They're Out There – Somewhere: Locating and Evaluating CFLs Distributed through Markdown and Buydown Programs

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ABSTRACT

Sponsors of energy-efficient lighting promotions are increasingly pursuing markdown programs in which they enter into agreements with manufacturers and retailers to reduce the price consumers pay for compact fluorescent lamps (CFLs). Markdown programs have been associated with dramatic increases in program-supported and spillover sales of compact fluorescent lamps. Their design also makes it difficult to collect purchaser contact information and note the model number or quantity of products an individual purchases. The lack of customer and product information greatly limits the ability of the sponsors to track participants and the CFLs they obtained through the program. This becomes problematic when program sponsors need to estimate demand and energy savings specifically for participants, and these participants are the best source of the critical data needed for the impact evaluation. Evaluators have pursued various strategies of identifying markdown program participants and products for inclusion in impact evaluations, but it is not clear that their methods succeeded in selecting either a random group or actual markdown participants and products. This paper describes a study in which the researchers used a series of screening questions in a random digit dial telephone survey and post-survey analysis to identify recent CFL purchasers and their products. The authors summarize the results of the impact evaluation, including coincidence factors, operating hours, wattage reductions, and installation rates comparing the results to previous studies. The study concludes by proposing strategies to facilitate the accurate identification of products and customer recall of the purchase and installation of markdown lighting products.

Introduction

Sponsors of energy-efficient lighting programs are increasingly pursuing markdown and buydown programs (hereafter markdown programs) in which they enter into agreements with manufacturers and retailers to reduce the price consumers pay for compact fluorescent lamps (CFLs).[1] Purchasers simply buy the products at the price listed on the store shelves, usually without knowing that the price of the CFLs is a promotional one funded by an energy efficiency program. Markdown programs have been associated with dramatic increases in program-supported and spillover sales of CFLs, but they also make it difficult for evaluators trying to measure the impact of the programs on demand and energy savings through approaches that rely on participants' contact information to gather program attribution and savings data. The difficulty stems from a key difference between markdown programs and in-store rebate program as administered in the

[1] The sponsors of this study each had at least one program in which they negotiated with retailers and/or manufacturers for reduced prices of CFLs on store shelves. They used different nomenclature to describe these programs. Some called them "markdown" only. Others used "markdown" to refer to a program in which the incentive payments to the industry partner were based on sales data and used "buydowns" to refer to a program in which a portion of the incentives were paid to the industry partner upon receipt of confirmed shipment reports and the remaining incentive was based on confirmed sales data. For ease of discussion, the sponsors have agreed to let us refer to all of these programs as "markdown".

study area: The in-store rebate programs require the purchaser to provide contact information as well as the model number and quantity of products purchased.[2] This is typically not the case in markdown programs. The lack of customer contact information and knowledge of the exact products individuals purchased greatly limits the ability of programs to track participants and the CFLs they obtained through their efforts.

Program evaluators have pursued various strategies of identifying markdown program participants and CFL products they purchased for inclusion in impact evaluations. Due to the nature of markdown programs in their area, other studies have not focused on selecting a random group of actual markdown participants and the program products they purchased. For example, some of the first markdown programs developed samples of participants by asking purchasers to return post-cards indicating their willingness to take part in a study (e.g., Athens 1999; SDG&E 2001, 2003). While the evaluators were certain the products came from the targeted program, the resulting sample was self-selected, not randomly selected. Other programs used random digit dial (RDD) telephone surveys to identify samples of recent CFL purchasers (e.g, Itron and KEMA 2007; KEMA 2005). While they probed about point-of-sale rebates and program influences, the evaluators logged usage and collected other relevant energy savings data for any CFL obtained by the respondents during the period under study. The evaluators believed that most CFLs purchased were in-program sales or indicative of them and that usage would not vary by how the products were obtained.

