Uniform Methods for Upstream Lighting Program Evaluation

Scott Dimetrosky & Katie Parkinson, Apex Analytics, Boulder, CO

ABSTRACT

The Uniform Methods Project (UMP) is a Department of Energy (DOE) initiative to develop common protocols for energy efficiency program evaluation. The protocols include the most common residential and commercial energy efficiency measures found in utility-sponsored energy efficiency programs in the United States. This paper will present the results of final evaluation protocols for residential lighting.

Residential lighting continues to represent a large percentage of savings from utility portfolios around the country. While the savings may decrease due to new standards as part of the 2007 Energy Independence and Security Act, lighting is expected to continue to play an important role in utility energy savings as LEDs decrease in price and increase in availability. Using consistent evaluation approaches – as those recommended by the UMP and presented in this paper – will provide for more consistency and transparency in how energy savings are determined.

The evaluation protocols were rigorously reviewed by energy efficiency program administrators, stakeholders, and the leading EM&V lighting experts from around the country. The result is a peer-reviewed, best-practices approach for how to conduct residential lighting evaluations. The paper will present the recommended methods for a number of key parameters, including hours of use (including metering protocols), delta watts, and in-service rates. The paper discusses key areas of uncertainty, and includes recommendations for both small and large utilities to effectively evaluate their residential lighting programs.

Introduction

The Uniform Methods Project (UMP) is a Department of Energy (DOE) initiative to develop common protocols for energy efficiency program evaluation. The protocols include the most common residential and commercial energy efficiency measures found in utility-sponsored energy efficiency programs in the United States. The UMP brought together leading industry experts including representatives from

- Energy efficiency program administrators
- Regulators from public service commissions
- Investor-owned, public, and cooperative electric and gas utilities
- Electric utility associations
- Evaluators
- Federal and state agencies involved in energy efficiency programs
- Energy efficiency advocates, and
- Regional energy efficiency organizations.

The result is a peer-reviewed, best-practices approach for how to conduct evaluations for commercial lighting & lighting controls, commercial unitary air conditioning, residential boilers and furnaces, residential lighting, residential refrigerator recycling, and residential whole house retrofits.

This paper presents an overview of the residential lighting UMP, focusing on parameters with the highest uncertainty. These protocols are meant to be applied for the evaluation of compact fluorescent lamps (CFLs) or light-emitting diode (LED) bulbs delivered through upstream buydowns/markdowns, direct installations, giveaways, and instant or mail-in coupons.

Savings Calculations

Gross energy first-year savings from residential lighting measures can be calculated through a number of different algorithms. The approach recommended is based on the following general algorithm:

$$kWh_{saved} = NUMMEAS \times \left(\frac{\Delta W}{1{,}000}\right) \times HRS \times ISR \times INTEF$$

Where:

kWh_{saved}	=first-year electricity savings measured in kilowatt-hours
NUMMEAS	=number of measures sold or distributed through the program
ΔW	=delta watts = baseline wattage minus efficient lighting product wattage
HRS	=annual operating hours
ISR	=in-service rate
INTEF	=cooling and heating interactive effects

The recommended techniques for estimating each of these parameters, based on either primary or secondary data, are described in the following sections.

Number of Measures Sold or Distributed

The number of measures sold or distributed through a program should be collected by the administrator or a third-party implementation contractor. Data should be compiled in electronic format in a database that tracks as much detail as possible[1] regarding the measures delivered.

At a minimum, the evaluation should include a basic verification of savings, whereby the evaluator (1) sums up the detailed transactions and (2) attempts to replicate the calculation of total claimed savings for the specific time period in which the savings were claimed, such as a program year or cycle.

Discrepancies between claimed and verified number of measures should be treated as adjustments to the number of program measures. In other words, if the *total* number of measures distributed does not match the number of measures claimed by a program administrator, the number of measures assumed sold or distributed should be adjusted accordingly. (That is, if the number of measures claimed by a program administrator does not match what is in the detailed tracking data, the tracking data should be regarded as correct.)

Delta Watts

Delta watts represent the difference between the wattage of the efficient lighting measure and the wattage of the assumed baseline measure. The wattage of the efficient measure should be available from the program tracking database. Where possible—such as with direct installation programs—the program implementation contractor should record the wattage of the particular lamp that the program measure is replacing.

[1] Useful data include installation location, wattage of installed CFL, bulb shape, base type, and any specialty features, such as dimmable or three-way capabilities.

