**Table 28. Plans for Stored Spare Program CFLs**

| Do you plan on using the remaining CFLs in the next year? | Participants with Spare Program Bulbs in Storage (N=64) | |
|---|---|---|
| | N | % |
| Plan on using remaining program CFLs in the next year | 46 | 71.9% |
| Do not plan on using remaining program CFLs in the next year | 6 | 9.4% |
| Not sure / don't know if all program CFLs will be used in the next year | 12 | 18.8% |

The six surveyed customers with spare bulbs in storage who do not think they will install all of the bulbs in the next year were asked why not. These responses are listed below; three of these six customers have concerns about the toxicity and quality of CFLs, while the other three don't think they will have enough available sockets to install all of their spare bulbs within the next year.

- *I have concerns about the mercury content of the bulbs.* (N=2)
- *The CFLs are not bright enough and take too long to warm up.*
- *I already had some CFLs that I bought previously; I probably won't use them all that quickly.*
- *I don't have anywhere else to install them and the CFLs will last a long time.*
- *I doubt that I will need to install all 13 of the remaining bulbs within the next year.*

All customers with spare CFLs that have not been installed yet were asked why they have not installed all of their program bulbs yet; their reasons for not installing all bulbs are shown in Table 29. The three reasons given most frequently all have to do with a lack of empty and available sockets: "waiting for standard bulbs to burn out" (68.8% or 44 out of 64), "waiting for CFLs to burn out" (53.1% or 34 out of 64) and "already installed everywhere they will fit" (25.0% or 16 out of 64). Reasons that have to do with the quality of the bulbs were mentioned by fewer than 10% of customers surveyed.

**Table 29. Reasons for Not Installing All Program CFLs**

| What are the reasons that you have not installed [your spare bulbs stored for future use]? | Participants with Spare Program Bulbs in Storage (N=64) | |
|---|---|---|
| | N | % |
| I am waiting for my other standard bulbs to burn out | 44 | 68.8% |
| I am waiting for my other CFL bulbs to burn out | 34 | 53.1% |
| I already have CFLs installed everywhere they will fit | 16 | 25.0% |
| The other lamps or light fixtures in my home are on a dimmer switch and don't work with the CFLs | 4 | 6.3% |
| The CFL bulbs are too dim for the other locations where I could install them | 3 | 4.7% |
| I don't like the way the CFL bulbs look in some of my fixtures | 3 | 4.7% |
| I have concerns about the mercury content of the bulbs | 2 | 3.1% |
| Other reasons (listed below) | 6 | 9.4% |
| Don't know / not specified | 1 | 1.6% |

*Percentages may total to more than 100% because participants could give multiple responses.*

Six surveyed customers gave unique reasons for not installing all of the program CFLs. These responses are listed below.

- *I am waiting for someone to help me install the bulbs in my ceiling fixtures.*
- *The CFL bulbs don't work properly in my outdoor fixtures.*
- *The CFLs are too large for my glass globe-encased lights.*
- *The CFL bulbs take too long to warm up.*
- *I am reluctant to change to CFLs. I still really like standard incandescent bulbs.*
- *I can't find them. I really can't remember where I stored them.*

Customers were asked how long they think it will take them to install all of the bulbs they received through the direct mail CFL program. Only 4.9% (4 out of 81) think they will take more than two years to use all the bulbs, and another 2.5% (2 out of 81) don't plan to use their remaining bulbs, as seen in Table 30.

**Table 30. Estimated Length of Time Until All Program-Provided Bulbs are Installed**

| How long do you think it will be before you will have installed al of the free bulbs you received from this Duke Energy program? | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| Already installed (and/or given away) all program bulbs | 17 | 21.0% |
| 1 year or less | 38 | 46.9% |
| 13 to 24 months | 12 | 14.8% |
| 25 to 36 months | 1 | 1.2% |
| 37 to 48 months | 2 | 2.5% |
| More than 5 years | 1 | 1.2% |
| Don't plan to use remaining bulbs | 2 | 2.5% |
| Don't know / not specified | 8 | 9.9% |

## CFL Order Tracking System

TecMarket Works asked all survey respondents if they were aware of the direct mail program's online order tracking tool which allows participants the option to check their CFL order status. As seen in Table 31, only 3.7% (3 out of 81) of surveyed participants used the tracking system, although 19.8% (16 out of 81) were aware of its existence.

**Table 31. Awareness and Use of the Order Tracking System**

| Awareness and Use of the Order Tracking System | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| Aware of order tracking and used it | 3 | 3.7% |
| Aware of order tracking system but did not use it | 12 | 14.8% |
| Aware of order tracking system but not sure if used it | 1 | 1.2% |
| Not aware of order tracking system | 65 | 80.2% |

Among the three participants who used the tracking system, the average satisfaction rating for this aspect of the program is 9.0 on a 10-point scale (these three customers gave ratings of "10", "8" and "don't know").

The online order tracking system has a low awareness rate and a very low participation rate. While the mean satisfaction rating for the tracking system is very high among users, the low participation rate, even among those aware of the tool, indicates that a large majority of respondents do not currently find it to be a useful part of the CFL direct mail program.

# Future CFL and LED Intentions

Survey participants were asked whether their experience with Duke Energy's free CFL direct mail program made them more or less likely to use CFLs in the future. A large majority of these customers (76.5% or 62 out of 81) said they would be more likely to purchase and install CFLs, while only 6.2% (5 out of 81) said they would be less likely to, as seen in Figure 5.

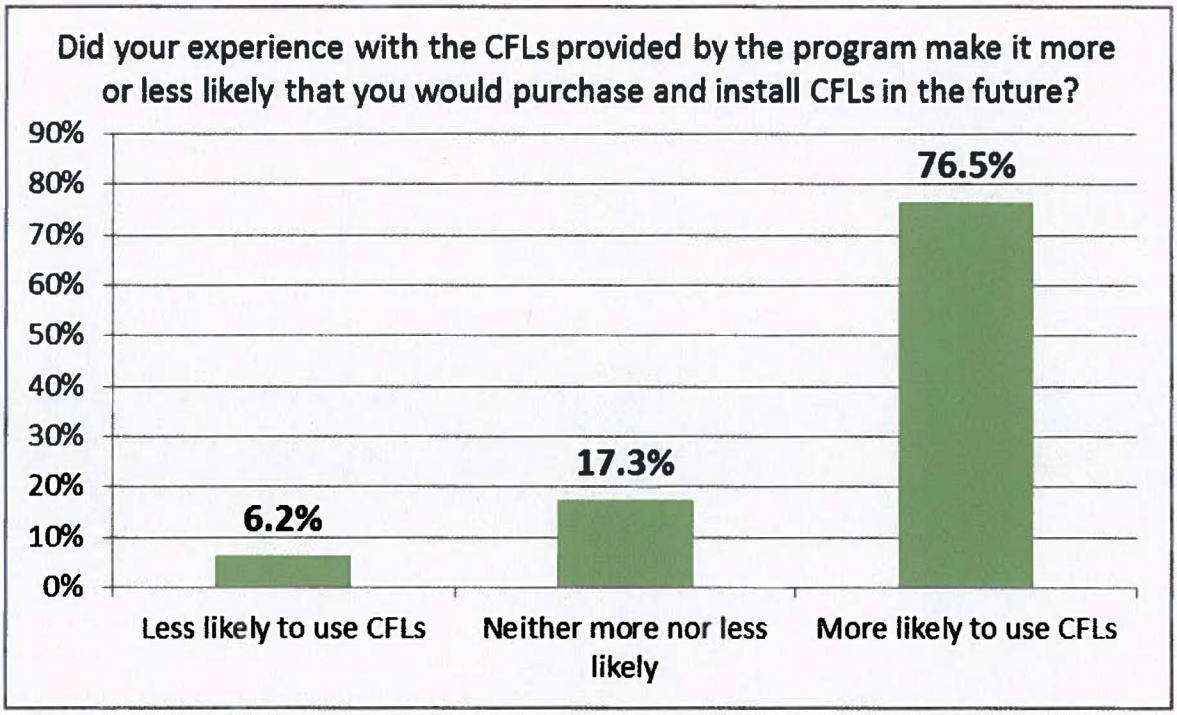


**Figure 5. Effect of the Program on Future CFL Purchase and Installation (N=81)**

Customers who said their experience with the program made them more or less likely to purchase and install CFLs in the future were asked why. The "more likely" responses are categorized in Table 32, followed by the list of "less likely" responses.

The most frequently cited reasons why customers say they are more likely to purchase and install CFLs in the future are that they prefer the quality of the CFL bulbs and their light to standard bulbs (46.8% or 29 out of 62), the greater longevity of CFLs (32.3% or 20 out of 62), and the fact that using them saves energy (30.6% or 19 out of 62).

**Table 32. Reasons Customers Would Be More Likely to Use CFLs in the Future**

| Reasons | Participants Who Are More Likely To Use CFLs (N=62) | |
|---|---|---|
| | N | % |
| Prefer CFLs / like the quality of CFL light | 29 | 46.8% |
| Greater longevity of CFLs | 20 | 32.3% |
| Save energy by using CFLs | 19 | 30.6% |
| Save money by using CFLs | 13 | 21.0% |
| Had the opportunity to try them / get used to them | 12 | 19.4% |
| Incandescent bulbs are being phased out / less available | 3 | 4.8% |
| Better for the environment / green | 2 | 3.2% |
| LEDs are still too expensive | 2 | 3.2% |
| Other (listed below) | 2 | 3.2% |
| General positive comments | 2 | 3.2% |

*Percentages may total to more than 100% because participants could give multiple responses.*

Two customers who say they are more likely to use CFLs in the future gave unique reasons, which are listed below.

- *Because they produce less heat.*
- *They were recommended by Duke Energy.*

Among the five surveyed customers who said they would be less likely to use CFLs, two are concerned about the mercury content of the bulbs (2.5% of 81 surveyed), and the other three dislike the high cost of bulbs and/or the light quality.