In contrast to these earlier efforts, this paper describes a study in which the researchers used an RDD telephone survey to identify recent CFL purchasers but further screened for the price, retailer, and model number in order to limit the impact evaluation to markdown participants and the purchased program products. The evaluators required the information on participants and their products for an on-site study, which involved logging products to estimate energy and demand savings. The paper discusses the reasons behind their choice of an RDD survey to identify participants in the on-site study, the steps taken to limit the potential weaknesses associated with the approach, and the persistent challenges that remained despite efforts to minimize issues such as participant self-selection bias and product identification error. The authors summarize the results of the impact evaluation, including coincidence factors (CFs), operating hours, installation rates, and wattage reductions, and compare the results to previous studies when possible. The study concludes by proposing strategies to facilitate the accurate identification of products and customer recall of the purchase and installation of markdown lighting products. Throughout, the authors focus attention on factors related to their use of an RDD survey to identify markdown CFLs, but they also address other pertinent methodological and analytical issues related to impact evaluation when appropriate.

Methodology

The purpose of the study was to conduct an impact evaluation of CFLs distributed through markdown programs in the New England states of Connecticut, Massachusetts, Rhode Island, and Vermont. The evaluators needed to provide the study's sponsors with information to assist in the calculation of demand and electricity savings, specifically seasonal load shapes, monthly and seasonal CFs, delta watts, daily and annual hours of use, and first-year and lifetime installation rates. This section first describes the overall approach. Next, the authors present the sample designs used to recruit RDD survey respondents and

[2] The in-store rebate programs referenced in this paper have the following design: The Sponsors rebate CFLs using coupons that customers obtain in the store on the date of purchase. Customers find these rebates in the store hanging next to the CFLs qualified for the rebate. Customers must fill out contact and product information (e.g., manufacturer, model number, number purchased) and give them to the store clerk when checking out to receive the in-store rebate. The evaluators frequently use the databases from these in-store rebate programs and have found that most participants provide complete and accurate contact and product information on the rebate form. The Sponsors in the study area use the terminology of a "rebate" to refer to the program described in this footnote and "markdown" and "buydown" to refer to the program and discounts discussed in the remainder of the paper.

participating on-site households. The section ends by describing the actual methods used on-site to identify the CFLs logged as part of the evaluation.

Identifying Markdown Purchasers and Products

Given the stated objectives of the impact evaluation, the evaluators and sponsors chose an on-site lighting logger study as the primary method of gathering the necessary data on CFL installation and use. While that decision was fairly straightforward, the evaluation team had a more difficult time deciding how to identify a sample of markdown products and the households that had purchased them. The evaluators had to confront the same challenges that plague many researchers of markdown programs, namely that they lacked both contact information for markdown participants and data on the products purchased by the participating households. The team, moreover, faced an additional challenge: time. The kickoff meeting was held in October 2007, and while the study was expected to continue for a year and ultimately include lighting-use data collected in the summer, the sponsors required that the team deliver winter load shapes and CFs by February 28, 2008. In short, the team needed a method that would quickly identify markdown participants and products and allow for the installation of lighting loggers prior to the winter peak usage period in January of 2008.

The evaluators first proposed a store-intercept methodology, but abandoned this approach for two reasons.[3] First, major participating retailers in one of the sponsoring states refused to take part in the study. Second, some of the study sponsors noted that the approach would under-represent areas in which program sales were concentrated at numerous small retailers instead of large home improvement or warehouse stores. In response, the evaluation team and sponsors brainstormed alternative methodologies, ultimately settling on an RDD survey of the population of the participating states, an approach recently taken in impact evaluations of markdown lighting programs in California (e.g, Itron and KEMA 2007; KEMA 2005).[4]

The ability of the RDD approach to successfully identify markdown purchasers and products in a timely and cost-effective manner hinged on having an adequately high incidence rate—that is, the percentage of households in the population purchasing markdown CFLs. The team had evidence from lighting consumer surveys conducted for the Massachusetts ENERGY STAR Lighting Program sponsors that suggested that as many as 17% of households in the region purchase CFLs every three months (NMR 2007). Although some of these households likely confused CFLs with regular fluorescent lighting and others purchased CFLs outside of the markdown programs, the sponsors and evaluation team surmised that the incidence was *potentially* high enough to give the RDD approach a chance.

