RESIDENTIAL CFL IMPACT EVALUATION

City of Alameda – Fiscal Year 2009

Project Number 1331

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EXECUTIVE SUMMARY

PROJECT OVERVIEW

The purpose of this project is to evaluate the effects of Alameda Municipal Power's (AMP) programs to promote residential use of compact fluorescent lamps (CFLs). Specifically the evaluation had the following objectives:

- Assess the role of AMP's CFL programs on residents' acquisition of CFLs
- Estimate the saturation of residential CFLs in Alameda
- Estimate the energy impacts of residential CFL installations in Alameda

To address these objectives Global Energy Partners conducted an online survey of AMP's residential customers for whom the utility had valid email addresses. A total of 398 customers completed the survey.

SUMMARY OF EVALUATION FINDINGS

Highlights of the study are included below:

- The gross direct FY2009 program impacts of CFLs distributed by AMP and installed by customers is 108,240 kWh per year.
- The estimated market effects of CFLs installed in the last year in Alameda are 4,324,184 kWh per year. This includes all CFLs installed, not only those influenced by AMP's programs.
- Relatively few customers claim to be aware of AMP's efforts to promote CFLs. Only 16% of respondents said they were familiar with programs or promotional activities that AMP has offered to encourage customers to purchase CFLs. Seventy-seven percent of the customers who are aware of AMP's efforts were influenced by these efforts to some extent in their decision to obtain CFLs in the last year.
- Penetration of CFLs is on par with the rest of California. Fully 87% report having at least one CFL in their home.
- Sixty percent of the CFLs obtained in the last 12 months were installed. A third of the CFLs installed replaced working incandescent bulbs.

CHAPTER | 1

BACKGROUND

1.1 OBJECTIVES OF THIS EVALUATION

The purpose of this project was to provide the Alameda Municipal Power (AMP) staff with a very basic assessment of the state of CFL adoption and the effects of the city's activities to promote residential use of compact fluorescent lamps (CFLs). Specifically the evaluation had the following objectives:

- Assess the role of AMP's CFL programs on residents' acquisition of CFLs
- Estimate the saturation of residential CFLs in Alameda
- Estimate the energy impacts of residential CFL installations in Alameda

The results of this evaluation will provide AMP staff with an assessment of customers' CFL adoption and usage related to their programs. This will help guide the development and improvement of future energy efficiency programs that AMP can offer.

1.2 OVERVIEW OF AMP'S PROMOTIONAL ACTIVITIES

AMP has undertaken several activities to promote the increased use of CFLs in Alameda. 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. AMP also offers $2 off coupons to be used to purchase a CFL at participating area hardware and drug stores. Table 1-1 shows the number of CFLs given to customers by AMP and the AMP coupons redeemed in Fiscal Years 2009 and 2010.

Table 1-1 Number of CFLs Given Away at Promotional Activities

Type of Event	FY2009	FY2010
Audits	126	364
Trade-In Events	441	284
Giveaway Events	1092	699
Coupons	3422	5781
Total	**5081**	**7130**

1.3 RESEARCH METHODOLOGY

Data that would allow us to address the evaluation objectives was collected by conducting a survey of AMP's residential customers. AMP does not collect information about which customers obtain CFLs through AMP-sponsored activities. Therefore, short of conducting a prohibitively expensive census of all residential customers, no survey effort could be assured of reaching customers who actually participated in the events or used the discount coupons. However, the objectives of the evaluation address issues common to all AMP residents (i.e., everyone has lights) and we determined that responses from a sample of 375 customers drawn from the population of about 30,000 residential account holders, all located in this geographically compact area, exposed to the same media, and with access to the participating stores and events, would provide a robust set of results. Fielding the survey using a tested web-based survey approach

with a set of AMP-maintained email addresses made it affordable to obtain and manage this number of responses.

AMP provided a sample of 6,000 customers for whom they had obtained valid email addresses. These customers with valid email addresses comprise about 20% of AMP's total residential accounts. AMP collects emails only for those customers who sign up for their online bill pay service.

