

# **Who's Buying CFLs? Who's Not Buying Them? Findings from a Large-Scale, Nationwide Survey**

*Michael Reid, E Source*

## **ABSTRACT**

A nationwide U.S. sample of residential consumers completed an Internet-based survey that included four questions pertaining to their use of compact fluorescent lamps (CFLs). The questions addressed:

- The number of CFLs in use in the home
- Reasons for using CFLs
- Views on the quality of lighting from CFLs
- Plans to purchase CFLs in the future

Demographic data on respondents and their households was also obtained.

Using this rich data set, we found that CFL usage differs significantly across the states and is distributed unevenly across households, with 21 percent of households accounting for 76 percent of all CFLs in use. Usage is positively correlated with age, income, education, and the length of time people have been in their current home. The opportunity to save on electricity costs is the dominant reason cited for using CFLs. Those who use CFLs are, on the whole, satisfied with the quality of light—over three-fourths say CFLs are the same or better than incandescents— but dissatisfaction rises with the age of the user. Evidence for a “gender gap” in men’s and women’s views of CFLs is equivocal, as men report higher usage, but women’s views on quality and intention to purchase are very similar to men’s. Focusing CFL marketing programs on customers who are not using CFLs should be fruitful, because customers who are using CFLs at any level—even just one per household—are significantly more likely to plan additional CFL purchases.

## **Introduction**

Programs that promote purchase and installation of compact fluorescent lamps (CFLs) are central to the demand-side management (DSM) efforts of utilities and other organizations promoting energy efficiency.

One barrier to effective program planning is the limited availability of data on consumer uptake of CFLs. There is no single, reliable source of state-level CFL sales data. This is due, in part, to incomplete participation of retailers in data collection efforts (Oman et. al. 2007). Further, the limited data available from retail channels tells us little about the purchases of CFLs. We generally do not know, for example, whether CFLs are destined for residential or commercial sockets. Information on who is purchasing CFLs, the motivation for their purchases, and customer satisfaction with CFLs would be of great value in targeting CFL marketing efforts and in designing effective messaging.

E Source was given an opportunity to add energy-related questions to a large-scale survey of U.S. consumers fielded in early 2007. The available space in the survey was limited to

four questions. Having seen an increase in requests from E Source customers (mainly utilities) for CFL-related data, we used our survey space to pose questions on:

- The number of CFLs in use in the home
- Reasons for using CFLs
- Views on the quality of lighting from CFLS
- Plans to purchase CFLs in the future

This paper is based on our analysis of 34,750 responses to these questions.

## **Methodology**

Our four questions were a small component of a much larger survey sponsored by McGraw-Hill Construction ([www.construction.com](http://www.construction.com)) that was intended to identify households that had undertaken home repair or remodeling projects during the preceding year. The survey was implemented by Synovate ([www.synovate.com](http://www.synovate.com)), a market research firm, using its panel of 1.5 million U.S. households that are asked to complete a survey quarterly via the Internet. A wide variety of demographic statistics is available on panel members and their households.

The survey was fielded in the first quarter of 2007. The number of completed surveys was 115,885. Synovate applied a sampling technique with quotas to the data set to select a subset of respondent households whose demographic characteristics are reflective of the U.S. population as a whole along several dimensions: geographic region, population density of community, household income, age of panel member, household size, and whether or not the household is a family unit. This subset, referred to as the “balanced block,” comprised 34,750 completed surveys. All analyses presented below are based on the balanced block.

Gender was not used in selecting the balanced block, except in the case of non-family households. Due to the composition of the panel, respondents are disproportionately female. While this could be a serious impediment for many survey topics, it is arguably a less critical issue for surveys that explore household behavior.

The four CFL questions were worded as follows:

- About how many CFLs are you using in your home today?
- What’s the most important reason you use CFLs in your home?
- Compared to regular incandescent light bulbs, do you think the lighting quality of CFLs is ... (better / about the same / worse / don’t know)?
- How many CFLs do you plan on purchasing in the next year?

