Doing More with Less: Getting What's Needed Most from Evaluations

Barb Ryan, Global Energy Partners, Walnut Creek, CA
Patrice Ignelzi, Global Energy Partners, Walnut Creek, CA

ABSTRACT

Evaluation of energy efficiency programs has evolved enormously over the years, and has become a crucial component in achieving success. While some EM&V budgets commonly cost hundred of thousands of dollars, and are well justified, there are situations where those kinds of funds cannot be appropriated. This is especially true for small programs; applying the 2-10% of program costs rule-of-thumb, a $250,000 program suggests an EM&V budget of no more than $25,000. Programs with these limited budgets are numerous—municipal utilities, smaller investor-owned utilities (IOUs) and pilot programs often operate programs at this level of funding.

For evaluators used to performing the full spectrum of activities, from assessing program outreach, the program process, and customer satisfaction to estimating the energy savings and other market impacts, the challenge in conducting an evaluation on a limited budget often involves identifying which activities to cut. A better approach is to ask the question: What do we really need to know? Followed by, how can we learn it most efficiently?

Global Energy Partners faced just this situation when asked to perform an evaluation of a municipal power provider's Compact Fluorescent Lighting (CFL) program. In developing a successful strategy, we used this bottom-up approach to determine a limited set of activities that were needed to get the job done. We leveraged every resource working collaboratively with the program manager to identify exactly what she needed to learn, why she needed it, and how she planned to use it to come up with a focused evaluation plan that delivered results she needed.

Introduction

Even programs running on limited funding need evaluation to confirm and help improve their effectiveness. Our client, a municipal utility in California, had a program to promote the use of CFLs in their city. With a very limited budget -- $24,000 -- they hoped to understand the penetration of CFLs in their city, the effect of their programs to promote residential use of CFLs, and what they could do to improve the program's effectiveness.

Working closely with the program manager, we developed a focused list of objectives that could be addressed within the $24,000 budget:

- Assessing the role of the utility's FY2009 CFL programs on residents' acquisition of CFLs,
- Estimating the saturation of residential CFLs in the service territory, and
- Estimating the energy impacts of residential CFL installations in the service territory.

These objectives would give the program manager important information such as the number of CFLs in use in the service territory, the amount of energy savings achieved by the city and customers as a result of the program and the existing remaining potential savings from CFLs. This would also inform and improve the utility's program activities.

This approach worked for several reasons. (1) The utility was a municipal power company and had less stringent EM&V protocols regarding program evaluation[1], (2) CFLs are a simple, common measure that most residential customers are familiar with allowing us to rely on self-reported behavior to understand program awareness, the number of CFLs acquired, and how many of those recently acquired bulbs were in use, and (3) we were able to use a low-cost online survey methodology.

It was important early on that everyone was aware of the limitations of the study and was comfortable with the results despite these limitations. While we were able to estimate the saturation of residential CFLs in the service territory and estimate the energy impacts of the CFLs that were installed, we could not directly attribute those savings to the utility's programs. The savings estimate provided a snapshot of current annual savings but we could not tightly link those savings to the utility's FY 2009 programs. Also the online sample introduced bias in the survey results and self-reported behavior is not as accurate as on-site verification.

Developing the Evaluation Strategy

The utility has undertaken several activities to promote the increased use of CFLs in its service territory. These efforts include giving customers three free CFLs during residential home energy audits, free CFL giveaways at schools and events, and trade-in events where customers exchange one of their incandescent bulbs for a free CFL. The utility also offers $2 off coupons to be used to purchase a CFL at participating area hardware and drug stores.

The utility does not collect information about which customers obtain CFLs through their sponsored activities; therefore a list of participating customers was not available for evaluation. As a result, short of conducting a prohibitively expensive census of all residential customers, no survey effort could be assured of reaching enough customers who actually participated in the events or used the discount coupons. A reasonable sample of residents would likely capture too few participants to make the participant representation valid.

The objectives we set out to evaluate, however, address issues common to all residents (i.e., everyone has lights). The utility's residential customers are located in a geographically compact area, are exposed to the same media and all have access to the participating stores and events. We also had the following data available from the utility, which we used to ensure ample survey sample size, to contact the survey recipients, to calculate the direct program savings, and to estimate the remaining savings potential:

- Valid email addresses for 6,000 of their customers.
- The number of bulbs distributed at audits, giveaway and trade-in events
- The number of program coupons redeemed
- Annual per-unit deemed kWh savings, averaged over all lamp types promoted
- The number of residential accounts to which we could apply the per household savings estimate

The customers with valid email addresses comprise about 20% of the utility's total residential accounts. The utility collects emails only for those customers who sign up for their online bill pay service. We felt that an online survey of residential customers could yield 375 responses; enough to provide us with a robust set of results. Fielding the survey using a web-based approach with the utility-provided sample, made it affordable to obtain and manage this number of responses within the budget.