Since not all customers have email access or are signed up for online bill pay, the customers included in this 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 is also true of the survey sample, we compared education and household income of the sample to city of Alameda census data. Ninety-nine percent of the respondents have at least a high school education and 77% have a bachelor's degree or higher, compared to 91% and 45% of the city of Alameda respectively. Twenty-four percent of the survey respondents have incomes less than $50,000 compared to 33% of the city of Alameda, 33% of survey respondents have incomes between $50,000 - $100,000 compared to 30% of the city of Alameda, and 44% of survey respondents have incomes greater than $100,000 compared to 37% of the city of Alameda[1].

These results indicate that the survey sample is more educated and has higher household incomes than the city of Alameda 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 AMP website and seen the information available there about CFLs and energy efficiency. How much these differences affect 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. To minimize introducing systematic bias into the results, we weighted the survey responses so that they accurately reflect the income distribution of the population. That is, the weight given to responses from those in the highest income group, which was overrepresented in the sample, was reduced and that of the lower groups was increased to the proportions these groups are represented in the population. Characteristics of the survey respondents (unweighted) are detailed in Appendix A.

One objective of the survey was to address customers' decision-making processes for obtaining CFLs and AMP's influence on lighting choices. It also addressed the saturation of CFLs by assessing the amount of lighting in homes, the portion met with CFLs, and the remaining potential for CFL usage.

Specifically, the survey addressed the following:

- Awareness and influence of AMP promotional activities and other sources
- How and why residents have obtained CFLs
- How many CFLs were obtained in the past year
- How many of the CFLs obtained in the last year
    - are installed vs. in storage
    - were used to replace burnt out vs. functioning incandescent bulbs
- How many light sockets at the residence
- How many of the sockets have CFLs vs. other bulbs
- Locations of CFL and other lights throughout the residence

[1] U.S. Census Figures 2006, Alameda City California, http://factfinder.census.gov

- How many of the remaining sockets could use CFLs

Customers were invited to take the survey via an email invitation on July 7, 2010. The invitation explained that the survey was sponsored by AMP, was about household lighting, and would help AMP improve their efforts to help customers improve the energy efficiency of their lights. Qualifying respondents received a $10 Amazon gift certificate as a thank you 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. This is atypical for an online survey. The field period required to get an adequate number of completed surveys is usually 5 – 10 days. Often an email reminder sent to non-respondents near the end of the field period is necessary. There are 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 than other utilities and their customers are often more willing to help them by responding to a survey.
- The incentive. A $10 gift certificate to Amazon was likely very appealing to most customers, because it can be used for a wide variety of useful products.

A total of 398 customers completed the survey.

IMPACT EVALUATION RESULTS

2.1 DIRECT PROGRAM IMPACTS

The gross direct program impacts of CFLs distributed by AMP and installed in FY2009 is 108,240 kWh per year. This number was derived from AMP records of the number of bulbs distributed survey data, and AMP's annual per-unit deemed savings averaged over all lamp types for the 2009 residential sector.

AMP has distributed 5,081 CFLs in FY2009, and according to the survey data AMP customers installed 60% of the CFLs they obtained in the last year. AMP's 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 60% results in an estimated 3,049 CFLs installed through AMPs programs. Multiplying the 3,049 installed bulbs by the annual deemed savings results in the gross energy impact estimate of 108,240 kWh per year.

2.2 MARKET EFFECTS OF CFLS IN ALAMEDA

The estimated market effects of all CFLs installed in the last year in Alameda are 4,324,184 kWh per year. This number was derived from the survey data, AMP's annual per-unit deemed savings averaged over all lamp types for the 2009 residential sector, and the total number of residential customers in AMP's service territory. This number represents the savings achieved from all CFLs installed in the last 12 months, not only those installations influenced by AMP's programs.

The survey results showed that customers installed an average of 4.05 new CFLs in the last year. This average includes customers who did not obtain any CFLs in the last 12 months. AMP's annual deemed savings of 35.5 kWh per year was used. Multiplying the average number of new CFLs by the deemed savings results in an average annual savings of 143.78 kWh per residential customer. Applying the average savings of 143.78 kWh to Alameda's 30,075 residential customers results in the estimate of 4,324,184 kWh per year.

The gross market effects of CFLs in Alameda represent 3.1% of the total residential electric load. This is comparable to other utilities in California. PG&E and SC&E's gross program impacts for CFLs from 2006 – 2008 represents 2.9 and 2.5% of their total residential load respectively[2]. AMP is also likely to have higher impacts from lighting than other utilities because there isn't air conditioning in AMPs service territory and thus lighting represents a higher percentage of the overall load.