Approaches for Estimating Baseline Wattage

The Residential Lighting Evaluation Protocol recommends using a lumen equivalency approach to estimate delta watts for conditions where the baseline wattage cannot be collected by the program implementation contractor at the time of measure installation. The lumen equivalency approach determines the baseline wattage from the lumen output. This approach is recommended because (1) it provides consistency with the EISA requirements and (2) most manufacturers' rated baseline wattage is already based on similar lumen categories.

Alternatively, for studies that have sufficient budget to screen for a statistical sample of recent CFL purchasers, the self-report approach[2] may be used to estimate delta watts (as well as other purchase attributes, including location and price). The Residential Lighting Evaluation Protocol recommends, however, that the self-report approach apply these time limits:

- A maximum of a six-month "window" (and preferably a three-month "window") for standard spiral CFLs;
- Up to a year for specialty CFLs and LEDs, as these have far lower incidence but represent larger purchase decisions.

Table 1 provides the assumed baseline wattage based on lumen range and incorporates the timing of EISA requirements as the new baseline standards.

Table 1. Estimated Baseline Wattage for Lumen Equivalencies

Lumen Range	2011 Baseline	2012 Baseline	2013 Baseline	2014 Baseline
1490—2600	100-W	72-W	72-W	72-W
1050—1489	75-W	75-W	53-W	53-W
750—1049	60-W	60-W	60-W	43-W
310—749	40-W	40-W	40-W	29-W

Note: Shading represents initial year of EISA phase-in requirements

While there may be "sell through[3]" of existing product during the phase-in years, the Residential Lighting Evaluation Protocol recommends using the new baseline values for the entire year in which they take effect *unless* research shows significant "sell through" periods. However, since the UMP was developed evidence has become available that demonstrates significant "sell through" periods, and a number of Technical Reference Manuals, including Illinois and Arkansas, recommend using the EISA standard for all affected bulbs sold after June 1st of the appropriate phase-in year.

Baseline wattage should be calculated for each lamp in the tracking database. The total estimated delta watts, therefore, is calibrated to the actual type and number of measures sold or distributed through the program.

There are two additional points of clarification for this approach:

- For lumens above or below these ranges, the marketed baseline wattage reported on the product should be used. In other words, lumens above the ranges in Table 1 might qualify for a 150-W baseline.
- EISA has a number of exceptions, including three-way bulbs, candelabras, and reflectors.[4] In these cases, the baseline wattage should continue to be the 2011 standard incandescent wattage based on the lumen equivalence.

2 Note the self-report approach does offer the advantage of capturing consumer "bin-shifting." A literature review did not reveal any studies that assess the magnitude of bin shifting, although forthcoming studies conducted by Navigant Consulting and the NMR Group found some evidence that customers purchased a higher -wattage bulb than the recommended replacement.

3 Sell Through is the period of time retailers take to sell through their current stock of bulbs

4 Note, however, that certain ER and BPAR reflector lamps have separate EISA requirements that took effect in July 2012,

Replacements of Efficient Lighting Products with Newer Efficient Lighting Products

The Residential Lighting Evaluation Protocol methodology assumes that at the time of measure failure, the consumer has the choice of installing an energy-efficient lighting product or a standard-efficiency lighting product, regardless of what was previously installed. In areas with long history of CFL promotion—and as market penetration increases for CFLs or other high-efficiency lighting products—there is a higher probability that some fraction of the energy-efficient lighting products distributed through programs are being used to replace installed CFLs that fail.

There are two approaches available to address this issue.

- The first is to assume the baseline is the federal standard (for example, EISA), even if the consumer had previously installed a CFL or LED. In this approach the CFL-to-CFL replacement scenario is assumed to be handled under investigation of program attribution, where it is more likely that consumers replacing CFLs with other CFLs may be freeriders (Nexus Market Research, Inc. et al. 2009).[5]
- The second is to revise the baseline wattage assumptions to reflect the share of in-kind replacement of CFLs. This approach requires the collection of data on the proportion of high-efficiency lamps distributed through the program that are replacing existing CFLs.

To avoid underestimating program savings, the Residential Lighting Evaluation Protocol recommends that only one, rather than both, of these adjustments be applied. For jurisdictions that do not include any application of a net-to-gross adjustment, this would require using the second approach—conducting a market characterization study to determine the baseline and the percentage of high-efficiency lighting products that are replacing CFLs.

Finally, as more efficiency programs promote LEDs in the future, further research will be required to investigate the likelihood that energy efficiency minded consumers are replacing CFLs with LEDs.