The difficulty with an RDD approach, however, would be isolating non-markdown CFLs, a requirement set by the sponsors. They believed that non-markdown CFLs may differ, perhaps substantially, from in-program products.[5] Furthermore, they hypothesized that markdown purchasers may use CFLs differently than those obtaining CFLs through other means, including other sponsor programs such as in-store rebate or catalog programs. They were not content with logging all CFLs found. In response to the requirement that the loggers be placed on actual markdown products, the evaluation team devised a screening process in the RDD survey that they believed isolated CFLs that were *very likely* to have been obtained through markdown programs. Specifically, respondents (or sometimes individual products if some of the household's CFLs met eligibility requirements and others did not) were excluded from the RDD or the on-site study once the team determined any of the following:

[3] However, see the related study NMR and RLW (2008) Memorandum: Results of the Connecticut Markdown Store Intercept. Submitted to ECMB, UI, and CL&P on September 8, 2008.

[4] Some of the alternative methodologies the team considered included stickers on packages and actual markings on the products themselves, but these methods took more time to plan and implement than allowed for by the evaluation schedule.

[5] They particularly worried about potentially inferior quality CFLs not supported by the sponsors affecting the results.

1. The respondent was not familiar with CFLs.
2. The respondent did not purchase CFLs within the past three to four months. This requirement increased the likelihood that the respondent would accurately recall where they purchased the product, for what price, and whether it was currently installed.
3. The respondent used an in-store rebate coupon to purchase the CFL.
4. The price of the CFL exceeded $3.
5. The CFL was purchased from a retailer that did not take part in the markdown program.

The last criterion—the purchase of products at non-program retailers—was determined in post-fielding data review but prior to the on-site study because the RDD survey programming would have been too complicated to skip out all non-participating retailers. The evaluators instead compared the name of the store supplied by the respondent to a list of participating retailers. If the respondent recently purchased the CFL during the specified time period, without a rebate or coupon, at the correct price point, and from a participating markdown retailer, the team considered it very likely that the household had obtained a markdown program CFL. However, the evaluators implemented one last criterion for product inclusion in the study—an on-site technician had to verify that the CFL model number was included on a list of markdown program offerings before installing a logger on the CFL at the respondent's home.[6]

As discussed in more detail below, this approach to identifying markdown purchasers and products had shortcomings, but the sponsors and evaluation team considered the method to be very successful at identifying actual markdown purchasers and products in a timely and cost effective manner. In fact, only one household of the 158 homes visited for the on-sites failed to have any recently obtained markdown CFLs installed or in storage.[7] All other on-site households had at least one markdown product installed in the home. This success, however, reflected the fact that the incidence rate of households purchasing CFLs in the past three months hovered around 10% during the period of study, a point addressed again later in this paper.

Sampling Assumptions and Sample Designs

Prior to implementing the study, the evaluation team estimated that it would need to log a total of 678 CFLs to meet the sponsors' and the Independent Service Operators of New England (ISO-NE) requirements that energy and demand savings parameters and estimates achieve 80% confidence and 10% relative precision. Based on existing data on summer and winter peak CFs, the evaluators posited a lower error ratio for the winter period than for the summer period. In response, they divided the sample into winter and summer panels, with 217 CFLs being logged in both panels (that is, loggers were placed in the winter and kept in place through the summer) and an additional 461 being logged in the summer panel only. The winter load shapes and CFs would be based solely on the 217 CFLs placed in winter while the summer load shapes, CFs, and all electricity savings estimates would be based on the total sample of 678 CFLs no matter when placed. The smaller sample size for the winter panel also allowed the team to install the winter loggers prior to the winter peak usage period.