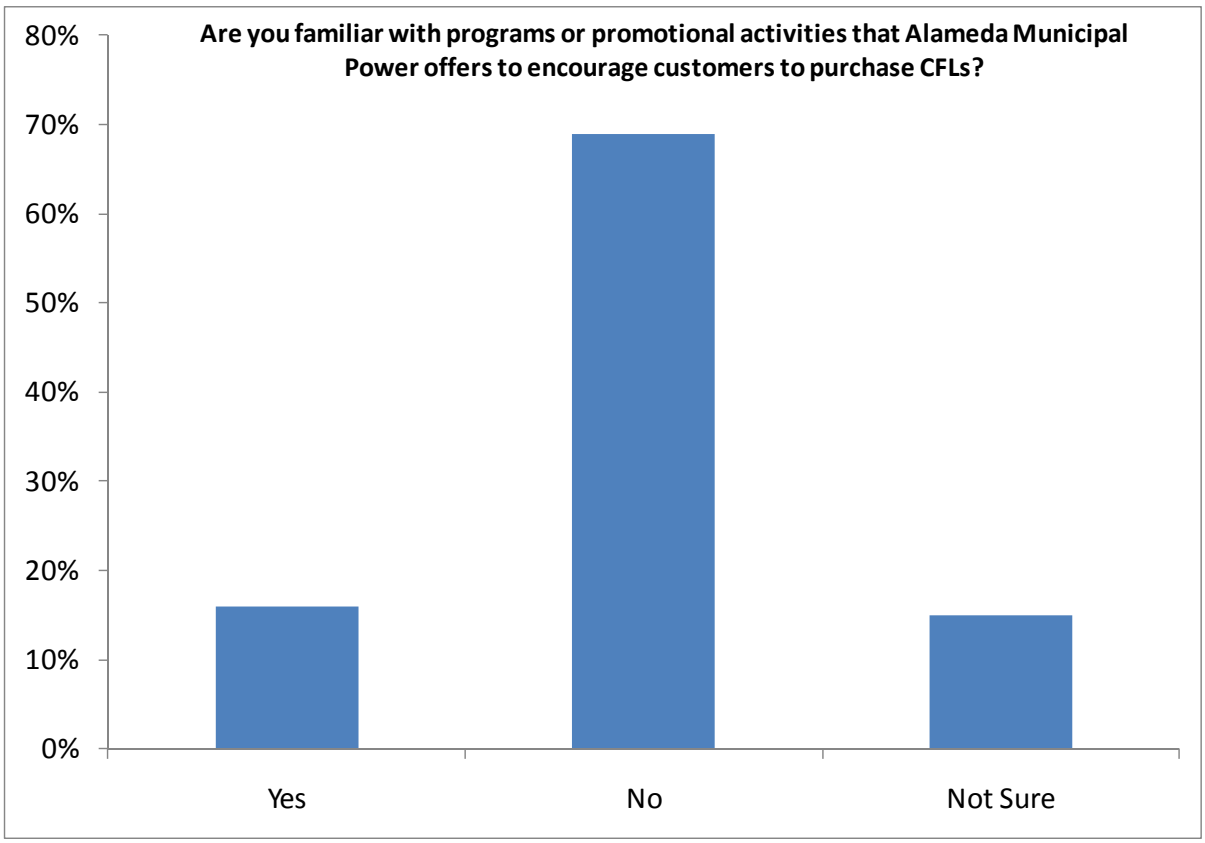
We reviewed the results of our study for reasonableness by looking at the differences between demographic groups of respondents and as noted in Chapter 1, weighting the data to more accurately reflect the income of the broader population. We also compared the results in our study to other studies conducted in California. The installation rate of CFLs found in this study is lower than those in PG&E, SC&E and SDG&E's service territory. The number of households with at least one CFL and the number of CFLs per household from our study is on par with what other studies have found in California, but the percentage of household bulbs that are CFLs is somewhat higher in our study than in comparison studies. These data comparisons are discussed in more detail in the corresponding sections of this chapter.