**Reasons customers would be less likely to use CFLs in the future (N=5)**

- *CFLs are too expensive. They cost way too much for me to afford.*
- *The bulbs cost more and I dislike the dim light quality and the time it takes for them to warm up.*
- *Unless the light quality improves, I will still prefer incandescent.*
- *I have concerns about the mercury content of the bulbs, and I'm also disappointed that the outside of the CFL package lacks a prominent warning label.*
- *I am concerned about the mercury content of the bulbs.*

TecMarket Works asked survey respondents to rate the likelihood, on a 1-to-10 scale, of continuing to use CFLs, of replacing any bulb with a CFL, and of telling friends or family about the CFL program. Likelihood ratings for all three of these questions are quite high, averaging about 8.6 for likelihood to use CFLs in the future and to replace bulbs with CFLs, and an even higher 9.14 for telling others about the free CFL program (significantly higher than the first two ratings at $p<.05$ using student's t-test). For all three of these ratings questions, the majority of participants surveyed gave the highest possible score of "10 out of 10" (70.4% or 57 out of 81 for telling others about the offer, 55.6% or 45 out of 81 for both of the other two ratings). The mean rating scores for these three questions are shown in Table 33, and the complete distributions are shown in Figure 6.

**Table 33. Mean Ratings of Likelihood of Three Behaviors Across All Participants**

| Likelihood Ratings | Valid N | Average Rating |
|---|---|---|
| Likelihood to continue to use CFLs | 80 | 8.59 |
| Likelihood to replace bulb with CFL | 81 | 8.58 |
| Likelihood of telling friends/family about this offer | 81 | 9.14 |

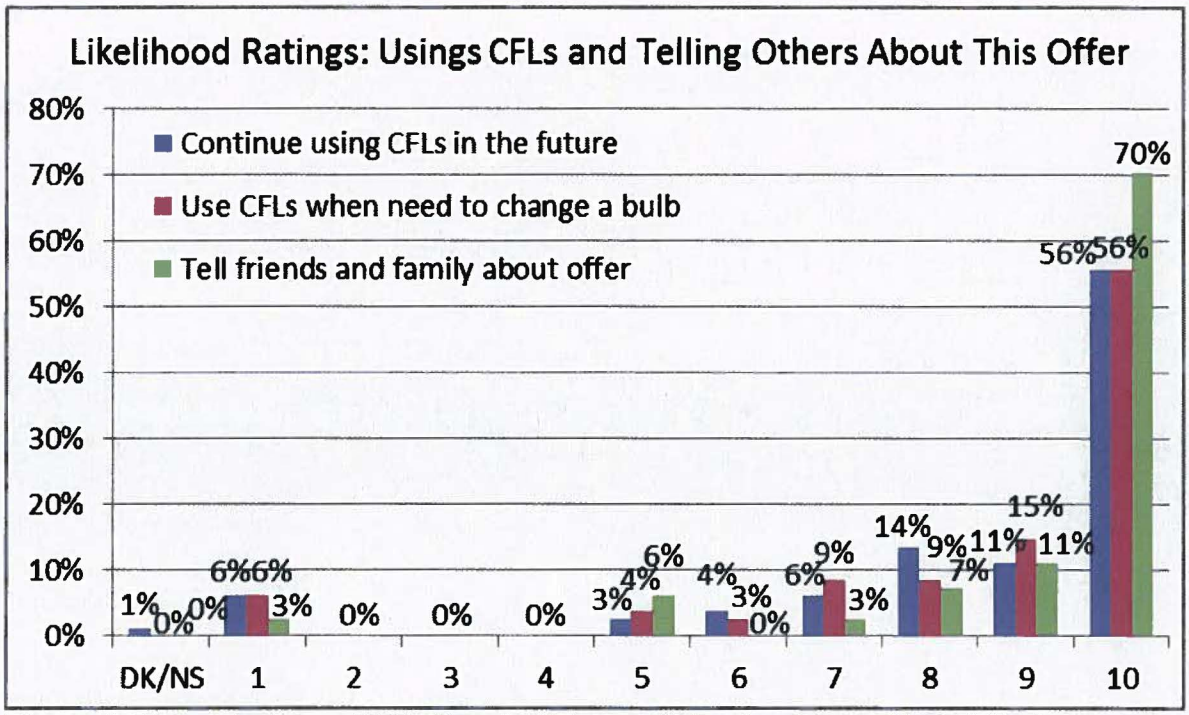


**Figure 6. Mean Ratings of Likelihood of Future Behaviors Regarding CFLs by Respondents (N=81)**

## Intent to Purchase LED Light Bulbs and Interest in a Direct Mail LED Program

In addition to questions about intentions for future CFL usage, this survey also asked program participants about their intentions to use LED bulbs. Figure 7 shows that only 13.6% (11 out of 81) of customers surveyed say they are more likely to purchase LEDs after participating in the Duke Energy CFL program, while 38.3% (31 out of 81) say they are less likely to use LEDs after the program. A plurality of 48.1% (39 out of 81) say they are neither more nor less likely to use LEDs since participating in the program.

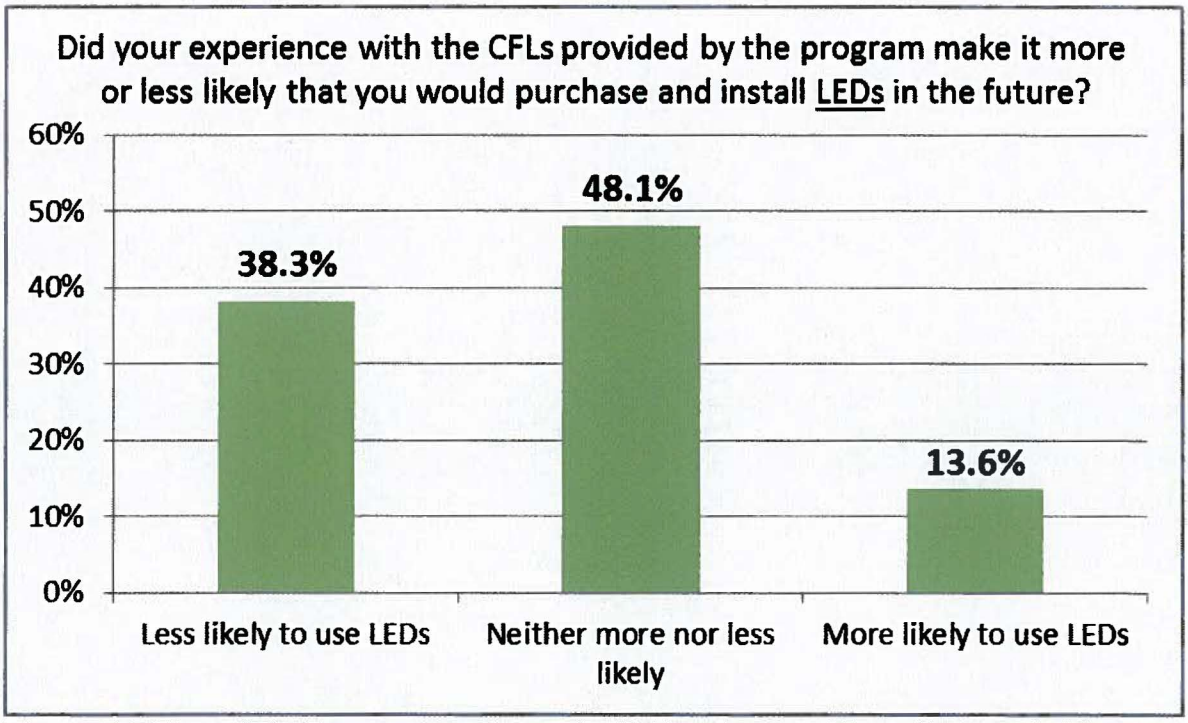


**Figure 7. Effect of the Program on Future LED Purchase and Installation (N=81)**

Customers who said their experience with the program made them more or less likely to purchase and install LEDs in the future were asked why. The "more likely" responses are listed below, followed by the "less likely" responses categorized in Table 32.

Among the eleven surveyed customers who said they would be more likely to use LEDs, four (4.9% of 81 surveyed) said the reason was that they were interested in trying out new lighting technologies. One customer said they are more likely to use LEDs based on their past experience with this type of bulb, and the remaining reasons for being more likely to use LEDs in the future have to do with qualities of the bulbs: their efficiency, longevity, brightness, light quality and ability to dim.

**Reasons customers would be more likely to use LEDs in the future (N=11)**

- *Mostly because of LED aesthetics: They are a more attractive bulb and the type of light they emit is more attractive. Also, they are supposed to have a greater longevity.*
- *I am more likely to use LEDs in the future based on their longevity, light quality, and because they generate less heat.*
- *LEDs save energy and money.*
- *LEDs are brighter and more energy efficient.*
- *LEDs are more energy efficient.*
- *LEDs are dimmable.*
- *I guess I'd just like try them, to see what they are like.*
- *I would like to have the chance to try LEDs and see how they work in every room to compare them to other lighting methods.*
- *I'm willing to give any new lighting options a try.*

- *Since I took advantage of the CFL program and it gave me more experience with the CFLs, I am willing to try new light bulb technologies as they are available to me.*
- *I have used LEDs before and they work well.*

The most frequently cited reasons why customers say they are less likely to purchase and install LEDs in the future are that they just don't know what LED bulbs are, that they have no experience with them, and/or that they don't see any reason to use them (45.2% or 14 out of 31 customers who say they are less likely to use LEDs in the future). The higher purchase price of LED bulbs was mentioned by 16.1% (5 out of 31) of these customers.

**Table 34. Reasons Customers Would Be Less Likely to Use LEDs in the Future**

| Reasons | Participants Who Are Less Likely To Use LEDs (N=31) | |
|---|---|---|
| | N | % |
| Don't know what LEDs are / no experience with them / don't see any reason to switch | 14 | 45.2% |
| Too expensive / not worth the extra expense | 5 | 16.1% |
| Don't like LEDs / prefer CFLs or incandescent bulbs | 4 | 12.9% |
| Concerns with light quality (brightness, color, etc.) | 3 | 9.7% |
| Still have CFLs left over from program / don't need any more bulbs right now | 2 | 6.5% |
| Other reasons (listed below) | 4 | 12.9% |

*Percentages may total to more than 100% because participants could give multiple responses.*

Four customers who say they are less likely to use LEDs in the future gave unique reasons why, which are listed below.