The logging needs for the on-site portion of the study in large part drove the sample design for the RDD recruitment survey—the evaluators needed to recruit enough qualified households to allow for drop-outs (i.e., respondents who changed their mind about the on-site) and those who post fielding data review revealed did not purchase at participating retailers. The evaluation team also took steps to ensure the adequate representation of the ISO-NE load zones in which the sponsors operated (i.e., the states of

[6] See Table 3 and Table 4 for discussions of the accuracy of telephone self-reported purchases vs. actual number of CFLs found at the participants' homes.

[7] The household had numerous CFLs installed (71% of 38 sockets counted), but the on-site portion of the screening process led the technician to conclude that none were recently obtained markdown CFLs.

Connecticut, Rhode Island, and Vermont and the three zones in Massachusetts). Using the conservative assumption that each household participating in the on-site would have 2.5 recently purchased markdown CFLs, the evaluators estimated needing 87 households to yield the 217 CFLs for the winter panel and 184 *additional* households to yield the 461 CFLs needed for the summer panel (for a total of 271 homes to log 678 CFLs). Again being conservative, the team recruited 300 qualified respondents from the RDD survey in the winter panel and 600 in the summer panel to meet the on-site sampling needs (**Table 1**). The overall sampling error for the RDD survey at the 90% confidence interval assuming a 50%/50% break in responses was less than three percent. The error for the winter panel was 5.0% and for the summer panel was 3.4%, with the difference simply reflecting the larger sample taken for the summer panel. The sampling errors for states never exceed 12%.

Table 1. RDD Survey Sample Design and Error

States	Households[a]	Winter		Summer		Overall	
		Sample	*Error*	*Sample*	*Error*	*Sample*	*Error*
Connecticut	1,268,519[b]	75	9.6%	150	6.7%	225	5.5%
Massachusetts	2,034,113[c]	130	7.2%	260	5.1%	390	4.2%
Rhode Island	405,627	50	11.7%	100	8.3%	150	6.7%
Vermont	253,808	45	12.4%	90	8.7%	135	7.1%
Overall	3,962,067	300	5.0%	600	3.4%	900	2.7%

[a] As reported in the 2006 American Community Survey
[b] Excludes areas served by municipal utilities
[c] Excludes areas served by municipal utilities and by Western Massachusetts Electric

The team fielded the winter panel in December of 2007, asking respondents about products purchased between August of 2007 and the date of the survey; fielding of the summer panel occurred in February and March of 2008, focusing on products purchased from November of 2007 to the date of the survey. In order to recruit these 900 households, the evaluators surveyed 6,597 households willing to take part in the study (**Table 2**).[8] The first two rows of **Table 2** include the 900 "recruited" households; post-survey analysis revealed that four percent of these households purchased the CFLs from non-participating stores and were excluded from on-site logging. The shaded row includes the actual eligible and recruited respondents. While the team had predicted that incidence rates—the percentage of cooperative households with recent markdown purchases—could be as high as 17% in a best case scenario, the actual incidence of households with recent markdown CFL purchases was 9.5% of respondents overall—11.6% in the smaller winter panel and 8.7% in the larger summer panel. These rates were still sufficiently high to meet the sampling needs in a timely and cost effective manner. The remainder of the table demonstrates that most respondents were screened from the survey because they had not recently purchased CFLs. Another 11% were qualified for the on-site, but they indicated during the RDD survey that they did not want to take part in the on-site portion of the study.

[8] The telephone interviewers made contact at 11,299 random numbers. Of these, 6,597 (58%) were willing to take part in the study. The remainder either were businesses or refused to answer even the initial screening questions. Note that the sponsors and evaluators were less concerned about the response rate and more concerned about finding an eligible pool of respondents and, especially products, in a very short time period.