[2] Final Evaluation Report, Upstream Lighting Program, Volume 1, CALMAC Study ID: CPU0015.01, KEMA, February 2010

2.3 AMP'S ROLE IN CFL ACQUISITION

Despite the fact that AMP has been actively promoting CFLs for several years and the likelihood that the respondents to this survey have seen AMP's informational and promotional statements about the benefits and opportunities to improve energy efficiency on the AMP website (through which they have signed up to pay their utility bill), only 16% of respondents said they were familiar with programs or promotional activities that AMP offered to encourage customers to purchase CFLs (Figure 2-1). This result is on par with general awareness rates of utility programs. Although some utility programs have awareness rates in the 55 – 70% range, research suggests that most programs achieve awareness of 9 – 32%[3].

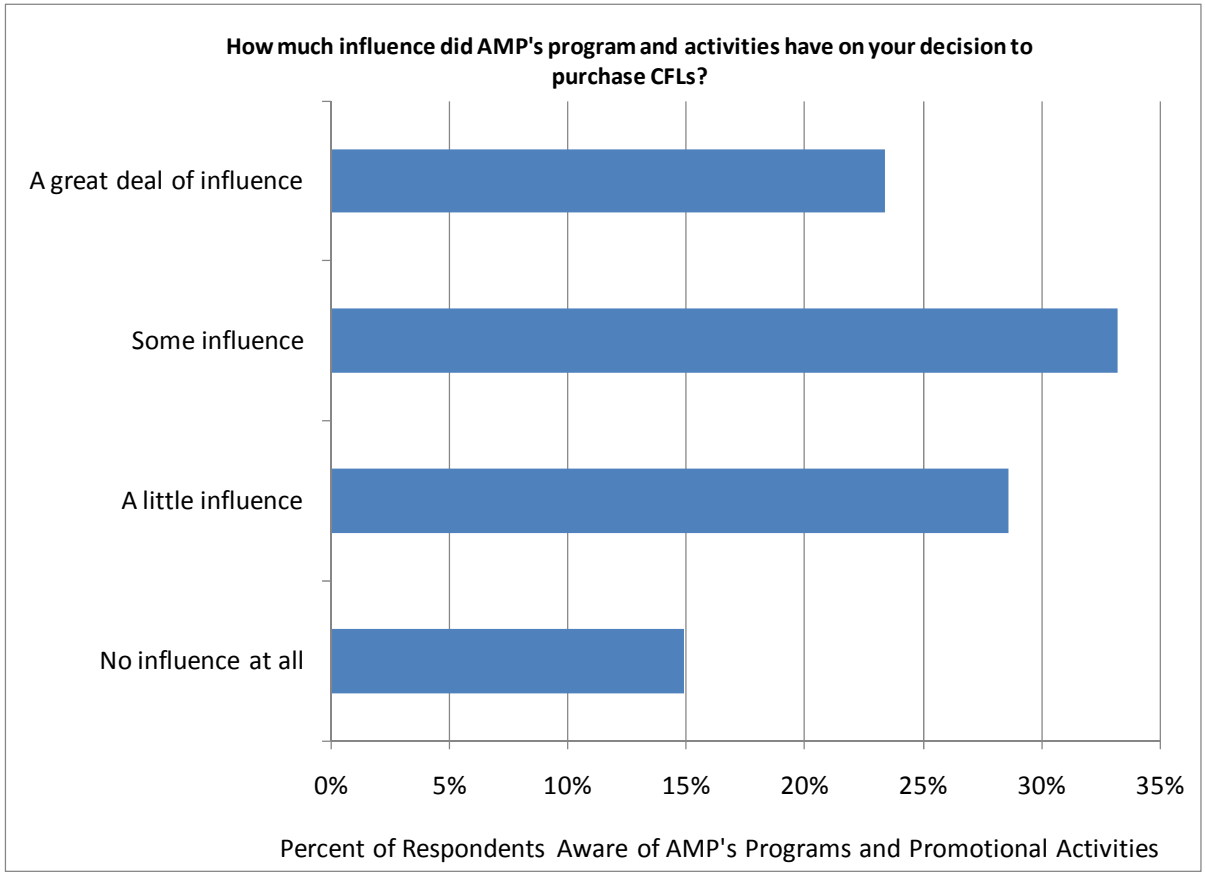
Figure 2-1 Customer Awareness of AMP's CFLs Promotional Activities



Of those that were aware of AMP's programs or promotional activities, 77% said the programs or activities had at least a little influence on their decision to purchase CFLs (Figure 2-2). Only 15%, however, said AMP had a great deal of influence on their purchasing decisions.