Uncertainty Regarding the Baseline and the Need for Ongoing Research

The recommended protocol acknowledges uncertainties around the residential lighting market in the next few years. These uncertainties deal with the types and prices of future lighting products that will be available on the market. Another source of uncertainties regards consumer reactions to the requirements and new products—for example, potential product hoarding, "bin jumping" to different incandescent wattage levels, and how quickly retailers sell through the existing product inventories.

The uncertainty around EISA was further heightened in December 2011 with the passage of the fiscal year (FY) 2012 omnibus spending bill, which included a rider that halted funding for the U.S. Department of Energy to enforce the new standards. The National Electrical Manufacturers Association (NEMA), representing more than 95% of the U.S. lighting manufacturing industry, issued a press release after the passage of the bill stating that they did not support it. NEMA also points out that (1) American manufacturers have invested millions of dollars in transitioning to energy-efficient lighting and (2) EISA gave state attorneys general the authority to enforce the standards.

Thus, in cases where actual pre-program measure wattage is not available, the Residential Lighting Evaluation Protocol recommends that the EISA standards continue to be adopted as the new baseline. However, program administrators having adequate resources should conduct ongoing monitoring and research to determine whether the delta watts assumptions reflect actual market

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and should be used as the baseline for any program equivalent lamps.

5 The New England *Residential Lighting Markdown Impact Evaluation*, January 20, 2009 found that 43% of respondents (24 out of 56) stated that the CFLs recently purchased and not installed were intended for use to replace incandescent lighting. That is, 57% of the respondents intended to use the stored CFLs to replace existing CFLs when they failed. While this was used to discount the delta watts, if those respondents who are already intending to replace CFLs with CFLs are presumably counted as freeriders, then program attribution should already incorporate any necessary adjustments.

conditions during the phase-in of the EISA requirements, and use a lagged approach to phasing in the requirements. In particular, research in California—where the standards take effect one year in advance of the rest of the United States—may be informative for determining retailer and manufacturer reactions to EISA.

Annual Operating Hours

Hours of use (HOU) represents the estimated hours per year that the energy-efficient lighting product will be used. Recent studies have shown a wide range of estimated HOU for CFLs, from a low of 1.5 to a high of 3.0 hours per day (or 548 to 1,088 hours per year). A myriad of factors affect differences in the expected HOU for energy-efficient lighting products, including differences in demographics, housing types and vintages, CFL saturation, room type, electricity pricing, and even annual days of sunshine. As a result, extrapolation of data from one region has not proven successful in accounting for these influencing factors (Navigant Consulting and Cadmus Group, Inc. 2011).[6]

Based on these disparate results, this protocol recommends that program administrators collect primary data through a metering study for residential lighting measures.

Metered Data Collection Method

Metering should be based on the following factors and associated guidelines, which are described in this section:

- Logger type
- Length of metering period
- Information collected on site
- Data integrity

Logger Type

Change-of-state loggers are preferred over periodic readings because they can capture short intervals and switch rates (the number of times lights are turned on and off). In addition, current-sensing meters (rather than light-sensing meters) are one approach for outdoor conditions in which ambient light can potentially inflate the estimated hours of use from light-sensing meters.

Length of Metering Period

Due to the seasonality of lighting usage, logging should (1) be conducted in total for at least six months and (2) capture summer, winter, and at least one shoulder season—fall or spring. At a minimum, loggers should be left in each home for at least three months (that is, two waves of three-month metering will attain six months of data). All data should be annualized using techniques such as sinusoidal modeling to reflect a full year of usage.[7]

Information Collected On Site

In-home lighting audits should be conducted for all homes participating in the metering study. The audits should record the number and type of high-efficiency lighting products by fixture and room type. It is highly recommended that a full socket inventory be conducted to allow for an estimate of saturation of high-efficiency lighting equipment. In addition, on-site information specifically related to

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6 For example, Cadmus' analysis of metered CFL hours of use, conducted as part of the evaluation of 2010 EmPOWER Maryland Residential Lighting and Appliances Program, revealed a significant difference in average daily hours of use as compared to extrapolating the hours of use from the ANCOVA model developed as part of the evaluation of the 2006-2008 California Upstream Lighting Program.

7 Sinusoidal modeling assumes that hours of use will vary inversely with hours of daylight over the course of a year. Sinusoid modeling shows that (1) hours of use change by season, reflective of changes in the number of daylight hours and weather and (2) these patterns will be consistent year to year, in the pattern of a sine wave. An example of this approach is provided in the evaluation of the 2006-2008 California Upstream Lighting Program evaluation.

the logger placements should also be collected, including room type, window orientation, fixture type, notes about possible ambient light issues, etc.