Table 2: Disposition of all RDD Survey Respondents

Sub-group	Winter		Summer		Overall	
	#	%	#	%	#	%
Eligible Recruited Respondents	205	12%	421	9%	626	9%
Recruited but purchased at non-participating retailer[a]	95	5%	179	4%	274	4%
No recent CFLs purchases	743	42%	2,031	42%	2,774	42%
Not familiar with CFLs	308	17%	892	18%	1,200	18%
No qualified purchases or installations	207	12%	648	13%	855	13%
Did not agree to on-site	186	11%	589	12%	775	12%
Not sure of number purchased	17	1%	76	2%	93	1%
Number of Respondents	1,761	100%	4,836	100%	6,597	100%

[a] Identified in post-survey data review due to the difficulty of programming the large number of both participating and non-participating stores into the survey.

The evaluation team analyzed the RDD survey results to determine the likely number of qualified markdown CFLs the household had purchased. They used this information to develop a sampling approach to select homes for on-site logging. The approach involved stratifying households by the state of residence and the number of qualified CFLs they reported purchasing in the RDD survey to account for potentially divergent behaviors between those purchasing just a few versus many CFLs. The evaluators then called the households in random order within strata and set up on-site visits with those still willing to take part in the study. However, the team recognized that the actual number of markdown CFLs purchased may differ from respondents' self-reported purchases in the RDD survey. They therefore left the approach flexible to make sure that the required number of CFLs were logged in a timely and cost effective manner while reflecting the diversity of the population of purchasers. In total, the evaluation team logged products in 157 households (with one additional home having no qualified products) instead of the originally expected 271. Below, the paper summarizes the number and disposition of all products reported during the RDD survey and found during the on-site.

On-site Markdown CFL Verification and Logging

Technicians went to the homes of on-site participants armed with a list of CFL models supported in the sponsors' markdown programs and data on the number of qualified CFLs the respondent reported purchasing during the RDD survey. The technicians asked the respondents to show them the CFLs identified during the survey, verifying that the products had been purchased at the correct price points from participating stores.[9] The technicians then cross-checked the model number of the product with the list of

[9] The technician confirmed the price and store of purchase stated on the phone, but did not ask the respondent to answer the question "blindly" again.

qualified models. If the product met all the qualification criteria, the technician placed a logger on the CFL or the circuit containing multiple CFLs. Technicians also logged additional CFLs that respondents acquired after the RDD survey that met all other qualification criteria.

Winter panel loggers were placed in late December 2007 and early January 2008; technicians downloaded peak winter usage data in February 2008, but they replaced the loggers for continued data collection through September 2008. Summer panel loggers were placed in April and May 2008 and removed and read in September 2008. The team collected usable data from 657 CFLs (some of the 678 loggers failed or were lost while in the field).

Analysis and Results

The primary objective of this paper has so far been to describe a methodology to identify markdown CFL purchasers and to isolate actual markdown CFLs in order to log their usage. As described above, the approach requires a few simple RDD screening questions and on-site verification of model numbers, and, *as long as the incidence rate is sufficiently high,* does not greatly increase the time or costs involved in identification of purchasers or their products. For these reasons alone, the authors believe that other evaluators may wish to adopt a similar methodology if they have indications of an incidence rate of about 10% or higher and a program design that suits the methodology.[10]

Yet, the question remains: does the extra effort—regardless of how small—matter? Unfortunately, this study did not include a matched control or comparison group; instead, the authors can only compare the results of the current study to those from other states, program types, and/or earlier time periods. The comparison studies discussed below include the following:

- KEMA (2005) focused on all CFLs obtained through 2001 to 2004 in the PG&E and SDG&E service territories in an effort to estimate the impacts of markdown CFLs.
- Itron and KEMA (2007) focused on all CFLs obtained through 2001 to 2004 in the areas served by California's four investor owned utilities (IOUs) in an effort to estimate the impacts of markdown CFLs.
- NMR and RLW (2004) focused on Massachusetts, Rhode Island, and Vermont CFLs obtained through sponsors' catalog or in-store rebate programs in 2003
- NMR and RLW (2008) focused on all New England states and included CFLs obtained through direct install and in-store rebate programs from 2002 to 2006, although the results highlighted here focus on products obtained in 2006.