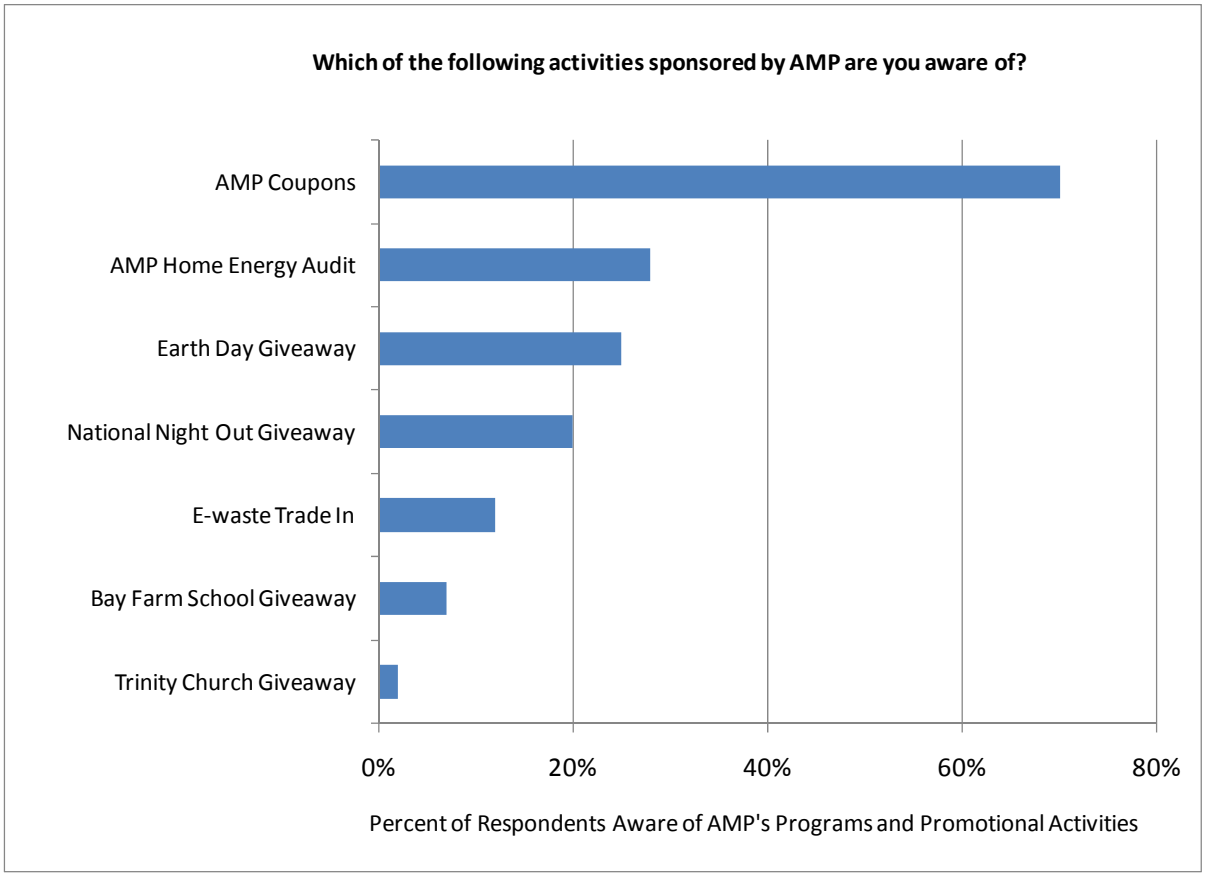
[3] --"Sure I'd Buy That" Results of the Primen Say/Do study, McNulty, Byrnes, December 2003

Figure 2-2 Influence of AMP's Programs and Activities on CFL Purchases



Of those aware of the AMP promotions, 70% had heard about the AMP coupons, and 28% had heard of the AMP home energy audit (Figure 2-3).