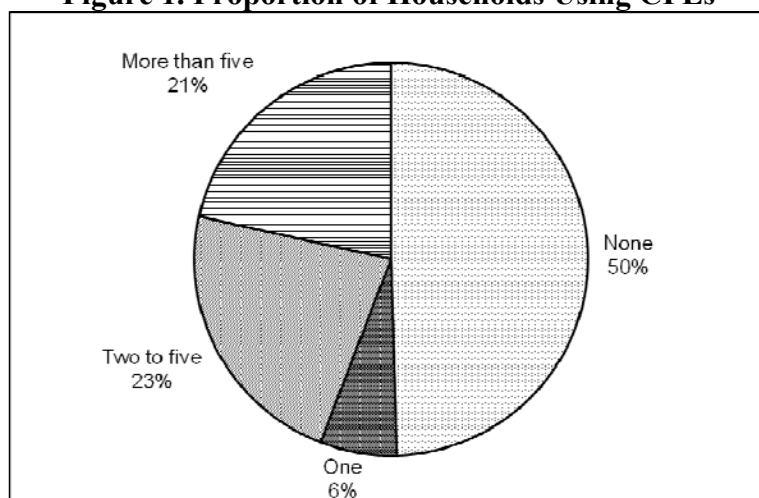
## **Results**

### **Number of CFLs in Use in the Home**

Across all respondent households, the average number of CFLs reported in use is 3.37 bulbs. The 95 percent confidence interval for this value ranges from 3.31 to 3.43. Usage, however, is distributed very unevenly. Figure 1 one show the distribution of the reported number of CFLs per household. Fully 50 percent of respondents said they are using no CFLs. However, those who are using CFLs tend to have more than one. Those whom we might call “heavy

users”—those reporting more than five CFLs in use—average 11.9 CFLs per household and account for 76 percent of all the CFLs in use.

**Figure 1. Proportion of Households Using CFLs**



**Geographic analysis.** CFL usage is distributed unevenly across the states. Table 1 shows the average number of CFLs per household by state. Only one state, Vermont, averages more than five CFLs per household. It should be no surprise that states and regions known for strong DSM programs—for example, New England, the Pacific Northwest, California, Wisconsin, and Idaho—tend to have higher CFL counts per household.