Data Integrity

All metered data need to be thoroughly cleaned to check for errant and erroneous observations. For example, downloaded data need to be clipped at the moments of installation and removal to eliminate extraneous readings, any loggers that are broken or removed from the fixtures by residents should be removed from analysis, and the data need to be examined for "flicker" (that is, very frequent on/off cycling).

Metering Sample Design

Ideally, metering is conducted for large samples of all major lighting types (including incandescent baseline lamps and fixtures); however, in practice, most evaluations do not have adequate resources for a scope of this size. Consequently, to optimize the allocation of moderate evaluation resources, target the metering to select lighting measures—typically CFLs—that represent the majority of savings in a residential lighting program. For measures representing a small percentage of savings (such as LEDs in more recent programs), the overall HOU should be estimated by examining the CFL hours of use for similar rooms and fixture types.

Given the difficulty of identifying program bulbs in an upstream program, loggers may be placed on energy-efficient bulbs in a random sample of homes that have installed similar measures, even if those measures are not definitely known to be part of a mark-down or buy-down. For homes that have many energy-efficient lighting products, a subsample of fixtures may be selected, so long as they are selected randomly within the home. For example, if a home selected for a metering study has CFLs in 10 fixtures, meters can be placed on three to five randomly selected fixtures.[8] This will both minimize the invasiveness in homes that are highly saturated with energy-efficient lighting products and allow for a more cost-effective approach to include a larger sample of homes in the study.

The total number of loggers installed should be determined based on the desired levels of statistical confidence and precision, assuming a coefficient of variation (CV) based on recent studies of programs with similar CFL saturation (using maturity of program as a proxy, if necessary) and housing characteristics (Cadmus 2010) (Navigant Consulting and Cadmus Group, Inc. 2011).[9]

Following metering and annualization of results, the distribution of loggers by room type should be compared to the actual distribution of energy-efficient lighting products per room type, as collected at the time of the audit. The HOU should then be weighted to reflect the actual distribution of lighting products by room type. For example, if 10% of the loggers are installed in kitchen fixtures, but the audit data reveals that 15% of all CFLs are installed in kitchens, the data from the loggers in kitchens should be weighted up by 1.5 when calculating total hours of use.

In addition, the demographic and household characteristics of the metering sample should be compared with the characteristics of the total population of homes believed to have purchased energy-efficient lighting products. (This information can be collected through telephone surveys.) If significant differences appear *and* there is a large enough sample to support re-weighting based on such characteristics, the results should be weighted to reflect these differences.

Using Secondary Data

While metering is the recommended approach, program administrators who are just launching a program—or do not have sufficient resources to conduct a metering study—may use secondary data

8 A number of studies, including the evaluation of the California Upstream Lighting Program, provide publicly available examples of how to randomly select fixtures for metering.

9 Recent Cadmus studies for Ameren Illinois and EmPOWER Maryland found CVs of approximately 0.6; however, the CV could be higher for mature programs where CFLs are in a wider selection of fixtures with more variable hours of use. Actual sample size should exceed the required number by at least 10% to allow for attrition due to data cleaning.

from other metering studies.[10] This protocol recommends using the following criteria when selecting and using secondary data to estimate hours of use:

- Similarities in service territories, such as customer demographics
- Maturity of program or measure saturation
- Appropriate sample size
- Length of metering period
- Adjustments to reflect hours of use by room type

Snapback/Rebound or Conservation Effect

"Snapback" or "rebound" refers to changes in use patterns that occur after the installation of an energy-efficient product and result in reducing the overall measure savings. For example, when residential lighting customers use a CFL for more hours per day than they used the replaced incandescent bulb, this constitutes snapback. This behavior change may be due to factors such as the cost savings per unit of time from the CFL or a concern that turning CFLs on and off shortens their effective useful life (although it is unlikely most consumers are aware of this effect on life). Some customers, however, might have lower hours of use after installing a CFL, perhaps due to a corresponding desire to reduce energy consumption.

Due to the nature of residential lighting programs, it is not typically possible to conduct metering both before and after installation of energy-efficient lighting. Therefore, the Residential Lighting Protocol does not recommend adjusting for snapback/rebound effects in the hours of use.