The first two studies (KEMA 2005 and Itron and KEMA 2007) represent the closest approximation to the methods described here—the use of an RDD to identify CFL purchasers—but without the further screening to isolate markdown purchases among them. The other two studies (NMR and RLW 2004 and 2008) provide comparisons to other types of programs in order to determine whether markdown purchasers use CFLs differently than those who obtained the products through in-store rebate, catalog, or direct install programs. The authors believe it is worthwhile to compare the results of the current study to these others, but they do not assert that doing so provides definitive evidence that the isolation of markdown products affected the actual savings parameters developed for the impact study.

Reported Versus Actual Product Disposition

As mentioned earlier, the sponsors and evaluators deemed the RDD survey method—including the screening questions—as a useful and accurate approach for identifying recent purchasers of markdown

[10] Note that the costs of meeting sampling needs at lower incidence rates could become prohibitive. .

CFLs. The team, however, noted one key difficulty with the method—respondents inaccurately estimated the number of markdown products they had purchased. Typically, respondents overestimated the number of CFLs they purchased; in fact, technicians could not find 38% of the CFLs that respondents collectively reported purchasing during the RDD, most likely because the respondents had never purchased them. Additionally, some respondents undercounted the number of markdown CFLs they purchased and others bought new markdown CFLs after taking part in the RDD survey. The "newly found" markdown CFLs accounted for 26% of the 1,544 qualified CFLs found in the home and 38% of the products logged. Finally, 30% of the qualified CFLs could not be logged because the customer refused placement, the product was in storage, or had been removed.

Table 3: Products Reported during RDD Survey and Qualified Markdown Purchases Found On-site

Product Disposition	**Overall**	
	#	%
Markdown CFLs reported during phone survey (customer recall)	1,868	100%
RDD markdown CFLs reported and found	1,137	61%
RDD markdown CFLs reported but not purchased	703	38%
RDD markdown CFLs reported to be installed elsewhere[a]	28	1%
All markdown CFLs found in home	1,544[b]	100%
Markdown CFLs logged	1,073[c]	69%
RDD markdown CFLs logged	666	61%[a]
New markdown CFLs found and logged	407	38%[a]
Markdown CFLs eligible not logged	239	15%
Markdown CFLs in storage or removed	232	15%
Loggers placed in all homes	657	100%

[a] The evaluators did not verify the reported installation of these CFLs at other locations.
[b] The number of CFLs found in the homes (1,544) is 83% of the number identified on the phone, but the number found at home includes newly identified markdown products either that the customer forgot to report during the RDD survey or that they obtained between the survey and the onsite visit.
[c] Percentage based on the CFLs logged.

As determined by on-site verification, the accuracy of customer self-reported CFL purchases in the RDD survey varied by the number the respondent actually recalled purchasing. **Table 4** compares the grouped number of CFLs reported purchased by households in the RDD survey (the columns) to the total number of CFLs purchased by households in each of the purchase groups (the rows). For example, the households saying they purchased one to five CFLs collectively reported buying 128 CFLs, while those who reported buying eleven or more collectively said they purchased 1,442 CFLs. The table shows that on-site participants who reported buying ten or fewer CFLs overestimated their actual purchases by just 9%. In contrast, respondents who said they bought eleven or more CFLs overestimated their purchases by 46%. In short, it is very difficult for respondents to recall CFL purchases accurately during an unexpected, quick RDD telephone survey. Researchers using this method in the future should keep this weakness of the approach in mind when relying on RDD surveys alone (for reasons of time, budget, or other situations) to estimate household or program-wide sales.