- *I don't think of LEDs as bulbs for the house. I've never considered them for interior home lighting.*
- *I feel safer using incandescent bulbs.*
- *I don't think the LEDs are going to be compatible with my existing light fixtures.*
- *Once we saw the energy savings with using the CFLs, we thought it was crazy not to switch from LEDs to CFLs.*[11]

Respondents were also asked to rate the likelihood that they will purchase and use LEDs in the future, and their interest in Duke Energy launching a direct mail LED program similar to the CFL program under evaluation. These ratings are on a 10-point scale with "10" meaning very likely or very interested. The average rating of the likelihood of purchasing and using LEDs in the future is a moderate 4.53 on a 10-point scale, while the average rating of interest in a Duke Energy direct mail LED program is significantly higher at 6.54 on a 10-point scale ($p<.05$ using student's t-test). The complete distributions of these two ratings questions are shown in Figure 8: While only 28.4% (23 out of 81) of participants rate their likelihood of purchasing and using

[11] According to this customer's responses, they are either confused about the difference between incandescent and LED bulbs (and they never really had any LEDs installed), or else they mistakenly believe that CFLs are more efficient than LEDs (and they really did uninstall LEDs and replace them with CFLs). This customer's "LED" bulbs were installed in their home by a contractor during remodeling, and were not purchased or installed by the customer.

LEDs in the future at "6" or higher on a 10-point scale, fully 61.7% (50 out of 81) rate their interest in participating in a direct mail LED program at "6" or higher on a 10-point scale.

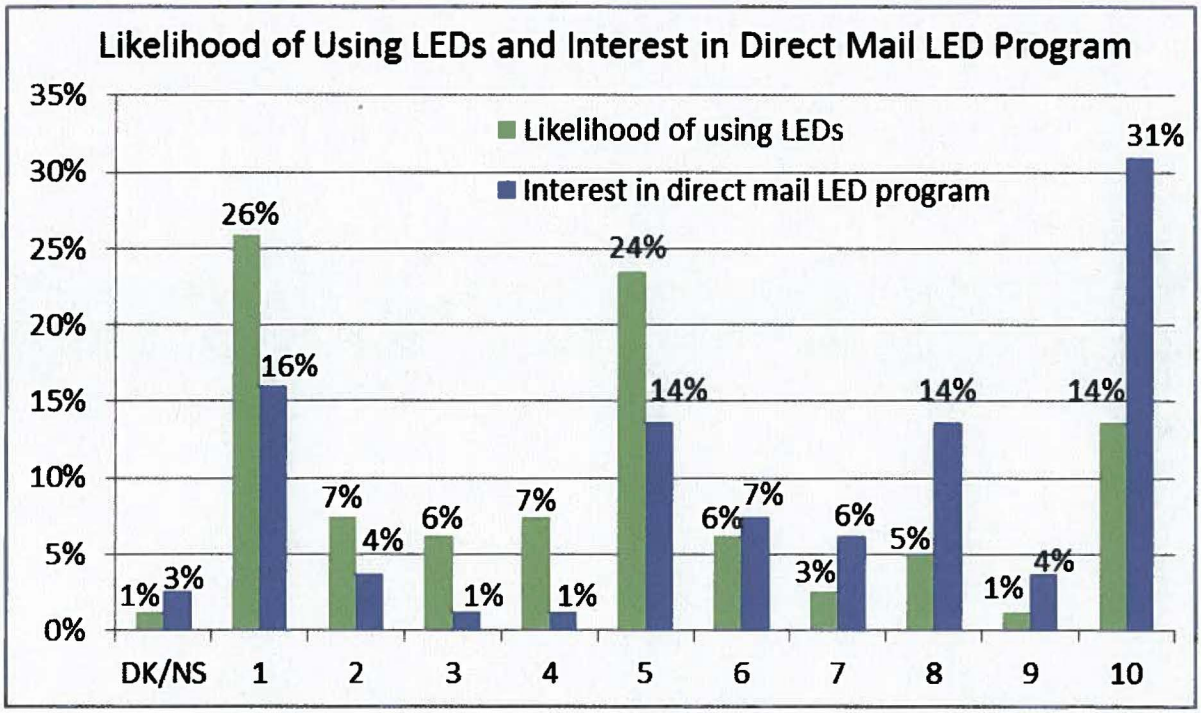


**Figure 8. Effect of the Program on Future LED Purchase and Use and Interest in a Direct Mail LED Program (N=81)**

## Incandescent Light Bulbs: Sockets Installed and Bulbs in Storage

Survey respondents were also asked to estimate the number of installed bulbs in their home that are standard incandescent bulbs, and how many of these bulbs are used for more than two hours per day, as well as the number of spare standard incandescent bulbs they still have in storage for future use. The results are shown in Table 35. The average participant home still has more than eight sockets with incandescent bulbs, about a third of these are used more than two hours per day, and they have about four standard bulbs in storage for future use. Furthermore, about one in five customers surveyed (19.8% or 16 out of 81) currently have no standard incandescent bulbs installed in their home, and about two in five (39.5% or 32 out of 81) have no incandescent bulbs in storage for future use.

**Table 35. Estimated Number of Sockets Available and Stored Incandescent Light Bulbs**

| Number of Incandescent Bulbs Still In Use | All Surveyed Participants (N=81) |
|---|---|
| Average number of incandescent bulbs still installed in home | 8.43 |
| Average number of incandescent bulbs used at least 2 hours/day | 2.78 |
| Average number of incandescent bulbs in storage for future use | 3.89 |
| Percent of respondents with zero incandescent bulbs installed | 19.8% |
| Percent of respondents with zero incandescent bulbs in storage | 39.5% |

## Intentions for Future Light Bulb Purchases: Distribution of Types of Bulbs

Surveyed customers were asked how many of the next ten light bulbs they purchase will be standard incandescent (or halogen), CFL and LED bulbs. As seen in Table 36, most participants surveyed intend to buy both CFLs (84.0% or 68 out of 81) and standard incandescent or halogen bulbs (65.4% or 53 out of 81), though only about one in six (16.0% or 13 out of 81) has any intention of buying LED bulbs at this point. The majority of bulbs these customers intend to purchase in the future will be CFLs (61.8% or 473 out of 765 bulbs), while about a third will be standard incandescent or halogen bulbs (33.3% or 255 out of 765) and only about one in twenty bulbs purchased will be LEDs (4.8% or 37 out of 765).

**Table 36. Purchase Intent: Next Ten Bulbs Purchased**

| Of the Next Ten Light Bulbs You Purchase, How Many Will Be...? | All Surveyed Participants (N=81) |
|---|---|
| % of surveyed customers who intend to buy at least one incandescent and/or halogen bulb | 65.4% |
| % of surveyed customers who intend to buy at least one CFL bulb | 84.0% |
| % of surveyed customers who intend to buy at least one LED bulb | 16.0% |
| | **All Bulbs To Be Purchased (N=765)[12]** |
| Percentage of next ten bulbs that will be incandescent and/or halogen bulbs | 33.3% |
| Percentage of next ten bulbs that will be CFL bulbs | 61.8% |
| Percentage of next ten bulbs that will be LED bulbs | 4.8% |

*Percentages in the first three rows total to more than 100% because participants could give multiple responses. Percentages in the bottom three rows are mutually exclusive and add up to 100%.*

Figure 9 presents the distribution of future bulb purchases in the form of an area chart as a visual aid: the Y-axis shows the distribution of bulbs intended to be purchased, and the X-axis shows all 79 valid responses sorted by the distribution of bulb types. The chart shows that none of the customers surveyed intend to purchase exclusively LEDs (and only one surveyed customer intends to buy more than 50% LEDs). In fact, most customers who intend to purchase any LEDs at all are intending to purchase a mix of all three categories of bulbs (out of thirteen customers who intend to purchase LEDs, seven intend to purchase all three categories of bulbs, while two respondents intend to purchase all incandescent bulbs and LEDs, and four customers intend to purchase all CFLs and LEDs).

Furthermore, 22 out of 81 customers surveyed (27.2%) say they intend to purchase exclusively CFLs for their next ten bulbs, while 9 out of 81 (11.1%) intend to purchase all standard

[12] All 81 respondents answered the question about the next ten bulbs they intend to purchase. Two respondents said they "don't know" what their next ten bulbs purchased will be, and across the other 79 respondents there were an additional nine bulbs that were categorized as "don't know". Additionally, there were 16 bulbs that were categorized as standard fluorescent tubes. When calculating the percentage of incandescent/halogen, CFL and LED bulbs purchased, "don't know" and standard fluorescent tubes were not included in the analysis. Thus the base number of intended bulb purchases is 765 bulbs (10 bulbs times 81 respondents minus 29 "don't know" bulbs and 16 standard fluorescent tubes).

incandescent and halogen bulbs for their next ten bulbs. If CFLs and LEDs are considered together as a single category of high efficiency bulbs, then about a third (32.1% or 26 out of 81) of participants surveyed plan to buy exclusively high efficiency bulbs the next time they buy bulbs.