[1] Municipals in this state are required to conduct evaluation of program impacts but are given more latitude in the focus, methodology, and detail level of the evaluation each period.

A drawback of using this approach is the potential bias of the survey results. Online surveys, like all survey methodologies, obtain results from a sample of customers willing to respond to the survey. It is possible that the customers who are willing to take the survey are different from the general population of customers. The appropriateness of using an online sample to represent the general population of customers has often been questioned largely because of noncoverage bias (not everyone has access to computers, email and the Internet) and the sample being chosen in a non-systematic way (people volunteering for online survey panels).

Noncoverage bias exists in all survey methodologies and is increasing in telephone surveys due to the growing number of cell phone only customers. The Center for Disease Control's National Health Survey reports that 27% of households are cell phone only households.[2] The increase in cell phone only customers has led to higher refusal rates, a larger number of non-working telephone numbers in utility-provided samples, and increased survey costs (Buhr, 2011).

At the same time, noncoverage bias is declining in online surveys as the percentage of households with access to the Internet grows. The Current Population Survey (CPS), a government in-person survey noted for its accuracy, reports that 68.7 percent of US households had an Internet connection while 76.7 percent had household members who connected to the Internet from home or some other location such as their workplace (Current Population Survey 2009).

It's also important to note that empirical mode comparisons show relatively small differences between Internet and other modes of data collection, with the exception of Internet and interview mixes for sensitive questions (De Leeuw and Hox 2011). Based on this evidence, we felt that an online survey would produce the same quality of results as any other single mode survey.

The way the online sample was selected can also produce bias. The utility did not have email addresses for all its customers. It only had emails for customers who signed up for their online bill pay service. To address this concern, we used post data collection weighting. We compared household income and education level of the respondents to those of the city using census data. High and moderate income households were over-represented in the survey and low income households were under-represented. College educated respondents were also over-represented in the survey. Analysis of the results showed statistically significant differences in reported CFL purchase and installation rate across income categories, but no significant difference across education categories. Therefore we weighted the survey responses so that the respondents accurately reflected the income distribution of the population.

The ideal methodology would have been to use a mixed-mode survey, using a combination of telephone, cell-phone and email samples. But this approach is costly and could not have been done within the available budget.

Implementing the Strategy

The survey questions addressed customers' decision-making process and the influence of the program on their energy efficiency activities. Other questions addressed lighting saturation, assessing the amount of lighting in homes, the portion met with CFLs, and the remaining potential for CFL usage. Specifically, the survey tried to obtain the following information:

- Awareness and influence of the utility's promotional activities
- Where and how residents have obtained CFLs
- Number of CFLs obtained in the past year
- For CFLs obtained in the last year, the percentage installed vs. in storage
- Number of light sockets at the residence

[2] CDC/NHIS National Health Survey, 2003 – 2010.

- Number of sockets having CFLs vs. other bulbs
- Number of the remaining sockets that could use CFLs

Collecting this information along with the data the utility provided allowed us to estimate the following:

- The direct gross impacts of the CFLs distributed by the utility (number of CFLs distributed * installation rate * deemed savings),
- The estimated market effects of all CFLs purchased and installed in the service territory in the last year (number of CFLs purchased * installation rate * deemed savings * population),
- The penetration of CFLs in the service territory (the percent of households with at least one CFL),
- The technical potential for CFLs in the service territory (the average number of sockets in a household that could hold a CFL * deemed savings* population).

Customers were invited to take the survey via an email invitation in July, 2010. The invitation explained that the survey was sponsored by their utility, was about household lighting, and would help their utility help customers improve the energy efficiency of their lights. The invitation also specified that qualifying respondents would receive an Amazon gift certificate as thanks for completing the survey.

The response to the survey was overwhelming, and the desired number of completed surveys was surpassed in only a couple of hours. A total of 398 customers completed the survey. In our experience conducting several online surveys for utilities, the quick and overwhelming response that we received is atypical. The fielding period required to get an adequate number of completed online surveys is usually 5 – 10 days. During that time period it is often necessary to send an email reminder to non-respondents in order to improve the response rate. We hypothesized several possible reasons why the response to the survey was so positive:

- The quality of the sample. All of the emails were valid. Typically, 2 – 10% of emails in an online sample bounce.
- The salience of the topic. There is a high level of awareness of the benefits of CFLs in California, and thus respondents may have found the survey especially interesting and important.
- The legitimacy of the survey sponsor. Municipal utilities tend to have high customer satisfaction and their customers are often willing to help them by responding to a survey.
- The incentive. The gift certificate to Amazon was likely very appealing to most customers, because it can be used for a wide variety of useful products.