Table 4: Accuracy of RDD CFL by Reported Number of CFLs Purchased

	Grouped Number of CFLs Household Reported Purchasing		
	One to Five	**Six to Ten**	**Eleven or More**
Total number of CFLs reported purchasing	128	298	1,442
% of reported CFLs actually purchased	93%	91%	54%
% overestimate of number of number purchased (i.e, bulbs that were never purchased)	7%	9%	46%

Savings Parameters and Comparison to Other Studies

The study involved developing load shapes and CFs as well as estimates of daily hours of use, wattage reductions (i.e., delta watts), and installation rates. The load shapes are not shown here in the interest of space, but **Table 5** on the next page summarizes the results for the CFs and various energy savings parameters for the current study, and, where available, for other studies as well. Below the table, the authors describe the development of these parameters for the current study and discuss how they compare to those from other studies.

Table 5: Savings Estimation Parameters

Parameter	Current Study	MA-RI-VT 2004[a]	California IOUs 2005, 2007
Winter Coincidence Factor On-Peak	0.22	0.25	n/a
Winter Coincidence Factor Seasonal	0.23	n/a	n/a
Summer Coincidence Factor On-Peak	0.11[d]	0.12	.07[be]
Summer Coincidence Factor Seasonal	0.11	n/a	n/a
Daily Hours of Use Logged (interior and exterior CFLs)	2.8	2.7[e]	2.3[c]
Daily Hours of Use – Self Reported	3.2	4.1 summer 5.3 winter	2.9[cg]
Delta Watts	46	49	n/a[h]
First Year Installation Rate	77%[h]	62%[h] 77%[dh]	76%[bi]

[a] NMR and RLW (2004) unless otherwise noted.
[b] Itron and KEMA (2007).
[c] KEMA (2005).
[d] NMR and RLW (2008).
[e] Summer non-holiday peak hours in California are from 11:00 am to 7:00 pm vs. 1:00 pm to 5:00 pm for New England. Note that the peak hours listed for California apply to the cited study only and may differ from those used in other studies.
[e] Estimated from logging results only for comparability; after the application of an adjustment factor the study recommended hours of use to be 3.2.
[g] California self-reported hours of use based only on interior CFLs, while New England includes both interior and exterior CFLs.
[h] California breaks delta watts down by lumens, so the data are not comparable.
[i] Installation rate for California is actually cumulative of products purchased from 2001 to 2004. The MA-RI-VT study includes products obtained via catalogs or retail coupons in 2003. NMR and RLW (2008) based on products obtained in 2006 and verified in 2007 and 2008. The current study includes only markdown products obtained from August 2007 through May 2008.

The evaluation team for the current study gathered CFL logging data at 15 minute intervals to calculate CFs during the ISO-NE summer and winter on-peak and seasonal peak performance hours. The CFs are essentially ratios that represent the percentage of operation during a period of interest and are one component of the demand reduction calculation. The winter on-peak hours were during non-holiday weekdays from 5:00 pm to 7:00 pm. The summer on-peak hours are during non-holiday weekdays from 1:00 pm to 5:00 pm. The seasonal peak performance hours were developed so that they could be used to estimate the seasonal peak performance CFs. Since the performance hours are dynamic and vary based upon ambient weather conditions, it is impossible to determine the performance hours with 100% accuracy prior to the seasonal peak period. Analyses of the winter 2007/2008 and summer 2008 ISO-NE system loads were performed to determine the actual seasonal peak hours, which are defined as occurring when the real-time system peak load meets or exceeds 90% of the most recent 50/50 peak load. The results indicate that winter CFs were 22% on-peak and 23% seasonal peak, and summer CFs were 11% according to both calculations.

The CFs are somewhat lower than in the NMR and RLW (2004) study, which was based on CFLs obtained from retail coupon and catalog programs. The summer on-peak CFs from New England (11% and 12%) are not comparable to that for California (7%); the on-peak period in California was reported by Itron and KEMA (2007, pages 6-8, 6-9) to be 11:00 am to 7:00 pm, when residents are more likely to be away from the home, while the on-peak period in New England is slightly later at 1:00 pm to 5:00 pm.