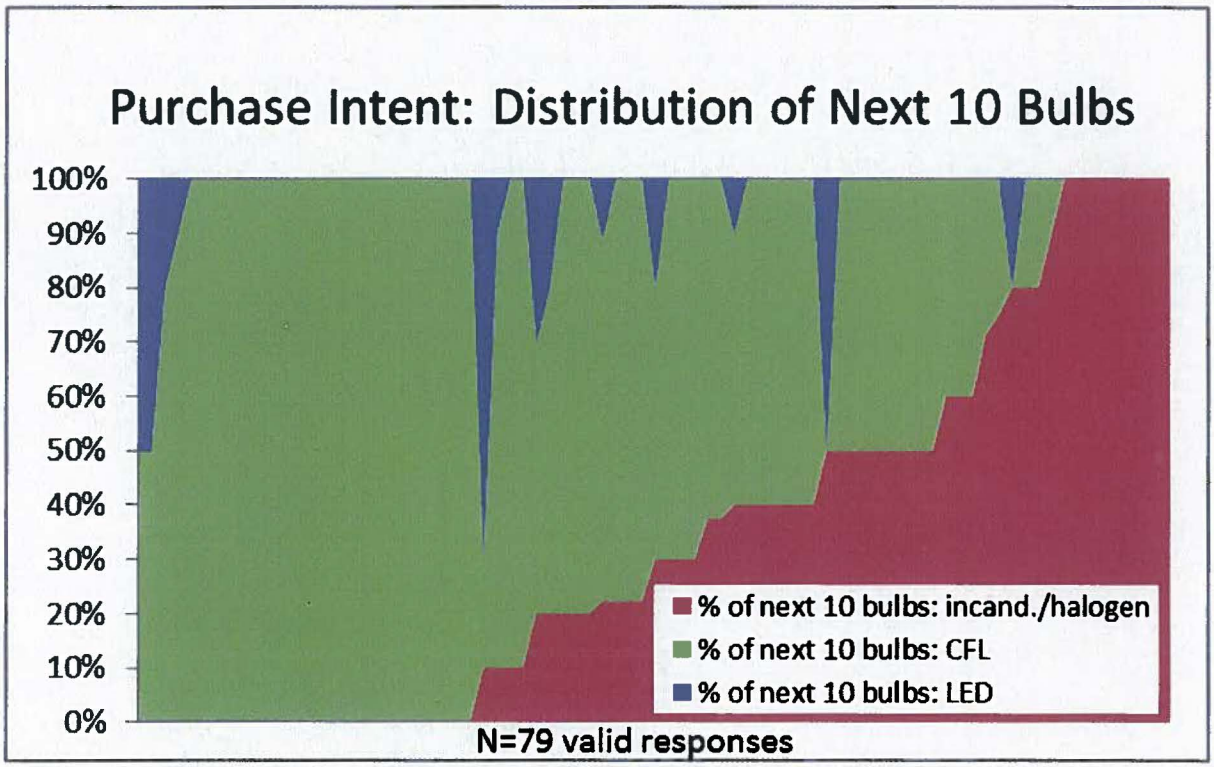


**Figure 9. Area Chart of Intentions for Next Ten Bulbs Purchased (N=81)**
*Two survey participants (2.5% of 81) "don't know" what kind of bulbs they will buy in the future.*

## Intentions for Future Light Bulb Purchases: Price Sensitivity

TecMarket Works asked survey respondents to consider their future CFL purchases and identify how many CFLs they would expect to purchase in the next year if CFLs were offered at a certain price compared to a standard incandescent bulb. The prices offered were:

- The same price as a standard bulb
- $1 more than a standard bulb
- $2 more than a standard bulb
- $3 more than a standard bulb
- Free, but you have to mail in a rebate form to get your money back
- Free, but you have to fill out a form online

Table 37 shows the number of CFLs that survey respondents would purchase as the bulbs increase in price. As expected, the general trend is toward purchasing fewer CFLs as they become more expensive: from an average of 7.1 CFL bulbs at the same price as standard bulbs, down to an average of only 2.5 CFL bulbs when they cost $3 more than standard bulbs (the

differences in mean number of CFLs purchased are statistically significant at every specific price point at $p<.05$ using student's t-test). Customers would actually order slightly fewer CFLs if they were free with a mail-in rebate (6.4) compared to if they were the same cost as standard incandescent bulbs (7.1), although if the CFLs are free with an online sign-up form customers would purchase about as many (7.2) as they would if they cost the same as standard bulbs (however these differences are not statistically significant). Table 38 presents the same data by percentage of surveyed participants indicating the number of CFLs they would purchase under various pricing scenarios.

**Table 37. Number of CFLs Purchased at Different Price Points (N=81)**

| Number of CFLs | Standard Incandescent Price | $1 More | $2 More | $3 More | Free with mail-in rebate | Free with online form |
|---|---|---|---|---|---|---|
| None | 6 | 11 | 24 | 38 | 10 | 13 |
| 1 to 3 | 6 | 8 | 11 | 14 | 6 | 4 |
| 4 to 6 | 34 | 33 | 27 | 17 | 29 | 22 |
| 7 to 9 | 5 | 3 | 2 | 2 | 9 | 5 |
| 10 to 12 | 23 | 19 | 8 | 2 | 16 | 25 |
| 13 or more | 5 | 4 | 2 | 2 | 3 | 4 |
| Don't know / other response | 2 | 3 | 7 | 6 | 4 | 4 |
| Maximum allowed | NA | NA | NA | NA | 4 | 4 |
| Average number of bulbs (not including "max allowed") | 7.1 | 6.1 | 4.1 | 2.5 | 6.4 | 7.2 |

**Table 38. Percent of Customers that would Purchase CFLs at Different Price Points (N=81)**

| Number of CFLs | Standard Incandescent Price | $1 More | $2 More | $3 More | Free with mail-in rebate | Free with online form |
|---|---|---|---|---|---|---|
| None | 7.4% | 13.6% | 29.6% | 46.9% | 12.3% | 16.0% |
| 1 to 3 | 7.4% | 9.9% | 13.6% | 17.3% | 7.4% | 4.9% |
| 4 to 6 | 42.0% | 40.7% | 33.3% | 21.0% | 35.8% | 27.2% |
| 7 to 9 | 6.2% | 3.7% | 2.5% | 2.5% | 11.1% | 6.2% |
| 10 to 12 | 28.4% | 23.5% | 9.9% | 2.5% | 19.8% | 30.9% |
| 13 or more | 6.2% | 4.9% | 2.5% | 2.5% | 3.7% | 4.9% |
| Don't know / other response | 2.5% | 3.7% | 8.6% | 7.4% | 4.9% | 4.9% |
| Maximum allowed | NA | NA | NA | NA | 4.9% | 4.9% |
| Average number of bulbs (not including "max allowed") | 7.1 | 6.1 | 4.1 | 2.5 | 6.4 | 7.2 |

TecMarket Works also asked survey respondents to consider their future LED purchases and identify how many LEDs they would expect to purchase in the next year if LEDs were offered at a certain price compared to a standard incandescent bulb. The prices offered were:

- The same price as a standard bulb
- $2 more than a standard bulb
- $5 more than a standard bulb
- $10 more than a standard bulb
- Free, but you have to mail in a rebate form to get your money back
- Free, but you have to fill out a form online

Table 39 shows the number of LEDs that survey respondents would purchase as the bulbs increase in price. In general, fewer customers from this CFL program are interested in LED bulbs compared to CFLs. Even when LEDs cost the same as standard bulbs, barely half of the surveyed participants (50.6% or 41 out of 81) are certain they would order any (compared to 90.1% or 73 out of 81who say they would order CFLs if they cost the same as standard bulbs). When LEDs cost $5 more than standard bulbs, the percentage of CFL program participants who would order LEDs falls to just 13.6% (11 out of 81) and when the LEDs cost $10 more than standard bulbs only 4.9% (4 out of 81) would order any.

Again, the general trend is toward purchasing fewer LEDs as they become more expensive: from an average of 5.1 LED bulbs when they are the same price as standard bulbs, down to an average of only 0.1 LED bulbs when they cost $10 more than standard bulbs (the differences in mean number of LEDs purchased are statistically significant at every specific price point at $p<.05$ using student's t-test). Customers would actually order slightly fewer LEDs if they were free with a mail-in rebate (4.4) compared to if they were the same cost as standard incandescent bulbs (5.1), although if the CFLs are free with an online sign-up form customers would purchase slightly more (5.5) than they would if they cost the same as standard bulbs (customers would buy significantly more LEDs if they were "free online" compared to "free mail-in rebate" and "same price as standard" at $p<.10$ or better using student's t-test). Table 40 presents the same data by percentage of surveyed participants indicating the number of LEDs they would purchase under various pricing scenarios.

**Table 39. Number of LEDs Purchased at Different Price Points (N=81)**

| Number of LEDs | Standard Incandescent Price | $2 More | $5 More | $10 More | Free with mail-in rebate | Free with online form |
|---|---|---|---|---|---|---|
| None | 31 | 44 | 59 | 65 | 22 | 19 |
| 1 to 3 | 9 | 7 | 6 | 3 | 11 | 11 |
| 4 to 6 | 15 | 8 | 3 | 1 | 20 | 16 |
| 7 to 9 | 0 | 2 | 0 | 0 | 1 | 2 |
| 10 to 12 | 12 | 7 | 2 | 0 | 12 | 16 |
| 13 or more | 5 | 3 | 0 | 0 | 2 | 4 |
| Don't know / other response | 9 | 10 | 11 | 12 | 9 | 9 |
| Maximum allowed | NA | NA | NA | NA | 4 | 4 |
| Average number of bulbs (not including "max allowed") | 5.1 | 3.0 | 0.8 | 0.1 | 4.4 | 5.5 |

**Table 40. Percent of Customers that would Purchase LEDs at Different Price Points (N=81)**

| Number of LEDs | Standard Incandescent Price | $2 More | $5 More | $10 More | Free with mail-in rebate | Free with online form |
|---|---|---|---|---|---|---|
| None | 38.3% | 54.3% | 72.8% | 80.2% | 27.2% | 23.5% |
| 1 to 3 | 11.1% | 8.6% | 7.4% | 3.7% | 13.6% | 13.6% |
| 4 to 6 | 18.5% | 9.9% | 3.7% | 1.2% | 24.7% | 19.8% |
| 7 to 9 | 0.0% | 2.5% | 0.0% | 0.0% | 1.2% | 2.5% |
| 10 to 12 | 14.8% | 8.6% | 2.5% | 0.0% | 14.8% | 19.8% |
| 13 or more | 6.2% | 3.7% | 0.0% | 0.0% | 2.5% | 4.9% |
| Don't know / other response | 11.1% | 12.3% | 13.6% | 14.8% | 11.1% | 11.1% |
| Maximum allowed | NA | NA | NA | NA | 4.9% | 4.9% |
| Average number of bulbs (not including "max allowed") | 5.1 | 3.0 | 0.8 | 0.1 | 4.4 | 5.5 |

## Light Bulb Characteristics

Surveyed participants were asked to rate the importance of specific bulb characteristics when making their bulb purchasing decisions. Responses were provided on a one to ten scale, where one is not at all important and ten is very important. The results of these importance ratings are shown in Table 41, in order from the highest rated characteristics to the lowest rated.