In-Service Rate

The in-service rate represents the percentage of incented residential lighting products that are ultimately installed by program participants. In-service rates vary substantially based on the program delivery mechanism, but they are particularly important in giveaway or upstream programs where the customer is responsible for installation *and* the customer may not have requested the more energy-efficient lamps.

For upstream/markdown programs, three factors have led to first-year, in-service rates well below 100%: (1) the often deeply discounted price, (2) the inclusion of program multipacks, and (3) the common practice of waiting until a bulb burns out before replacing it.

The Residential Lighting Protocol recommends that in-service rates be estimated using different methods, as determined by the delivery mechanism:

- For ***direct installation programs***, conduct verification (such as telephone survey or site visits) to assess installation and measure persistence, regardless of whether working bulbs were removed before they failed.
- For ***giveaway or coupon programs***, conduct verification when customer contact information is available. Also, ask respondents whether (1) the installation location was within the relevant service territory and (2) the measure was installed in a home or business. (If the installation was in a business, ask about the type of business.)
- If customer information is not available, rely on either secondary data (such as for a similar program where customer information was collected) or, if necessary, on the in-home audit approach (described in the next bullet).
- For ***upstream or markdown programs***, calculate in-service rates through an in-home audit. Because program bulbs cannot be easily identified, the in-service rate can be

[10] As discussed in *Considering Resource Constraints* in the "Introduction" chapter to this UMP report, small utilities (as defined under the U.S. Small Business Administration [SBA] regulations) may face additional constraints in undertaking this protocol. Therefore, alternative methodologies should be considered for such utilities.

calculated as the number of installed bulbs purchased in a recent 12-month period divided by the total number of bulbs purchased in the same 12-month period. If the sample size of homes with bulbs purchased in the recent 12-month period is insufficient to provide the necessary levels of confidence and precision, apply a long-term, in-service rate using all bulbs, regardless of the time of purchase.

Although first-year, in-service rates for upstream programs are less than 100%, recent studies have demonstrated that consumers plan to install virtually all of the incented bulbs; however, they sometimes wait until an existing bulb burns out. As a result, program administrators have been able to take credit in one of two ways for savings that occur in years following the year that the incentive was paid:

- Discount Future Savings
- Stagger Timing of Savings Claims.

To calculate the installation rate trajectories, the Residential Lighting Evaluation Protocol recommends using the findings from the evaluation of the 2006-2008 California Residential Upstream Lighting Programs, which estimated that 99% of program bulbs get installed within three years, including the program year. Because the study examined three years of program activity, it does not specifically include the percentage of bulbs installed by the year following program activity; it only estimates the total after three years. Therefore, program administrators should assume the bulbs that will be installed in future years are split equally between one and two years following the program year.

Interactive Effects With Heating, Ventilating, and Cooling

CFLs and LED lamps give off less waste heat than incandescent bulbs, which affects heating, ventilating, and cooling (HVAC) energy requirements. These effects vary based on space conditioning mode, saturation of space heating and cooling technologies and their relative efficiencies and climate zones. The influence of climate zone on interactive effects depends on a variety of house-specific factors. Taking all of these factors into account, the net impact on lighting energy cost savings could be positive, negative, or neutral (Parekh et al. 2005) (Parekh 2008). In cooling-dominated climates, the interactive effects are positive, resulting in additional savings due to decreased cooling load. However, in heating-dominated climates, the interactive effects are negative, with decreased savings due to increased heating load.

Because of the potential impacts of interactive effects, the Residential Lighting Evaluation Protocol recommends these effects be included in evaluations of residential lighting programs.[11] One approach is to estimate these effects through the use of simulation models, examining a mix of typical housing types (such as different vintages) and reflecting the estimated saturation, fuel shares, and size/efficiency of HVAC equipment (that is, the percentage of homes that have air-conditioning or electric versus gas heat). If necessary, secondary sources—such as the Residential Energy Consumption Study (RECS)—can be used to estimate these inputs. Other recent approaches include a billing analysis (Brunner et al. 2010).

Some regions have developed interactive effects calculators based on such simulations (for example, in California, the Database for Energy Efficiency Resources (DEER)[12] and the Regional Technical Forum (RTF) in the Northwest. Such regional collaboration can minimize the cost of determining the interactive effects for those regions that do not already have such a tool.

If regional collaboration is not an option *and* the program administrator does not have the resources to complete the simulations, the Residential Lighting Evaluation Protocol recommends using a

11 Note that interactive effects are only relevant for bulbs installed in conditioned spaces. Thus, exterior lights will not have HVAC interactive effects.)