How Respondents Compared to the General Population

Since not all customers have email access or are signed up for online bill pay, the customers responding to the survey may be different than the general population of customers. In general, we have found that customers with email access tend to have higher incomes and are better educated than the population at large. To determine if this was also true of the survey sample, we compared education and household income of the respondents to the city's census data (Table 1).

Table 1: Demographic Comparison: City population versus Survey Respondents

	City Population	Respondents
Household Income		
Less than $50,000	33%	24%
$50,000 - $100,000	30%	33%
More than $100,000	37%	44%
Respondent/Head of Household Education		
At least high school education	91%	99%
Bachelors degree or higher	45%	77%

These results indicate that the survey sample was more educated and had higher household incomes than the city as a whole. We know from past experience that customers who sign up for online bill pay (and whose email addresses were used to recruit the survey respondents) are also likely to be more technically savvy than the general population. We expected that they might be more likely to have visited the utility website and seen the information available there about CFLs and energy efficiency. How much these differences affected CFL ownership and behavior was not known ahead of time. Upon reviewing the results, we found statistically significant differences in reported CFL purchase and installation rate across income categories, but no significant difference across education categories. The post data collection weighting described earlier helped us minimize this difference in the results.

Results

Highlights of the results include the following:

- The gross direct FY2009 program impacts of CFLs distributed by the utility and installed by customers was 100,998 kWh per year.
- The estimated market effects of CFLs installed in the last year in the service territory were 4,324,184 kWh per year. This included all CFLs installed, not only those influenced by the program.
- Relatively few customers claimed to be aware of the utility's efforts to promote CFLs. Only 16% of respondents said that they were familiar with programs or promotional activities that the utility offered to encourage customers to purchase CFLs. Seventy-seven percent of the customers who were aware of the efforts were influenced by these efforts to some extent in their decision to obtain CFLs in the last year.
- Penetration of CFLs was on par with the state of California: fully 87% reported having at least one CFL in their home.
- Sixty percent of the CFLs obtained in the last 12 months were installed.
- There is a healthy technical potential for CFLs in the service territory. If every socket that could house a CFL was filled with a CFL, the annual residential energy savings would be 9.7 million kWh.

The utility distributed 5,081 CFLs in FY2009. According to the survey data, their customers installed 57% of all of the CFLs they obtained in the last year (±5.3% at the 90% confidence interval). The annual deemed savings for CFLs is 32 kWh per year for bulbs 15 watts and lower and 39 kWh per year for bulbs that are 16 watts or higher. Since the survey did not ask respondents to specify bulb wattage, an average deemed savings of 35.5 kWh per year was used. Multiplying the 5,081 by 57% results in an estimated 2,895

CFLs installed through the utility programs (±271). Multiplying the 2,895 installed bulbs by the annual deemed savings results in the gross energy impact estimate of 102,782 kWh per year (± 9,638 kWh)The survey results showed that customers installed an average of 4.05 new CFLs in the last year (± .61). This average includes customers who did not obtain any CFLs in the last 12 months. Multiplying the average number of new CFLs by the deemed savings (35.5 kWh per year) results in an average annual savings of 143.78 kWh per residential customer. Applying the average savings of 143.78 kWh to the residential customer population (30,075) results in the estimate of 4,324,184 kWh per year (±653,551 kWh).

According to survey data, there are on average 9.12 sockets per home (interior and exterior) that could use a CFL (± .79). It should be noted that respondents were not asked if they would, in fact, fill these sockets with CFLs, but whether they could. This reflects what is generally referred to as technical potential or the upper end of the range for remaining potential.

Applying the earlier equation of 35.5 kWh per lamp to 9.12 potential additional CFLs for the Alameda residential accounts population of 30,075, results in an estimate of technical potential savings of 9,737,082 kWh. In other words, if every socket that could house a CFL was filled with a CFL, the annual energy savings would be an additional 9.7 million kWh (± 8.5%).

The approach and results presented here have widespread and practical applications to small investor-owned utilities, municipal utilities, and any operators of small-scale programs. The success of the project and the approach taken provides results and recommendations on how one can indeed conduct meaningful and useful evaluations on even the tightest budget.

References

Buhr, T. 2011. *The Impact of Cell Phones on Evaluation Survey Quality,* Opinion Dynamics Corporation, Chester, VA. January.

American Community Survey Design and Methodology Report, 2009, chapter 7.Available online 23 November 2010: http://www.census.gov/acs/www/methodology/methodology_main/

DeLeeuw, Edith D. and Hox, Joop J. 2011. *Internet Surveys as Part of a Mixed Mode Design,* Social and Behavioral Research and the Internet: Advances in Applied Methods and Research Strategies. Ed. Marcel Das, Peter Ester, Lars Kaczmirek. New York: Taylor & Francis Group, pp. 45-76