**Table 1. Average CFLs per Household by State**

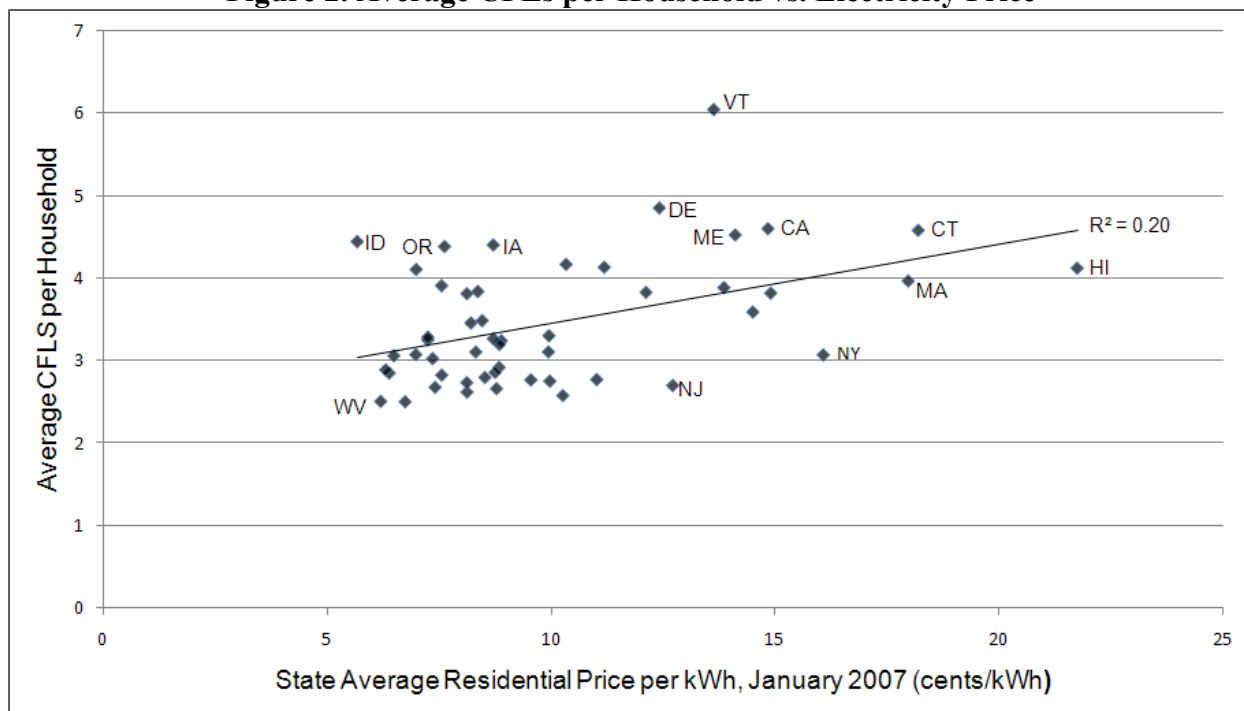
Vermont	6.1	New Mexico	3.8	Nebraska	2.9
Delaware	4.9	Texas	3.8	North Dakota	2.9
California	4.6	Alaska	3.6	Ohio	2.9
Connecticut	4.6	Arkansas	3.5	South Carolina	2.9
Maine	4.5	Minnesota	3.5	Alabama	2.8
Idaho	4.4	Illinois	3.3	Dist. of Columbia	2.8
Iowa	4.4	Mississippi	3.3	Florida	2.8
Oregon	4.4	South Dakota	3.3	Maryland	2.8
Wisconsin	4.2	Wyoming	3.3	Tennessee	2.8
Hawaii	4.1	Colorado	3.2	Georgia	2.7
Nevada	4.1	Louisiana	3.2	Kansas	2.7
Washington	4.1	Arizona	3.1	New Jersey	2.7
Massachusetts	4.0	Michigan	3.1	North Carolina	2.7
Rhode Island	3.9	Missouri	3.1	Pennsylvania	2.6
Utah	3.9	New York	3.1	Virginia	2.6
Montana	3.8	Oklahoma	3.1	Kentucky	2.5
New Hampshire	3.8	Indiana	3.0	West Virginia	2.5

Because the state-level sample sizes differ (roughly in proportion to state population), confidence intervals around the average number of CFLs also vary. For California, the most populous state, the 95 percent confidence interval is  $\pm 0.2$  CFLs. For Wyoming, the least populous state, the 95 percent confidence interval is  $\pm 1.3$  CFLs. Even with a sample size that is huge by conventional survey standards, drilling down to the level of small state exacts a high cost in confidence intervals.

It struck us as curious that one state not often associated with strong DSM programs, Delaware, shows a high per-household average (4.9) even while being surrounded by states with averages below 3.0. But only a few minutes of investigatory work revealed that in fall 2006, the state government funded a program that offered two free CFLs to every household (Thermal 2006).

One might expect that CFL usage would be positively associated with electricity prices: That is, consumers facing higher-than-average electricity prices would turn to CFLs as a way to reduce their electricity bills. Figure 2, which plots average CFL usage against average residential electricity prices as of January 2007, suggests this effect, but several states buck the trend. Vermont and Delaware, for example, have the highest CFL usage even though ten other states have higher electricity prices. And Idaho is sixth-highest in CFL usage even though it has the lowest average electricity price.

**Figure 2. Average CFLs per Household vs. Electricity Price**



A linear regression of CFL usage against price yields a line that slopes up and to the right, indicating that higher prices are associated with higher CFL usage; but the  $R^2$  is only .20, indicating that price alone has low explanatory power. Obviously, non-price factors such as the extent of DSM programs that promote CFLs figure importantly in consumers' usage patterns.

**Demographic analysis.** Using the demographic information on respondents and their households provided in the data set, we looked at household CFL usage by income, education, age, and length of current home occupancy (Table 2).