Figure 2-3 Awareness of Specific AMP Activities

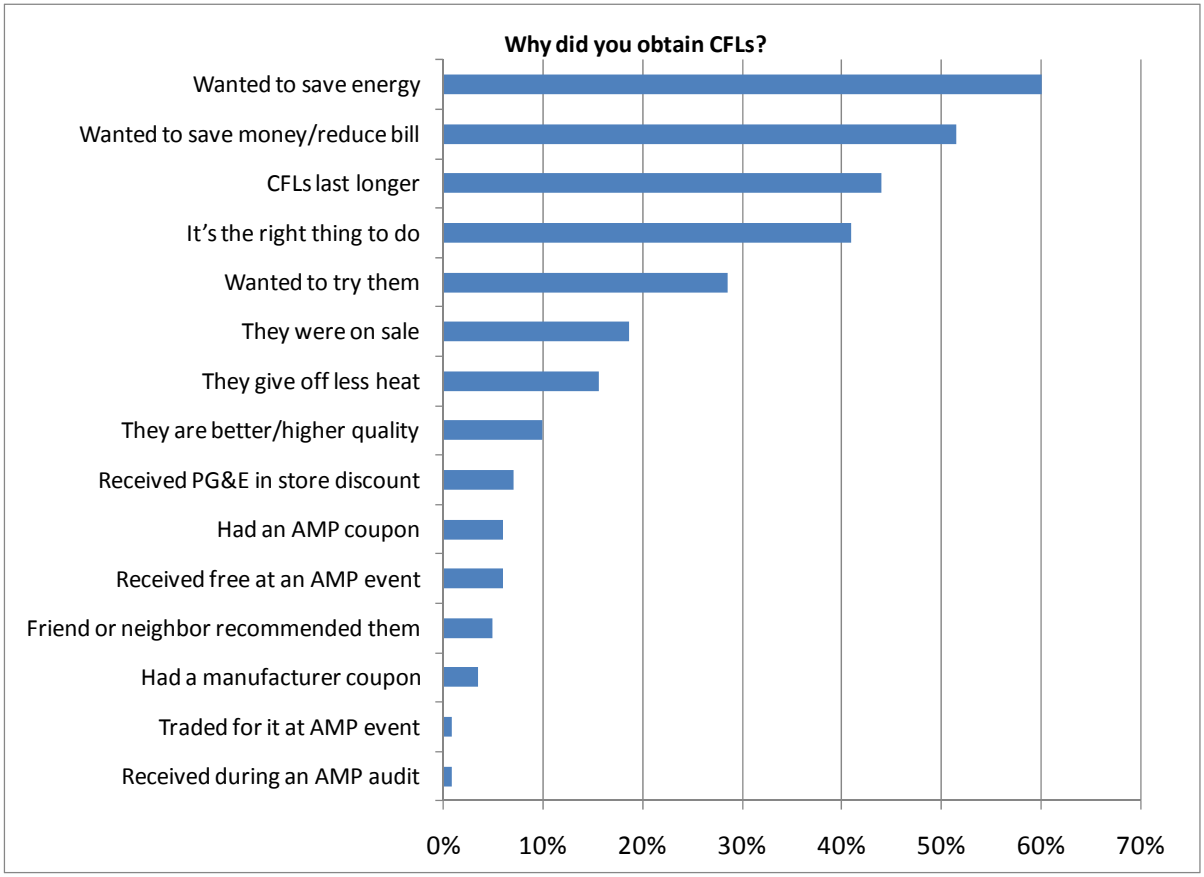


The most common reason respondents said they purchased CFLs was to save energy, followed closely by wanting to save money/lower their electric bill (Figure 2-4). The fact that CFLs last longer and buying CFLs is the right thing to do was also cited as a driver of purchase by large groups of respondents.

Six percent of respondents bought a CFL because they had an AMP coupon and 6% received a CFL free at an AMP event. Only 1% of respondents traded for a CFL at an AMP event or received CFLs during an AMP audit. Seven percent of respondents said they purchased a CFL because of the PG&E in-store discount and 4% said they used a manufacturer's coupon.

To determine the number of participants in the sample of respondents, the percent of respondents who said they received a CFL at an audit, a give-away event, a trade-in event, or redeemed an AMP coupon for a CFL was calculated. Twelve percent of respondents in the sample were AMP participants. In the last 2 fiscal years AMP distributed or provided coupons for approximately 6,000 CFLs per year (see Table 1.1), an average of 3,000 bulbs per year. Given that a single participant could receive or use a coupon for more than one bulb, a realistic estimate of participants in a random sample would be 7 – 20%. Therefore, the survey sample has a good representation of participants and further supports the reasonableness of applying the findings to the population at large. Further analysis revealed that there is no significant difference in CFL behavior (the total number of CFLs in a home, CFLs obtained, and CFLs installed) between participants and nonparticipants in the survey sample.