According to these ratings, the two most important characteristics to customers are the energy savings (8.98) and cost savings (8.88), followed closely by selection and wattage (8.64), availability in stores (8.49) and the purchase price (8.26; though only ratings for energy savings

and cost savings are significantly higher than for price, both at p<.05 using student's t-test). The least important factors are recommendations (6.65 from utilities, 6.30 from family and friends), ability to dim (5.51) and the appearance of the bulb (5.37). However, all characteristics asked about received mean importance ratings of 5 or better, indicating that none of these characteristics are truly "unimportant".

**Table 41. Importance of Bulb Characteristics When Purchasing Bulbs**

| Bulb Characteristic | Valid N | Average Rating |
|---|---|---|
| Energy Savings | 80 | 8.98 |
| Cost savings on your utility bill | 80 | 8.88 |
| Selection of wattage and light output levels available | 81 | 8.64 |
| Availability of the bulb in stores you normally shop | 80 | 8.49 |
| Purchase price of the bulb | 81 | 8.26 |
| Ease of bulb disposal | 80 | 7.71 |
| Availability of utility programs or services that offer the bulbs to you directly | 80 | 7.50 |
| Mercury content of the bulb | 79 | 7.25 |
| Speed at which the bulb comes up to full lighting level | 81 | 6.79 |
| Recommendations from the utility company | 81 | 6.65 |
| Recommendations from family and friends | 81 | 6.30 |
| Ability to dim the lighting level | 80 | 5.51 |
| Attractiveness or appearance of the bulb | 81 | 5.37 |

## Efficient Bulb Purchases since Participating in the Program

Survey participants were asked if they have purchased any additional CFLs or LEDs since participating in the Duke Energy CFL program, and how many of these additional bulbs are currently being used. As seen in Table 42, 21.0% (17 out of 81) of customers have purchased an average of 8.3 additional CFLs since the program. These customers were also asked to rate the influence of the program on these additional CFL purchases on a 10-point scale; the average influence rating was a moderately high 6.25.

**Table 42. CFL Bulbs Purchased Since Participating in the Program**

| CFLs and LEDs purchased after participating in the program | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| Purchased 1-4 CFLs after the program | 7 | 8.6% |
| Purchased 5-10 CFLs after the program | 5 | 6.2% |
| Purchased 11 or more CFLs after the program | 4 | 4.9% |
| Purchased unknown number of CFLs after the program | 1 | 1.2% |
| Have not purchased additional CFLs since the program | 64 | 79.0% |
| **Total CFL bulbs purchased after the program** | **141** | |
| **Average number of CFL bulbs purchased after the program** (among those who purchased additional CFLs) | **8.3** | |
| **Total CFL bulbs purchased after the program that are currently being used** | **114** | |
| **Percentage of post-program CFLs currently in use** | **80.9%** | |
| **Average influence rating of the program on the purchase of additional CFLs** (10-point scale) | **6.25** | |

Table 43 shows surveyed customers' LED purchases since the program: 4.9% (4 out of 81) of these customers have purchased an average of 1.8 additional LED bulbs. The average rating of the influence of the Duke Energy CFL program on these LED purchases is a moderately high 7.00 on a 10-point scale.

**Table 43. LED Bulbs Purchased Since Participating in the Program**

| LEDs purchased after participating in the program | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| Purchased 1-4 LEDs after the program | 4 | 4.9% |
| Purchased 5-10 LEDs after the program | 0 | 0.0% |
| Purchased 11 or more LEDs after the program | 0 | 0.0% |
| Have not purchased LEDs since the program | 76 | 93.8% |
| Don't know if purchased LEDs after the program | 1 | 1.2% |
| **Total LED bulbs purchased after the program** | **7** | |
| **Average number of LED bulbs purchased after the program** (among those who purchased LEDs) | **1.8** | |
| **Total LED bulbs purchased after the program that are currently being used** | **7** | |
| **Percentage of post-program LEDs currently in use** | **100%** | |
| **Average influence rating of the program on the purchase of LEDs** (10-point scale) | **7.00** | |

It seems notable that the average number of LED bulbs purchased is much smaller than the average number of CFL bulbs purchased, and that 100% (7 out of 7) of the LED bulbs purchased have already been installed, compared to 80.9% (114 out of 141) of CFLs purchased after the program. Perhaps because LEDs are significantly more expensive than CFLs (and also have a longer lifespan), LEDs seem to be purchased in small quantities only when needed, and are not stored for future use. However, due to the small sample size of just seven LED bulbs purchased

by four customers, the differences in installation rates and influence ratings between CFLs and LEDs are not statistically significant.

## Other Energy Efficiency Actions since Participating in the Program

TecMarket Works asked survey respondents if they had purchased and installed any energy efficient equipment, or made other energy efficient improvements to their home. As seen in Table 44, 26.3% of customers surveyed (21 out of 81) have installed high efficiency equipment on their own since participating in the CFL program. But a slight majority of 53.1% of customers surveyed (43 out of 81) have not taken any of the actions asked about in Table 44.

Customers who purchased and installed energy efficient equipment were asked to rate the influence of the CFL program on these actions on a 10-point scale (with "10" indicating the most influence). Among the 21 respondents who installed energy efficient equipment, the average influence rating was a low 2.57, with only four of these 21 respondents (19.0%) rating the influence of the program a "6" or higher out of 10, and 13 respondents (61.9% of 21) giving the lowest possible rating of "1 out of 10".

**Table 44. Additional Energy Efficiency Actions**

| Actions taken since participating in the program | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| Have purchased and installed energy efficient equipment (such as appliances, doors, windows, HVAC) | 21 | 26.3% |
| Have installed low-flow showerhead | 13 | 16.0% |
| Have installed programmable thermostat | 9 | 11.1% |
| Have installed wall or ceiling insulation | 8 | 9.9% |
| Have installed weather stripping | 7 | 8.6% |
| Have installed caulking | 7 | 8.6% |
| Have installed faucet aerators | 5 | 6.2% |
| Have installed outlet or switch gasket insulators | 1 | 1.2% |
| None of the above | 43 | 53.1% |

*Percentages may total to more than 100% because participants could give multiple responses.*

Survey participants were also asked if they had purchased any major electrical appliances in the past year, and about their awareness and response to the Energy Star label on appliances. About one surveyed customer in five has purchased a major appliance in the past year (21.3% or 17 out of 81), and the vast majority are aware of the Energy Star label (85.2% or 69 out of 81). Among those who are aware of Energy Star, 84.1% (58 out of 69) look for the Energy Star label when purchasing appliances. About half (46.4% or 32 out of 69) say they typically purchase appliances with the Energy Star label "all of the time" when purchasing appliances, and only 5.8% (4 out of 69) say they "never" buy appliances with the Energy Star label.

**Table 45. Appliances and the Energy Star Label**

| Appliances and Energy Star | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| Have added a major electrical appliance in the past year | 17 | 21.3% |
| Aware of Energy Star label for appliances | 69 | 85.2% |
| | Participants Aware of Energy Star Label (N=69) | |
| | N | % |
| Typically look for the Energy Star label when purchasing appliances | 58 | 84.1% |
| Typically buy appliances with the Energy Star label "all of the time" | 32 | 46.4% |
| Typically buy appliances with the Energy Star label "some of the time" | 33 | 47.8% |
| Typically "never" buy appliances with the Energy Star label | 4 | 5.8% |

Survey participants were also asked if they have changed any of their habits relating to energy use. About half of surveyed customers (49.4% or 40 out of 81) say they have changed their habits to become more energy efficient. As seen in Table 46, the most commonly cited changes in behavior have to do with turning off lights and other electronic items (47.5% or 19 out of 40 customers who have changed their habits) and temperature adjustments to reduce energy consumption due to heating and cooling the home (40.0% or 16 out of 40).

**Table 46. Changes in Energy Efficiency Habits**

| Action taken | Participants Who Changed Their Energy Use Habits (N=40) | |
|---|---|---|
| | N | % |
| Turn lights / electronic items off when not in use | 19 | 47.5% |
| Temperature adjustments (using less heating and cooling) | 16 | 40.0% |
| Using appliances less / using more efficiently | 5 | 12.5% |
| Conserving water | 3 | 7.5% |
| Using more natural lighting, cooling and heating | 2 | 5.0% |
| Don't heat and cool the entire home (seal off rooms, keep doors closed) | 2 | 5.0% |
| HVAC maintenance | 1 | 2.5% |
| Upgrading doors / windows | 1 | 2.5% |
| Generally more aware of energy usage | 4 | 10.0% |

*Percentages may total to more than 100% because participants could give multiple responses.*

# Participant Satisfaction

Participants were asked to rate their satisfaction on a 1-to-10 scale for a variety of program attributes: the ease of ordering their CFLs, the delivery time of the CFLs, the light quality of the CFLs obtained, the overall quality of the CFLs obtained through the CFL program, and their overall satisfaction with the CFL direct mail program, as well as their overall satisfaction with Duke Energy. The means for these satisfaction ratings are shown in Figure 10.

Overall program and CFL satisfaction levels are very high, and overall Duke Energy satisfaction is also high. The highest satisfaction ratings were recorded for ease of ordering (9.71) and delivery time (9.58). Though ratings for overall bulb quality (9.05) and the quality of the light (8.68) are also quite high, they are significantly lower than the ratings for ease of ordering and delivery time (at $p<.05$ using student's t-test). Overall satisfaction with the direct mail CFL program is also very high at 9.49, which is significantly higher than for Duke Energy overall (8.56; this difference is significant at $p<.05$ using student's t-test).