**Table 2. Average CFLs per Household for Various Demographic Groups**

Household Income		Age	
<\$25,000	2.5	18 – 34	2.8
\$25,000 - \$50,000	3.1	35 – 54	3.3
\$50,000 - \$75,000	3.6	55 and over	3.8
\$75,000 - \$100,000	4.0		
Over \$100,000	4.5		
Education		Years in Home	
High school or less	2.9	1 or under	2.9
Some college	3.2	2 – 5 years	3.2
College graduate	3.6	6 – 10 years	3.4
Graduate study or more	4.2	Over 10 years	3.8

Higher CFL usage is seen at higher levels of income, education, and age. CFL usage is positively correlated with household income, education, and age. Prior to doing the analysis, we surmised that younger persons' greater affinity for new technologies, as well as their presumed environmental leanings, might lead to higher usage among those under age 35—but that turned out not to be the case, possibly because age is usually correlated with income and to some extent with education, and the CFL-income relationship is strong.

Table 2 shows another relationship opposite to our initial hypothesis. We thought that people who had recently moved into their homes might show relatively high CFL usage, since they would have been in the market for bulbs and might be receptive to trying something new—especially since they wouldn't already be accustomed to having certain bulb types in particular fixtures. In reality, respondents who have been in their homes one year or less have the lowest CFL usage. Perhaps persons who have recently moved have the most stretched budgets (due to moving costs, security deposits or down payments, furnishing costs, etc.) and are therefore inclined to go with the lighting technology that has the lowest first cost—incandescent bulbs.

The low usage among customers who have not been in their homes for long suggests a possible avenue for CFL promotion: Utilities might consider targeting new customers when they contact the utility to set up a new account or move an existing account to a new address. For example, utilities could send coupons for CFLs as part of a “customer welcome kit.”

## Nonusers of CFLs

Households that report not using any CFLs are of interest, because they represent obvious targets for utilities seeking to increase CFL penetration. For this nonuser analysis, we narrowed the respondents to the subset from California—3,482 in all—as a rough way of controlling for the influence of utility programs.

For the California sample as a whole, 37 percent of households are nonusers. This is well below the national average of 50 percent (Figure 1), surely due in part to the influence of utility programs. Table 3 shows the percentage of nonusers among various demographic groups. By comparing the values in the table to the 37 percent statewide average, it is apparent that nonusers

are more likely to be on the lower end of the income, education, and age scales; to rent their homes; to live in multifamily dwellings; and to have occupied their homes one year or less.

**Table 3. Percentage of Nonusers  
for Various Demographic Groups in California**

<b>Household Income</b>		<b>Years in Home</b>	
<\$25,000	41%	1 or under	46%
\$25,000 - \$50,000	40%	2 – 5 years	38%
\$50,000 - \$75,000	37%	6 – 10 years	35%
\$75,000 - \$100,000	37%	Over 10 years	33%
Over \$100,000	30%	<b>Home Type</b>	
<b>Education</b>		Multifamily	45%
High school or less	45%	Duplex	33%
Some college	38%	Townhome	42%
College graduate	37%	Single family detached	33%
Graduate study or more	30%	Mobile home	35%
<b>Age</b>		<b>Home Ownership</b>	
18 – 34	44%	Own	31%
35 – 54	37%	Rent	45%
55 and over	32%		

Values may be compared to 37%, the percentage of all California respondents who are nonusers of CFLs.

## Reasons for Using CFLs

The second of our four questions asked, “What’s the most important reason you use CFLs in your home?” As implied by the wording, only those respondents who said they have one or more CFLs in use were asked this question. Respondents were asked to choose one of six answers:

- “Lower electricity costs”
- “Environmental benefits”
- “Long life of bulb”
- “Rebate or other financial incentive”
- “All of the above”
- “None of the above”

Table 4 shows the responses to these questions. It is interesting to note the dominance of the electricity-cost and long-life arguments. Environmental benefits, which figure prominently in many CFL campaigns, are a distant third. (The inclusion of an “all of the above” option in the responses, however, muddies the waters.)

Although we surmised that responses to this question might differ by age, the responses were virtually identical across the age categories. Younger respondents exhibit no greater interest in CFLs environmental benefits and no less interest in their bill-reducing and durability attributes.