12 www.deeresources.com/DEER2011/download/LightingHVACInteractiveEffects_13Dec2011.xls

value from an existing resource, but ensuring that at least the climate (heating and cooling degree days) and, ideally, the latitude, HVAC system types, and saturations are similar between the program administrator's territory and the territory from which the data are taken.

Other Evaluation Issues

The incentive structure of upstream lighting programs does not inherently allow for assurances that each purchaser of a program bulb is a residential customer in the sponsoring program administrator's service territory. Therefore, some program bulbs may go to non-residential customers or to customers served by other utilities. These parameters are discussed in this section.

Cross-Customer Class Sales

Non-residential customers typically use lighting products for more hours per day than do residential customers. Typically, non-residential customers also have higher peak coincidence factors. Therefore, lighting products incentivized through a residential lighting program but that are installed in non-residential sockets may lead to higher savings than those assumed through the methods outlined above.

The typical approach to estimating this parameter has been through customer intercept surveys, where customers who purchase lighting products participate in a short survey—asking about intended installation location and facility type—at the time of sale. This parameter has also been estimated through surveys with store managers (asking them to estimate the percentage of bulbs sold to non-residential customers) or with the owners of small businesses (asking them where they typically purchase lighting products).

The Residential Lighting Evaluation Protocol recognizes several key limitations in estimating this parameter, including:

- ***Customer intercepts may not represent all program sales***. Conducting customer intercept surveys can be expensive, and they are typically conducted only in high-volume stores (such as Home Depot, Lowe's, Walmart, etc.). In some cases, these surveys are conducted only during high-volume promotions. Also, because some retailers refuse to allow the surveys to be conducted, the surveys may not be representative of total program sales.

  Accuracy from intercepts is further challenged because business owners and contractors (1) may be a minority of purchasers, (2) may purchase more units per visit than residential purchasers, and (3) may not purchase during the same time as the average residential purchaser.
- ***Surveys lack high reliability***. Store managers usually do not have detailed information on program bulb purchasers, so their estimates of sales to non-residential customers may be unreliable. Surveys of small business customers also face challenges, as there is nonresponse bias (that is, calling a small business and not getting cooperation from the business decision maker to take a survey). Additionally, quantifying the number and type of bulbs purchased by channel may have recall bias.

Cross-Service Area Sales (Leakage)

Recent studies have also attempted to estimate the number of program bulbs sold to customers outside of the program administrator's service territory[13]. This is commonly referred to as "leakage" or "spillage."

[13] In some service territories, program administers are required to quantify or minimize leakage. In others, program administers must reduce savings by the percent of bulbs sold outside their service territory.

This protocol recognizes several key limitations in estimating this parameter, including:

- ***Cross-Region Sales.*** Many neighboring service territories are now targeted by residential lighting programs; thus, there is less of an incentive to shop outside one's own service territory to purchase less-expensive lighting products. In some cases, leakage of program bulbs occurs in both directions across service territory boundaries, which may offset the effect in either or both territories.
- ***Many programs now limit participating retailers, so that leakage is minimized***. Many program administrators now require retailers participating in upstream programs to be located far enough within the service territory or to be surrounded by a certain percentage of population of program customers as to minimize potential leakage.

Estimating Cross-Customer Class and Cross-Service Area Sales

Based on the limitations of estimating these parameters—and the fact these parameters may offset each other (that is, the increased savings of sales to non-residential customers may be at least partially offset by leakage) —this protocol recommends excluding these parameter estimates from impact evaluations of upstream residential lighting programs.[14]

For program administrators who are using intercepts for other purposes (including an assessment of program attribution), questions regarding the intended location and business type can be included in surveys. However, the results should be used cautiously with the following adjustments:

- The results should be weighted to reflect the percentage of program bulbs represented by those distribution channels. For example, if intercept surveys are conducted at retailers that represent 75% of program bulbs, the findings should be assumed to reflect 75% of program bulb sales. For those distribution channels that have not received intercept surveys, the evaluator should first assess how the cross-customer class and cross-service area sales might differ and then apply extrapolated values.
- Intercept surveys should be conducted at retailer storefronts that represent a mix of likely leakage (based on the distance to adjacent service territories). Alternatively, the results should be weighted to reflect the actual mix of retailer risk of leakage.

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[14] Note that these protocols do not imply that these effects will be exactly offsetting, only that they work in opposite directions: sales to non-residential customers will typically lead to greater savings, and cross-service area sales will lead to lower savings in the sponsor's service territory.

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