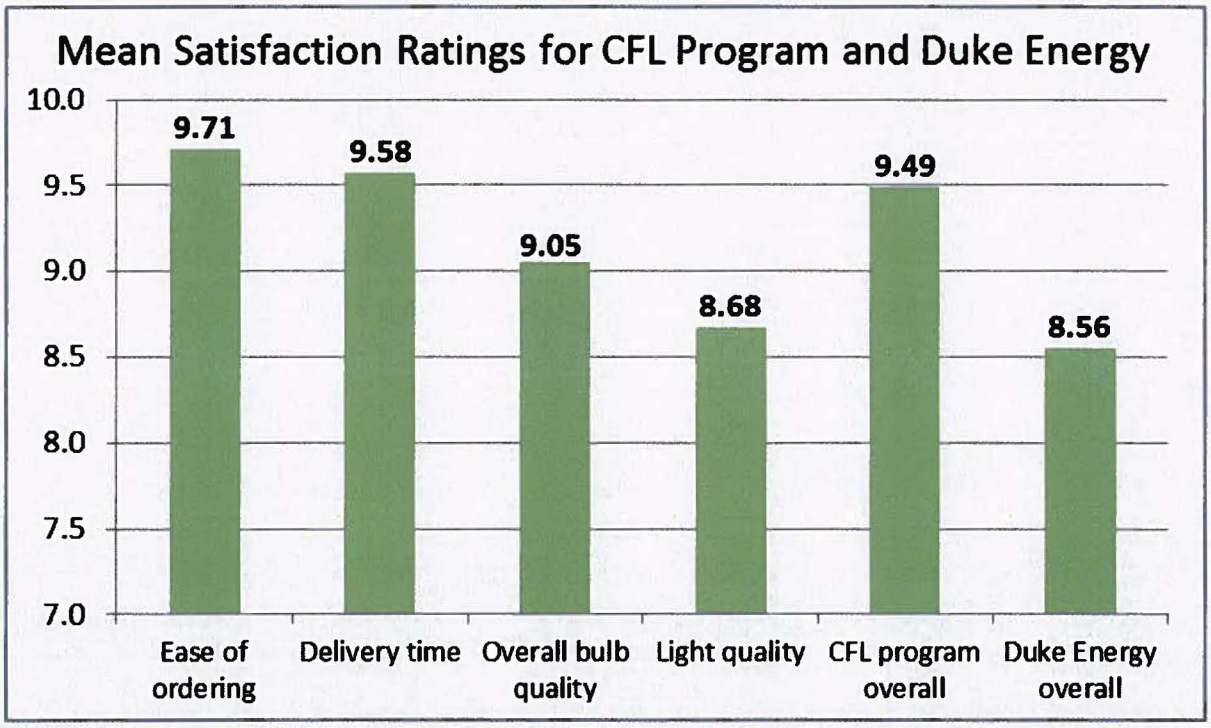


**Figure 10. Mean Satisfaction Ratings for CFL Direct Mail Program and Duke Energy (N=81)**

Participants who rated their satisfaction for any category at "7" or lower on a 10-point scale were asked a follow-up question as to what could be done to improve their level of satisfaction. These responses are listed below for each question.

**Why were you less than satisfied with the ease of ordering? (N=1)**

- *I think there should be more promotion of the program on the Duke website, including pop-up ads.* (This customer was asked if they would prefer to order the bulbs some other way and said "no".)

**Why were you less than satisfied with the delivery time? (N=2)**

- *I had almost forgotten that I had ordered the bulbs because they took so long to get here. It took at least 6 weeks for them to get here.*
- *I would have preferred UPS as the method of delivery, not USPS.*

**Why were you less than satisfied with the overall bulb quality? (N=9)**

- Not as bright as standard incandescent bulbs / too dim (N=1)
- CFLs take too long to warm up (N=1)
- Not bright enough and take too long to warm up (N=2)
- Concerned about mercury / toxicity (N=2)

**Unique responses:**

- *I was hoping the CFLs would provide a noticeable decrease in my energy bill.*
- *It appears that the bulbs are not lasting all that long, especially not as long as they are supposed to.*
- *The CFLs were too large in size.*

**Why were you less than satisfied with the quality of light? (N=13)**

- *Not as bright as standard incandescent bulbs / too dim (N=6)*
- *CFLs take too long to warm up (N=2)*
- *Not bright enough AND take too long to warm up (N=1)*

**Unique responses:**

- *I prefer a full spectrum light, which the CFLs do not provide.*
- *CFLs are dim when you first turn them on, and I also prefer a more natural-looking light quality.*
- *I was less than satisfied with the hospital-like white light quality of the CFLs.*
- *I was very dissatisfied because the CFLs provided by Duke were extremely dim, especially when compared to the superior-quality CFLs I had experience with previously.*

**How could your overall satisfaction with the CFL mail order program be improved? (N=2)**

- *The direct mail CFL program should feature prominent mercury warning labels and instructions on how to properly dispose of the bulbs.*
- *I don't know.*

**How could your overall satisfaction with Duke Energy be improved? (N=16)**

**Lower rates (N=6):**

- *Reduce the rates customers pay for energy (in general) (N=4)*
- *Duke should lower their natural gas rates.*
- *Duke should lower their rates and be more understanding of customers' financial burdens.*

**Customer service (N=4):**

- *Duke contractors should be actual Duke Energy employees rather than subcontracted through outside companies. Duke customer service representatives should be better trained and more knowledgeable.*
- *Duke service technicians should provide better communication. I waited around all day and eventually had to reschedule a meter installation after the technician failed to inform me that he would not be able make our scheduled appointment.*
- *Duke should improve their customer service, be more forgiving with occasional late payments, and fix power outages in a timely manner.*
- *Duke should improve their internal communication, and create a non-residential division which could assign representatives to become familiar with and handle their customers' needs.*

**Mercury concerns (N=2):**

- *Duke should not treat their customers like experimental guinea pigs. There should be warnings and instructions provided about the safe handling and disposal of the bulbs. Duke should offer a CFL recycling program.*
- *Duke should put prominent warning labels on the outside of the packages informing customers that CFLs contain mercury.*

**Other comments (N=4):**

- *Duke should offer incentives for solar panels and provide energy efficiency education for children.*
- *Duke should improve efforts to maintain & upgrade their infrastructure.*
- *Duke needs to upgrade their website to make it more Mac-compatible.*
- *We constantly get brown outs and our electricity goes completely off at least once a month. The time the electricity is out is usually about 10 minutes. I would like if Duke Energy could give some attention to this problem and fix it.*

Participants were asked what they liked most about the CFL program, and provided the responses shown in Table 47. The most frequent response given by 44.4% (36 out of 81) of customers is that participation is free, with the ease of participation (ordering the bulbs) being mentioned by 22.2% (18 out of 81), and the convenience of direct mail delivery by 21.0% (17 out of 81). Also see customer comments following Figure 10, where the free cost and ease of participation were also the most-mentioned reasons why "very satisfied" customers gave the program high ratings.

**Table 47. What Customers Like Most about the Direct Mail CFL Program**

| What did you like most about the direct mail CFL program? | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| They are free | 36 | 44.4% |
| Ease of participating / ordering | 18 | 22.2% |
| Convenience of direct mail delivery | 17 | 21.0% |
| Opportunity to try CFLs | 5 | 6.2% |
| Saving energy | 5 | 6.2% |
| Quick delivery | 4 | 4.9% |
| Saving money | 2 | 2.5% |
| Duke Energy's concern for customers | 2 | 2.5% |
| Quality of the CFLs | 2 | 2.5% |
| Better for the environment / "green" | 1 | 1.2% |
| Longevity of CFLs | 1 | 1.2% |
| Education / information provided by the program | 1 | 1.2% |
| General positive ("I like everything about it") | 2 | 2.5% |

*Percentages may total to more than 100% because participants could give multiple responses.*

Participants were asked what they liked least about the CFL program, and their responses are shown in Table 48. More than half of customers surveyed (54.3% or 44 out of 81) could not name a least favorite aspect of the program, and all specific categories of problems were mentioned by fewer than 10% of respondents. The most frequently mentioned least favorite aspects of the program have to do with concerns about shipping, delivery and packaging (7.4% or 6 out of 81), and the lack of different wattage and other bulb options when ordering (7.4% or 6 out of 81).

**Table 48. What Customers Like Least About the Direct Mail CFL Program**

| What did you like least about the direct mail CFL program? | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| Nothing / the program is fine as it is / don't know | 44 | 54.3% |
| Delivery method / packaging / shipping concerns | 6 | 7.4% |
| Lack of ordering options / different wattages etc. | 6 | 7.4% |
| Limit on size of order / wanted more bulbs | 3 | 3.7% |
| Took too long to arrive | 3 | 3.7% |
| Light quality / not bright enough | 3 | 3.7% |
| Do not like shape / do not fit fixtures | 2 | 2.5% |
| Bulbs arrived broken | 2 | 2.5% |
| Mercury concerns | 2 | 2.5% |
| Hassle of recycling the bulbs | 2 | 2.5% |
| Do not like CFLs | 2 | 2.5% |
| Lack of info explaining the program | 2 | 2.5% |
| Bulbs are defective / burn out quickly | 1 | 1.2% |
| Did not notice any energy / cost savings | 1 | 1.2% |
| Other (listed below) | 6 | 7.4% |

*Percentages may total to more than 100% because participants could give multiple responses.*

Six survey respondents gave unique responses when asked about their least favorite aspect of the program. These are listed below.

- *I dislike that I will now have to purchase the more expensive CFL bulbs.*
- *I disliked the lack of an online follow-up about the program.*
- *I don't like not knowing how I got signed up for this program in the first place.*
- *What I liked least about the program was its lack of promotion.*
- *When the bulbs arrived, there were two different sizes in my package. I don't recall those two sizes being described as what I would be receiving; I thought I'd just be getting all of the same standard sized bulbs.*

## Participation and Interest in Other Duke Energy Programs

TecMarket Works asked the CFL participants if they were participants of any of the following Duke Energy programs.

- Online Services
- Power Manager®
- Home Energy House Call
- My Home Energy Report (MyHER)
- Personalized Energy Report
- Residential Smart $aver®

We also asked what their level of interest is in other Duke Energy programs (after providing a brief description of the program[13]) on a 1-to-10 scale with 1 indicating "not at all interested" and 10 indicating "very interested".

Overall, nearly two-thirds of CFL participants surveyed (64.2% or 52 out of 81) are participating in at least one of the programs listed above. The most commonly reported program they have participated in was "Online Services" (38.3% or 31 out of 81) which is a variation of the Personalized Energy Report in which customers can log into their Duke Energy accounts online and complete a survey about their home to receive recommendations for energy efficiency improvements that they can make. However, it should be noted that many of these customers may not have been aware of the survey and the report (and free CFLs) that they would receive for completing the survey, and instead believed that having on online account with Duke Energy meant the same thing as completing the survey and being a participant in the program.