Figure 2-4 Reasons for Obtaining CFL's



Total responses add up to more than 100% because respondents were able to check more than one answer.

2.4 PENETRATION OF CFLS

Currently, 38% of interior light bulbs and 33% of exterior light bulbs in respondents' homes are CFLs. Bedrooms and bathrooms have the highest penetration of CFLs (Table 2-1). Only 13% of respondents did not have any CFLs in their home.

Table 2-1 Number and Type of Light Bulb by Room

Room	Average Number of Light Bulbs	Average Number of CFLs	Percent CFLs
Bedroom	5.05	2.27	46%
Bathroom	5.01	1.83	37%
Kitchen/dining area	5.51	1.51	31%
Living room/ great room/family room	4.33	1.78	47%
Hallways, entryways, foyers, closets	2.84	1.12	44%
Utility area, garages	1.80	.54	32%
Other	.69	.26	39%
Total	25.22	9.31	38%
Exterior Lights	2.8	.93	33%

The average number of light bulbs for the home is 25.22 which is a little low when compared to other studies. The Department of Energy 2009 CFL Market Profile[4] report uses 2005 California audit data and cites the average number of light bulbs in a home in California is 37.5. This is probably due to the fact that the survey data for this study is self-reported and the DOE study used audit data. People tend to under report the number of light bulbs and sockets in their home in a self-reported survey.

The DOE study also reports national CFL adoption at 70% of households, meaning household with at least one CFL installed (30% do not have any CFLs) whereas this study reports it at 87%. This is probably due to the fact that California is ahead of the nation in CFL penetration[5] and the data from that study being two to four years old. The California Informal Working Group on Lighting's (IWGL) CFL market overview states that in 2008 between 81% and 91% of Californian homes have at least one CFL[6] and the California CFL Market Effects Final Report[7] states that 79% of Californians have at least one CFL. The results from the AMP survey are in line with those findings.

The average number of CFLs per household is high when compared to the DOE study. The DOE reports estimates that there is an average of 4.39 CFLs per home nationally, while this study finds the average number of CFLs is 9.31. The CFL Market Effects report estimated that Californians had 10.3 CFLs per household. This further illustrates the fact that Californians are ahead of the nation in CFL penetration, but the finding that 38% of light bulbs are CFLs is much higher than the 21% estimate given in the IWGL memo using 2008 data and the 29% estimated in the CFL market effects report. There are several possible explanations for this discrepancy:

[4] "Big Results, Bigger Potential: CFL Market Profile," prepared by the U.S. Department of Energy, March 2009.
[5] Ibid, U.S. DOE.
6 Op cit, IWGL memo.
[7] California CFL Market Effects Final Report, Cadmus Group, April 2010.

- Barriers to CFL adoption (poor quality, high price, unavailability) have been coming down and the number of CFLs across the nation and within the average Californian home has been growing steadily so that the statewide average now likely exceeds the penetration rates in both the DOE study and the IWGL memo.
- The average number of lights reported in the AMP survey is notably lower than the national average reported in the DOE; possible undercounting of the total number of lights in the home would lead to an overstatement of the CFL penetration rate (though not the number of CFLs).
- The sample used for this study has certain defining characteristics that may make them more likely to have larger numbers of CFLs installed in their homes. For example, given that we used an email sample of customers who use online bill pay, they are more likely to have visited the utility website and have read the information about the benefits of CFLs.

Currently about a third of outside lights are CFLs. The average number of exterior lights is 2.8 and the average number of exterior CFLs is .93, a CFL penetration rate of 33% for outdoor lighting.

