evaluator assigned room square footage, and the average baseline and efficient lamp wattages from the PY3 findings*]
- HVAC system definitions: Packaged Single Zone Ducted DX with Furnace;10 EER Central A/C; Central forced air gas furnace 0.806 AFUE; Ducted system [*Highest frequency from 2009 ComEd RASS for single family detached dwelling*];

- Thermostat setpoints: Occupied– Cooling Temp 72.7°, Unoccupied Cooling Temp 73°; Occupied – Heating Temp 68.9°, Unoccupied Heating Temp 66.2 [*2009 ComEd RASS average of single family detached set point data*]

Once the interactive effects have been calculated they will be adjusted to account for residences without central A/C units (estimated to be approximately 11% of SFD homes based on the homes sample as part of the 2009 ComEd RASS). Currently no data is available that would allow us to also adjust for homes with low or no AC usage.

The evaluation team recognizes that the approach presented here could be further expanded for future program years if desired by ComEd. These refinements could include things such as the development of a model that would simulate energy use based on more rigorously defined occupancy, lighting, and HVAC cooling schedules or different housing configurations (single family attached or multi-family).