**Table 4. Most Important Reason for Using CFLs  
(Among Current Users)**

<b>Reason</b>	<b>Current Users (%)</b>
Lower electricity costs	34
Long life of bulb	28
Environmental benefits	8
Rebate or other financial incentive	1
All of the above	25
None of the above	3

We did find a weak relationship between reasons for using CFLs and the education level of respondents. Table 5 shows that “lower electricity costs” becomes less of motivator for using CFLs at higher levels of educational attainment, while “environmental benefits” moves in the opposite direction, becoming more prominent among the well-educated.

**Table 5. Most Important Reason for Using CFLs vs. Education (Among Current Users)**

<b>Reason</b>	<b>High school or less (%)</b>	<b>Some college (%)</b>	<b>College graduate (%)</b>	<b>Graduate study or more (%)</b>
Lower electricity costs	39	35	33	32
Long life of bulb	28	28	29	27
Environmental benefits	4	6	10	13
Rebate or other financial incentive	1	1	1	1
All of the above	23	26	25	24
None of the above	5	3	3	3

Still, at all education levels, “lower electricity costs” and “long life of bulb” remain the dominant reasons for CFLs, suggesting that program administrators should focus their messaging on those attributes.

### **Lighting Quality**

The third question, on lighting quality, asked whether CFLs were “better,” “about the same,” or “worse” in lighting quality compared to incandescents. “Don’t know” was also presented as an option. While all respondents were asked this question, the analyses below are based only on the responses from those currently using CFLs in their home.

Table 6 indicates a relationship between perceived lighting quality and age. Among the youngest group of respondents (those under 35), 38 percent say CFLs are better than incandescents. But the proportions favoring CFLs over incandescents are lower in the higher age groups. The percentages for “worse” move in the opposite direction.

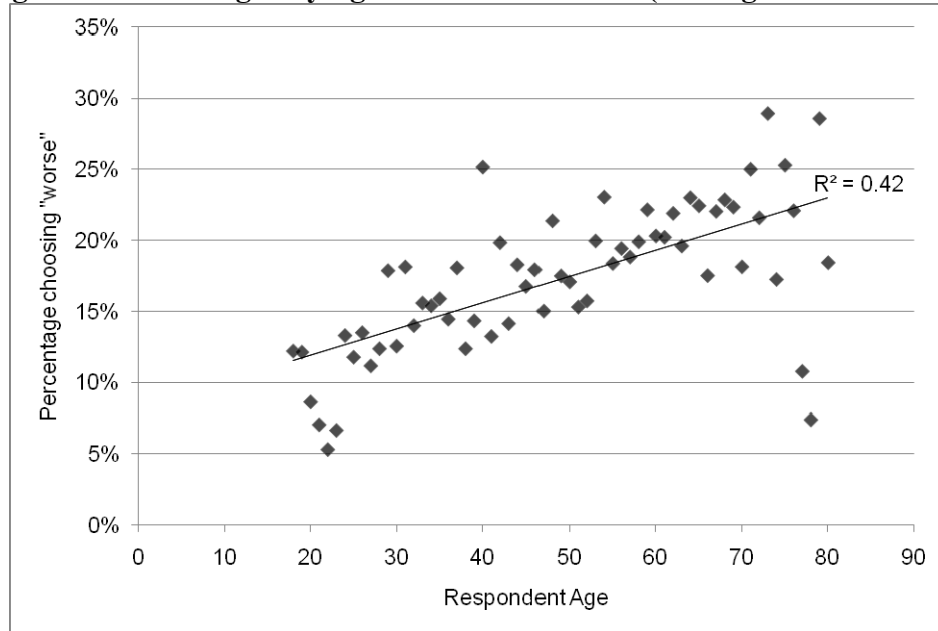
**Table 6. Quality of CFLs Relative to Incandescents (Among Current Users)**

Quality	Age 18 to 34 (%)	Age 35 to 54 (%)	Age 55+ (%)
Better	38	31	27
Same	44	48	49
Worse	13	17	21
Unsure	5	4	3

A striking finding is that over three-fourths of those using CFLs say that the lighting quality is equal or better to that of incandescents. This holds true across all age groups. We suggest that programs promoting CFLs might use this finding to address head-on the skepticism among non-users about CFLs' lighting quality.