2.4.1 Customer Use of Recently Acquired CFLs

The average number of CFLs obtained by respondents in the last 12 months is 7.18. This includes all CFLs they purchased independently or may have been obtained from AMP events. Of these, they claim to have installed an average of 4.05 lamps they obtained. This is understandable given that CFLs are often sold in multi-paks containing 4 – 10 bulbs. When compared to other studies the AMP customer CFL installation rate is lower than that of IOU customers in California. Installation rates for those utilities ranged from 67 -77% while our findings showed that 60% of CFLs that were obtained in the last year were installed[8]. The fact that 40% of CFLs obtained have not been installed is an interesting finding. In developing the total estimated annual kWh savings from CFLs obtained in the last year, we used the average number of lamps installed. It remains unclear whether the remaining CFLs in storage will be used in the future to replace CFLs when they burn out or replace additional incandescent bulbs. If they replace burned out CFLs or remain in storage, they will not provide new savings. However, if they do ultimately replace incandescent bulbs, they can substantially increase the annual savings achieved by Alameda households.

A third of the light bulbs obtained in the last 12 months replaced working incandescent bulbs. This indicates that in the last year alone, respondents increased the number of CFLs they use by an average of 2.4 lamps. This is quite consistent with the steady growth rate in California reported by the IWGL.

2.4.2 Remaining Potential for Residential CFL Adoption

As stated above, 38% of interior and 33% of exterior sockets currently contain CFLs. According to respondents there are on average 9.12 sockets per home (interior and exterior) that could use a CFL. 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] Final Evaluation Report, Upstream Lighting Program, Volume 1, CALMAC Study ID: CPU0015.01, KEMA, February 2010

2.5 RECOMMENDATIONS

Based on these findings we have several recommendations to improve AMP's CFL programs:

- Raise awareness of AMP programs and promotions. Possible strategies include:
  - Branding AMPs energy efficiency efforts; giving it an easy to remember name or tag line that is included in all promotional materials.
  - Partnering with trade allies and community organizations so they can help get the word out to their customers and members.
  - Using general mass media advertising (radio, cable, billboards) that steers customers to the AMP website.
- Encourage greater installation of CFLs obtained. Purchase is important but savings only accrue when lamps are installed. Possible strategies include:
  - Providing additional suggestions on types of fixtures and locations in the home that are suitable for change-out to CFL lamps. Including explanations of the suitability can help convince people to try these new places.
  - Providing suggestions on when to review whether any additional incandescent bulbs around the home can be replaced by CFLs; e.g., put on the same schedule as replacing smoke detector batteries or furnace filters. Many people choose a notable date, such as Fourth of July to do these tasks.
- Focus on the 13% of customers who do not have any CFLs installed. Promotional materials should attempt to overcome the barriers to install CFLs other than price, such as the quality of the lighting, concerns regarding disposal, and the lack of knowledge about the benefits of CFLs.
- Expand your promotional activities. Possible strategies include:
  - Conducting neighborhood campaigns where volunteers or employees canvas neighborhoods, going door to door handing out free CFLs and educational materials.
  - Using social networking to encourage energy efficiency. For example there could be an AMP Facebook page that promotes events, and challenges "friends" to save energy and share their ideas and experiences.

CHARACTERISTICS OF SURVEY RESPONDENTS

Respondents were asked a limited number of demographic and household questions. These included home ownership, square footage of home, number of bedrooms and bathrooms, gender, education and household income. A summary of these characteristics is included in tables below.

Table A-1 Household Characteristics of Survey Respondents

Characteristic	Percent of Respondents (unweighted)
Home Ownership	
Own home	43%
Rent home	57%
Square footage of home	
Less than 500	3%
500 -999	32%
1,000 – 1,499	29%
1,500 – 1,999	18%
2,000 – 2,999	14%
3,000 or more	4%
Number of bedrooms	
0/Studio/Efficiency apartment	2%
One	22%
Two	39%
Three	24%
Four	10%
Five or more	3%
Number of bathrooms	
One	47%
1.5	12%
Two	18%
2.5	15%
Three or more	8%

Table A-2 Demographic Characteristics of Survey Respondents

Characteristic	Percent of Respondents
Education	
Less than high school degree	>1%
High school degree	4%
Technical/trade school program	3%
Associate degree or some college	16%
Bachelors degree	45%
Graduate/professional degree	32%
Household Income	
Less than $39,999	10%
$40,000 - $49,999	6%
$50,000 - $74,999	20%
$75,000 - $99,999	20%
$100,000 - $149,999	26%
$150,000 or more	18%
Gender	
Female	50%
Male	50%

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