22.2% (18 out of 81) of CFL participants surveyed say that they have received a Personalized Energy Report. With the similarity of the Personalized Energy Report and Online Services, we did not ask about their interest in Online Services.

As presented in Table 49 below, the other program that has major overlap with the direct mail CFL program is My Home Energy Reports, which are reported as being received[14] by 35.8% (29 out of 81) of participants surveyed for the CFL program.

Four of the five programs listed above received mean interest ratings between 6 and 7 on a 10-point scale, indicating a moderately high level of interest in participating in these programs. The Power Manager program received a significantly lower interest score of 3.57 however (lower than interest in the other programs at $p<.05$ using student's t-test).

[13] Please see questions 91a-91e in Appendix B: Participant Survey Instrument for the program descriptions provided to the customers.

[14] According to the 2013 process evaluation of the MyHER program in Kentucky, only 81.6% (253 out of 310) of surveyed participants in that program recall receiving the Home Energy Reports. Thus the self-reported rate of 35.8% of CFL participants receiving Home Energy Reports may be lower than the actual percentage that receive the reports in the mail.

**Table 49. Self-Reported Participation and Interest in Other Duke Energy Programs**

| Participation in other Duke Energy programs | All Surveyed Participants (N=81) | Average Interest Rating Among Non-Participants (valid N) |
|---|---|---|
| Online Services | 38.3% | NA |
| My Home Energy Report | 35.8% | 6.32 (N=50) |
| Personalized Energy Report | 22.2% | 6.43 (N=60) |
| Home Energy House Call | 8.6% | 6.67 (N=72) |
| Power Manager | 4.9% | 3.57 (N=74) |
| Residential Smart $aver | 3.7% | 6.28 (N=75) |
| None of the above | 34.6% | |
| One program listed above | 29.6% | |
| Two programs listed above | 23.5% | |
| Three or more of the above | 11.1% | |
| Don't know / not specified | 1.2% | |

*Percentages may total to more than 100% because participants could participate in multiple programs.*

Survey respondents were asked to rate their interest in potential programs and services Duke Energy could offer on a 10-point scale. As seen in Table 50, the highest average interest rating for these customers is for rebates for energy efficient home improvements (7.18), which is significantly higher than any of the other potential services asked about ($p<.05$ using student's t-test). Most of the rest of the potential programs or services received scores between 5 and 6, indicating moderate interest. However, help in finding weatherization contractors received a slightly lower score of 4.67 (significantly lower than all other services but one at $p<.10$ or better using student's t-test), and the lowest interest score of all was for social networking sites at 3.33 (lower than all other services at $p<.05$ using student's t-test).

**Table 50. Ratings of Interest in Other Programs from Duke Energy**

| Duke Energy is interested in providing further services that might be of interest to customers. Please rate your interest on a scale from 1-10 in Duke Energy providing the following programs. | Valid N | Average Rating |
|---|---|---|
| Rebates for energy efficient home improvements | 78 | 7.18 |
| Home energy audits or inspections of your home with specific recommendations for improvements | 78 | 5.51 |
| Help in finding energy efficient equipment and appliances | 79 | 5.41 |
| Inspection services of work performed by contractors | 78 | 5.27 |
| Financing for energy efficient home improvements | 78 | 5.17 |
| Help in finding weatherization contractors to make your home more energy efficient | 79 | 4.67 |
| Social Networking sites such as Facebook and Twitter to read about or discuss energy efficient solutions with energy experts | 79 | 3.33 |

Participants in the CFL program were also asked an open-ended question, "What other services could Duke Energy provide to help improve home energy efficiency?" Sixteen customers (19.8% of 81) provided further suggestions, which are categorized and listed below.

**Better metering**

- *Duke should have the ability to read energy meters remotely.*
- *Duke should increase their ability to read energy meters remotely.*
- *Duke should install more Smart Meters to control & manage devices remotely.*
- *We just got a new power meter. I want to be able to read it myself. With the previous meter, I could watch the dial on the meter and actually see for myself how much power the house was using. I would once again like to be able to know in real time how much power my house is using. I don't have the internet, so I want Duke to figure out a way where I can monitor that meter like I used to.*

**Services for renters**

- *Duke should provide home energy audits for apartment renters.*
- *Duke should provide more rental tenant services.*

**More information / education / promotion / awareness**

- *Duke should provide more information and education on their website.*
- *Duke should provide alerts when customers experience unusual power spikes.*
- *Duke should provide energy efficiency education for children, power plant tours, and incentives for solar & wind energies.*
- *Duke should provide more advertising to raise awareness about ways to be energy efficient.*

**Other services**

- *Duke Energy could provide inspection services of gas furnaces and A/C units for their customers.*
- *Duke should provide assistance to residential customers in retrofitting their old T12 fixtures to T5 or T8.*
- *Duke should offer fix-it or handyman services for minor home repairs.*
- *Duke should provide more programs geared towards helping elderly people.*
- *Duke's website should offer the ability for potential home buyers to check average monthly billing statements.*

**Lower rates**

- *It would be nice if Duke Energy would stop raising their rates every year, or at least give people a break once in a while.*

## Duke Energy Website Usage

Participants in the CFL program were also asked how often they visit the Duke Energy website. As seen in Table 51, most customers surveyed (58.0% or 47 out of 81) say they visit the site at least once a month, while only 29.6% (24 out of 81) say they have never visited the site.

**Table 51. Duke Energy Website Usage**

| How often do you use the Duke Energy website? | All Surveyed Participants (N=81) | |
|---|---|---|
| | N | % |
| Often (once a month or more) | 47 | 58.0% |
| Sometimes (less than once a month) | 9 | 11.1% |
| Never | 24 | 29.6% |
| Don't know / not specified | 1 | 1.2% |

# Interest in Specialty CFLs and LEDs

Surveyed participants were asked to list the number of bulbs currently installed in their homes that are specialty bulbs. As a follow-up to that question, they were asked how many of the specialty bulbs installed are CFLs or LEDs. The results are summarized in Table 52. There are a total of 1143 specialty bulbs of various types installed in the homes of surveyed participants. Of these, 335 (29.3%) are CFLs and 92 (8.0%) are LEDs, implying that 716 (62.6%) are standard incandescent (or halogen) bulbs.

**Table 52. Currently Installed Specialty Bulbs and CFLs**

| Bulb Type | Population Total | | | Percentage of EE bulbs | |
|---|---|---|---|---|---|
| | Total | CFL | LED | CFL | LED |
| Dimmable | 204 | 58 | 34 | 28.4% | 16.7% |
| Outdoor flood | 108 | 14 | 9 | 13.0% | 8.3% |
| Three-way | 64 | 34 | 8 | 53.1% | 12.5% |
| Spotlight | 67 | 26 | 8 | 38.8% | 11.9% |
| Recessed | 162 | 71 | 7 | 43.8% | 4.3% |
| Candelabra | 370 | 98 | 26 | 26.5% | 7.0% |
| *Other | 168 | 34 | 0 | 20.2% | 0.0% |
| **TOTAL** | **1143** | **335** | **92** | **29.3%** | **8.0%** |

Participants were also asked to rate their interest in Duke Energy providing specialty bulbs through direct mail. The mean interest rating on a 10-point scale is 6.43 for CFL bulbs and 5.55 for LED bulbs (this difference is statistically significant at $p<.05$ using student's t-test). The distribution of responses is shown in Figure 11; despite only moderate mean interest ratings, 34.6% (28 out of 81) of customers surveyed rate their interest in specialty CFLs a "10 out of 10", and 21.0% (17 out of 81) rate their interest in specialty LEDs a "10 out of 10".

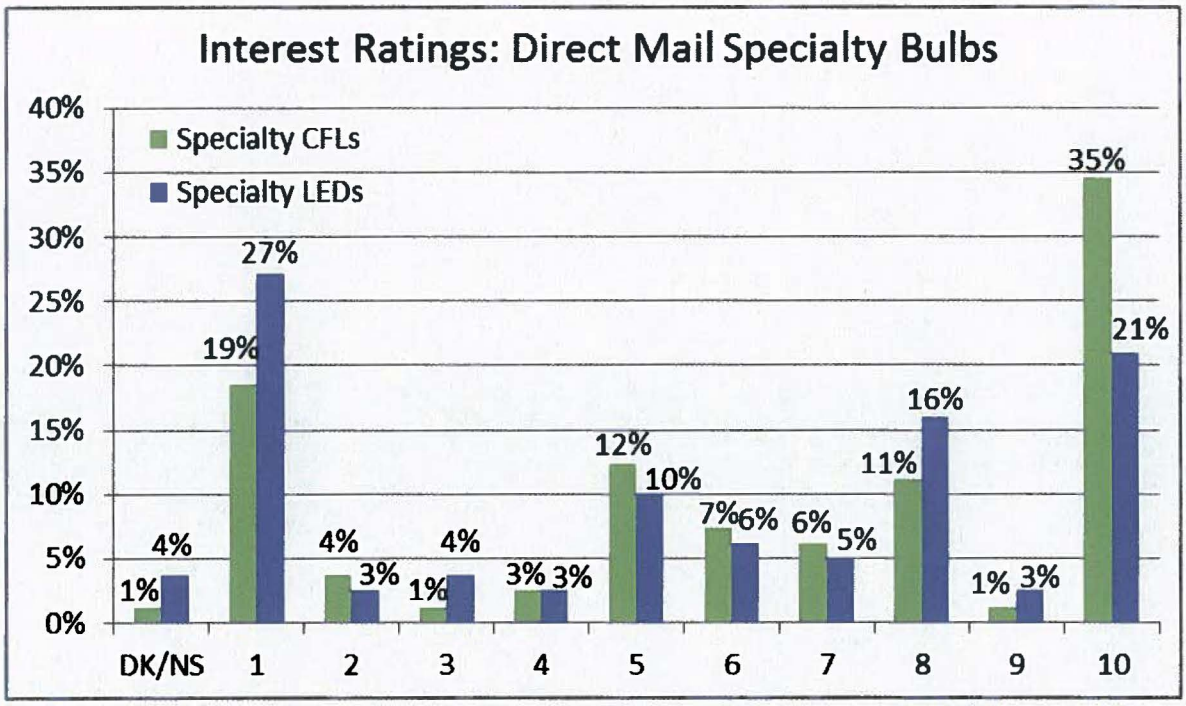


**Figure 11. Mean Interest Ratings for Specialty CFLs and LEDs by Direct Mail (N=81)**

After providing a rating of their general interest in specialty CFL and LED programs, respondents were asked to indicate their interest in receiving specific types of specialty bulbs if they were to be offered in the future. As a follow-up, if they were interested, they were asked to include an estimate of how many hours per day they would use the bulb. Their responses are summarized in Table 53. Of the surveyed participants, the highest level of interest was in outdoor flood lights for both CFLs (50.6% or 41 out of 81) and LEDs (37.0% or 30 out of 81). Outdoor flood lights were also the type of LED specialty bulbs that would be used the most (5.1 hours per day), though for CFLs spotlights would be used the most (5.2 hours). However spotlights also had the lowest level of interest of specific bulb types asked about (24.7% or 20 out of 81 for CFLs, 21.0% or 17 out of 81 for LEDs).