The average household daily use was based on the following method. Annual hours were determined by taking the average logger hours per day and multiplying them by the number of days for each month and then summing the months together. For instance, the evaluators had 164 loggers with January data. These loggers together averaged 3.3 hours per day or 103.5 total hours for January. This method was repeated for each month and summed to a total 1,010 annual. The annual estimate was divided by 365 to produce the daily use estimate of 2.8. This is comparable to logged results from the NMR and RLW (2004) study (2.7 hours, although that study ultimately recommended an adjusted estimate of 3.2 hours based on other data collected in the evaluation. The 2.8 estimate is slightly higher than results from the Itron and KEMA (2007) study (2.3 hours), which may reflect variations in geography and climate rather than behavioral differences among users of all CFLs (California) versus markdown CFLs (current study). Self-reported hours of use, however, varied tremendously across the three studies and is always higher than actual usage based on logger data, although markdown users in the current study and all CFLs users in the KEMA (2005) study provided somewhat more accurate estimates than did coupon and catalog CFL users in the NMR and RLW (2004) study, which also involved a combination of customer self-report on the telephone and on-site verification via logging but was conducted the following year after the products were obtained.

The delta watts—or the difference between the wattage of the bulb installed prior to the current CFL—for the current study were lower than for the NMR and RLW (2004). A closer look at the original data from both studies revealed an interesting explanation for this result: The reduction in delta watts reflected the fact that current study participants originally had installed lower-wattage products that they then replaced with even lower wattage markdown CFLs. They were not, however, replacing CFLs with other CFLs but were instead replacing, for example, 60 Watt incandescent bulbs with 13 Watt CFLs as opposed to 100 Watt incandescent bulbs with 23 Watt CFLs. The results do not allow us to determine whether the delta watt variation reflects differences between CFL users who obtained their products through markdown programs and coupon and catalog ones, change over time, or some other factor not explored in either study.

Finally, the first year installation rates as reported in these studies varied but not in a way that followed any clear patterns. The first year installation rate was just above 75% for the current study, NMR and RLW /(2008), and Itron and KEMA (2007). Yet, the products being evaluated were installed as early as 2001 (Itron and KEME 2007) and as late as May 2008 (the current study). Furthermore, NMR and RLW (2008) includes CFLs obtained via both direct install and coupon programs. Moreover, NMR and RLW (2004) also examined installation rates for coupon as well as catalog program CFLs obtained in 2003, but the installation rate was just 62%. Therefore, the authors cannot draw conclusions about the impact of the methodology or different program characteristics on first-year installation rates.

Conclusions

The purpose of this paper was to demonstrate a methodology by which researchers can successfully identify markdown CFL purchasers via an RDD survey and thereby limit impact evaluations to program-supported products only. The results of this study lead the authors to conclude that the methodology can be successfully deployed, but that success depends on the following conditions:

- Incidence of markdown purchasers at about 10% or higher (depending on the evaluation budget and schedule)
- Program design that allows evaluators to distinguish markdown CFLs from other CFLs being sold in the same area (e.g., price, retailer, model number)
- Screening questions to limit recruitment to highly likely markdown purchasers
- Verification of the model number of CFLs as a final screen for being an in-program purchase

This paper, however, does not provide ample evidence to conclude that the methodology affected the results of the impact evaluation. The evaluators had no matched control group of CFL purchasers who failed to pass the screening test but still took part in the on-site portion of the study. Likewise, it remains unclear if similarities and differences between the results of this and other studies reflect dissimilar methodologies, divergent program designs, or geographic and climatic variation.

Other studies currently being conducted throughout North America have relied on a similar methodology to the one described here. In light of these studies and the fact that the residential lighting efficacy standards begin to take effect in 2012, it is unclear whether future evaluators will have the opportunity to adopt these measures—or even if it would be cost effective to do so. However, future programs focused on markdown or buydown approaches for solid state lighting or other products may want to consider this methodology for identifying purchasers and products for evaluation purposes.

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