Curious about the apparent relationship between age and dissatisfaction with CFLs' lighting quality, we constructed a scatter plot (Figure 3) that shows at every age the percentage of respondents who chose the "worse" option. The linear relationship is unambiguous. A linear regression yielded an  $R^2$  of .42.

**Figure 3. Percentage Saying CFLs Are "Worse" (Among Current Users)**



Lighting designers know that as people age, greater lighting levels are required, because less light reaches the retina (Noell-Waggoner 2006). And E Source has found that manufacturers often exaggerate the lumen equivalence of CFLs—e.g., claiming that a 13-watt CFL has the light output of a 60-watt bulb—and that the lighting quality may be affected adversely by lamp age, position, temperature, and other factors (E Source 2005). Taking these factors into consideration, we suggest that program administrators should be careful not to oversell the benefits of CFLs and should consider education and messaging oriented to the needs of older consumers.



## Is There a CFL “Gender Gap”?

A 2007 article in the *Washington Post* described a phenomenon that has been reported anecdotally for years: Men sneak CFLs into fixtures—then their spouses remove them, ostensibly because they dislike the quality of light from the bulbs (Harden 2007). We realized that our data set could either support or refute the notion that CFLs are less acceptable to women.

One measure of acceptability is the number of CFLs in use. If men are more favorably disposed to CFLs than women, then we should be able to observe that effect if we tabulate respondents’ self-reported CFL counts by gender. Because respondents were asked to report the number of CFLs in use in their *household*—as opposed to their personal use of CFLs—we narrowed the respondent base for this analysis to persons living alone. (Presumably those respondents made their own bulb choices.) Among this group, on average, men in one-person households say they have 3.2 CFLs in use, significantly more than the 2.3 CFLs reported by women in one-person households. These data do indeed lend credence to a “gender gap”—assuming that men and women are equally accurate in their reporting.

When, however, we broke out by gender respondents’ views on the quality of CFL lighting, a different picture emerged. As shown in Table 7, men’s and women’s answers to the quality question are very similar, calling into question the hypothesis that women tend to dislike CFLs.

**Table 7. Quality of CFLs Relative to Incandescents by Gender (Among Current Users)**

Quality	Women (%)	Men (%)
Better	38	31
Same	44	48
Worse	13	17
Unsure	5	4

We also tabulated by gender the responses to our fourth question: “How many CFLs do you plan on purchasing in the next year?” Table 8 shows the results. To this question, men’s and women’s responses were essentially identical.

**Table 8. Planned Purchases of CFLs by Gender**

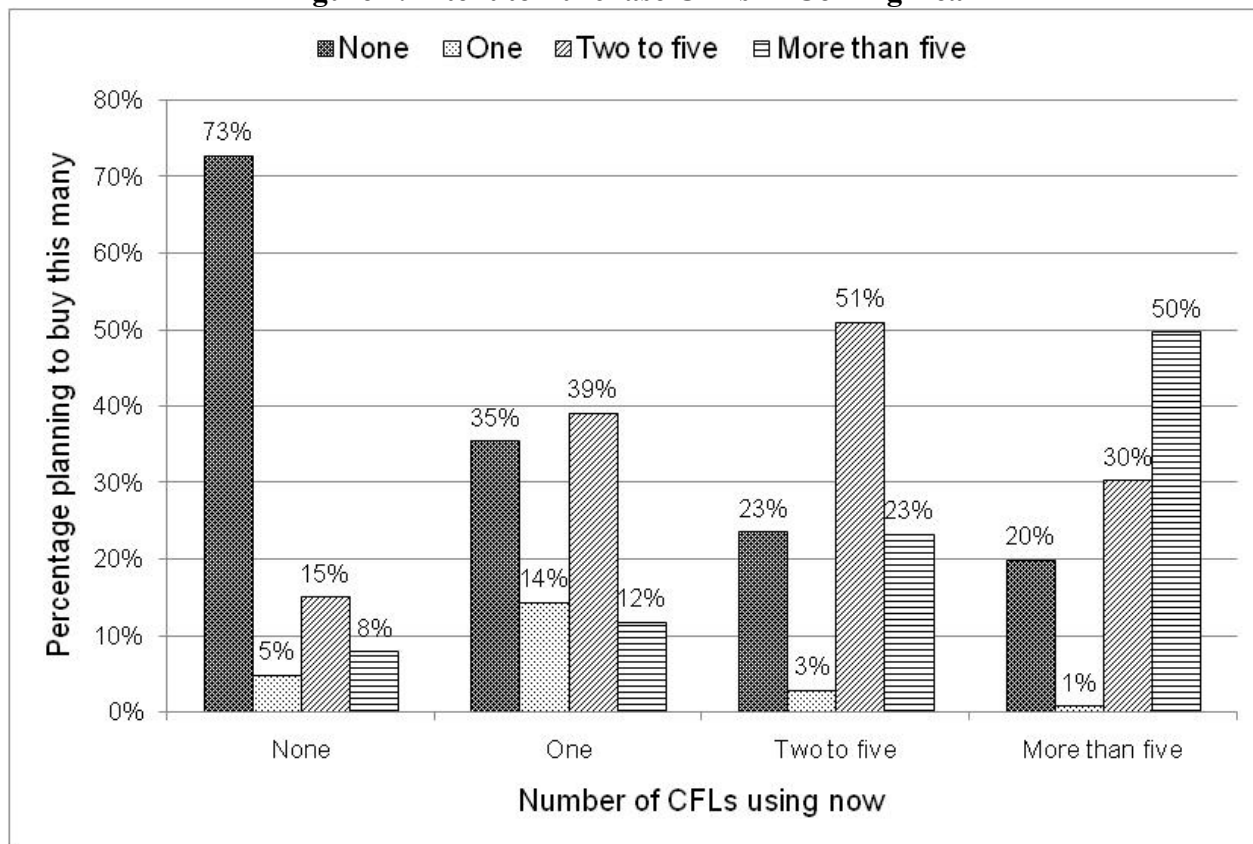
Number of CFLs	Women (%)	Men (%)
None	48	48
One	4	4
Two to five	28	28
More than five	21	20

To sum up, the evidence is mixed. While men reported using more CFLs (as determined from the subset of respondents in single-person households), the two genders’ views on quality and their plans to purchase CFLs are so similar as to call into question the supposition that there is a CFL gender gap.

## More on Planned Purchases

Our final analysis drilled down into respondents' CFL purchase plans in order to examine the influence of current CFL usage on the intent to make future purchases. In Figure 4, we divided all respondents into groups representing the number of CFLs currently in use: none, one, two to five, or more than five. Within each group, respondents are categorized by the number of CFLs they said they will purchase in the coming year.

**Figure 4. Intent to Purchase CFLs in Coming Year**



We call this the “good news/bad news” graph. Looking at the right end of the graph, the good news is that many of those who already are relatively heavy users of CFLs—having more than five in use—expect to be heavy *purchasers* in the year ahead: 50 percent of respondents in this group say they will buy more than five additional CFLs.

The bad news is found on the left end of the graph. Of those respondents who aren't using any CFLs, an overwhelming majority—73 percent—have no intent to purchase CFLs in the coming year.

More encouraging news is found among those who say they have one CFL: 65 percent of respondents in this group say they make CFL purchases in the coming year; and a majority (51 percent) say they will buy two or more. In other words, moving people from nonusers to single-CFL users should pay big dividends.

## Conclusions

With half of all households not currently using any CFLs, and heavy usage (more than five CFLs) concentrated in just one-fifth of households, the potential for increasing the uptake of this key energy efficiency technology remains substantial. Low- and non-usage of CFLs is associated with younger ages, lower income levels, lower educational attainment, and lower-cost forms of housing. Utilities and other program sponsors should consider marketing efforts targeted to these demographic groups.

Based on respondents' reported reasons for using CFLs, promotional messages that stress the utilitarian advantages of CFL—lower energy costs and longer life—should resonate well across all ages and educational levels. Program sponsors should also consider touting the fact that over three-fourths of users say that the lighting quality of CFLs equals or betters that of incandescents. There does not appear to be a strong basis for differentiating promotional messages by gender.

The central challenge facing program designers and implementers is to convert CFL nonusers to users—even very modest ones. If they can be persuaded to put just one CFL in service, the odds of stimulating future purchases are greatly improved.

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