**Table 53. Interest in Specific Specialty CFLs and LEDs (N=81)**

| Bulb Type | CFLs | | LEDs | |
|---|---|---|---|---|
| | Percent Interested | Mean Hours of Use | Percent Interested | Mean Hours of Use |
| Dimmable | 43.2% | 3.7 | 33.3% | 4.6 |
| Outdoor flood | 50.6% | 4.8 | 37.0% | 5.1 |
| Three-way | 37.0% | 4.9 | 29.6% | 4.6 |
| Spotlight | 24.7% | 5.2 | 21.0% | 3.4 |
| Recessed[15] | NA | NA | NA | NA |
| Candelabra | 42.0% | 3.6 | 33.3% | 3.3 |
| Other | 25.9% | 3.0 | 19.8% | 3.0 |

[15] Due to a survey programming error, respondents were not asked about their interest in recessed specialty bulbs.

# Net to Gross Analysis

## Freeridership

TecMarket Works used a three step approach from the participant survey to estimate freeridership. The instrument was established to account for the increasing prevalence of LED bulbs, a technology that has not previously been taken into consideration for the purposes of calculating freeridership. In this approach, freeridership is based on the responses to questions about how many CFLs and LEDs were in the homes of participants prior to the program, whether or not they would have purchased CFLs in the absence of the program, and their future purchasing intentions[16].

### Step One: Diffusion of Adoption Curve

A CFL program participant's freeridership score is predominantly determined by their past behavior regarding the technology. The best predictor of future behavior is past behavior. That is, the more CFLs and LEDs customers use in their home, the more likely they are to be freeriders for the program provided bulbs. To assess past behavior for assigning a freerider value, survey respondents are asked how many energy efficient light bulbs (CFLs and LEDs) were already installed in their home before they received bulbs through the program. Their responses, seen in Table 54, are mapped to the diffusion of adoption curve shown in Figure 12, which is simply a graphical representation of the first two columns of Table 54. The resulting percentage is considered their baseline freeridership.

[16] Using participant surveys to assess freeridership is a current and accepted practice in the industry. Please see the Basic Approach method in the section titled "Participant Net Impact Protocol" in the California Energy Efficiency Evaluation Protocols, April 2006. TecMarket Works, et al.

**Table 54. Pre-existing CFLs and LEDs with Freeridership[17]**

| Pre-existing CFLs and LEDS | Freerider Percentage | Number of respondents |
|---|---|---|
| 0 | 0.0% | 26 |
| 1 | 0.0% | 6 |
| 2 | 2.0% | 8 |
| 3 | 5.0% | 4 |
| 4 | 9.0% | 8 |
| 5 | 15.0% | 3 |
| 6 | 23.0% | 5 |
| 7 | 33.0% | 1 |
| 8 | 45.0% | 1 |
| 9 | 60.0% | 2 |
| 10 | 75.0% | 5 |
| 11 | 88.0% | 1 |
| 12 | 95.0% | 2 |
| 13 | 98.0% | 0 |
| 14 or more | 100.0% | 8 |
| **TOTAL** | | **80** |

**Figure 12. Diffusion of Adoption Curve for Determining Freeridership**

[17] Table 55 presents the same data as Figure 3 from the Participant Survey Results, but with the following differences used to calculate Net To Gross: one survey participant who had CFLs before the program but did not know how many was assigned the mean number of CFLs among all other participants with CFLs (seven when rounded to the nearest integer); six participants who did not know if they had LEDs or not before the program were assigned zero LEDs; and one survey participant who did not know if they had CFLs or not before the program was withheld from this analysis.

## Step Two: Purchasing Intentions Prior to Participation

People's behavior changes over time. This means that past purchase behavior needs to be informed by future purchase intent in order to more carefully assess freeridership. While self-reports of future behavior are not as reliable a predictor as past behavior and are impacted by several types of response bias, it is important to consider purchase intent in the assessment of freeridership. To add this dimension to the assessment, participants are asked about their purchasing intentions prior to their participation in the program. If a survey respondent indicates that they were intent on purchasing CFL and/or LED light bulbs, a follow-up question is triggered. Respondents are asked how many of their next ten light bulb purchases do they think will be CFLs, LEDs, standard incandescents or halogen bulbs. Participants are not asked this follow-up question if they either have no intention of purchasing energy efficient bulbs or already have them installed all available sockets. The decision to move to step three of the analysis follows the logic matrix in Table 55.

**Table 55. Step Two Decision Matrix Based on Purchasing Intentions**

| LEDs → / CFLs ↓ | Yes | No | Maybe | No, already installed in all slots | DK/NS |
|---|---|---|---|---|---|
| **Yes** | Use step 3 multiplier | Use step 3 multiplier | Use step 3 multiplier | Automatic 100% | Use step 3 multiplier |
| **No** | Use step 3 multiplier | Multiply by 0.25 | Use step 3 multiplier | Automatic 100% | Multiply by 0.25 |
| **Maybe** | Use step 3 multiplier | Use step 3 multiplier | Use step 3 multiplier | Automatic 100% | Use step 3 multiplier |
| **no, already installed in all slots** | Automatic 100% | Automatic 100% | Automatic 100% | Automatic 100% | Automatic 100% |
| **DK/NS** | Use step 3 multiplier | Multiply by 0.25 | Use step 3 multiplier | Automatic 100% | Use step 3 multiplier |

## Step Three: Future Purchasing Intentions

To score future purchase intent, each of the three bulb categories (incandescent/halogen, CFL, LED) is assigned a freeridership adjustment factor, or multiplier. These multipliers are shown in the example scenario in Table 56. With this configuration, purchasing intent for incandescents or halogens results in a 75% decrease in freeridership while purchasing intent for CFLs increases the respondent's freeridership by the same percentage. Purchasing intent for LEDs increases freeridership a further 75% over CFLs as these people are seen to be ahead of the curve.

Once a survey respondent's purchasing intentions have been collected for the next ten bulbs, a weighted average freeridership multiplier is calculated. Table 56 represents a scenario in which a respondent has indicated that they will likely purchase equal amounts of incandescents and CFLs for their next ten bulbs. The number in bold is the weighted average freeridership multiplier for this participant. This participant's freeridership score is then the product of their baseline

freeridership and their weighted average freeridership multiplier. Since the multipliers of CFLs and incandescents mirror each other, they are offset and freeridership is ultimately unaffected. That is, it is equal to the value from the diffusion of adoption curve in Figure 12.

**Table 56. Bulb Category Multipliers and Example Scenario**

| Type | Count | Multiplier |
|---|---|---|
| Inc. | 5 | 0.25 |
| CFL | 5 | 1.75 |
| LED | 0 | 2.5 |
| Weighted Multiplier | | **1.0** |

Each participant is assigned a freeridership score. The average of these scores represents the overall program freeridership, which is thus set at 25.09%.

### Validity and Reliability of the Freerider Estimation Approach

The field of freeridership assessment as specified in the California Evaluation Protocols basic estimation approach requires the construction of questions that allow the evaluation contractor to estimate the level of freeridership. The basic approach used in this evaluation is based on the results of a set of freerider questions incorporated into participant survey instruments. The approach used in this assessment examines the various ways in which the program impacts the customer's acquisition and use of CFLs in their home, and allocates a freeridership factor for each of the types of responses contained in the survey questions. The allocation approach assigns high freeridership values to participants who would have acquired CFLs on their own and that factor is influenced by their past purchase behavior and their stated future intentions.

## Spillover

TecMarket Works utilized three questions to calculate the amount of spillover. These questions were asked for both CFLs and LEDs with both technologies counting toward spillover.

Surveyed participants were asked how many energy efficient bulbs, if any, they had purchased since receiving the free CFLs from the direct mail program. Participants who indicated they had purchased energy efficient bulbs were asked how many of them they had installed. Participants were also asked to rate the influence of the program on their decision to purchase these bulbs using a 1-to-10 scale, with one signifying no program influence and ten meaning that the program was very influential. Each customer's influence rating was converted to an influence factor for the purposes of calculating spillover. The conversion method, along with a breakdown of customer ratings, can be seen in Table 57. Influence Factor is represented as "A" in Table 57.

Participants that were assigned 100% free ridership were automatically assigned zero percent spillover. The remaining participants' spillover, represented as "C" in Table 57, was determined as the product of their influence factor and the number of CFLs purchased since their participation in the program. Survey respondents with less than 100% freeridership purchased and installed a total of 85 CFLs and 7 LEDs after participating in the CFL direct mail program. The number of CFLs that count toward spillover is the product of the influence factor and the number of CFLs purchased and installed since participating (from Table 57: A*B=C). The 81

participants who answered the questions received a total of 993 CFLs from the program. Therefore, the spillover contribution is the quotient of the equivalent spillover CFLs and the total number of bulbs distributed to all participants who answered the net-to-gross question battery (from Table 57: C/993=D).

The spillover contribution from LEDs was calculated in the same way with one additional step. The equivalent spillover LEDs were increased by a factor of 11%. This is essentially a conversion factor converting LEDs into CFLs. The 11% is derived from the engineering algorithms in the Draft Ohio TRM. Using these algorithms, an installed LED saves approximately 11% more kWh than an installed CFL. These results can be seen in Table 58.

The sum of the CFL and LED contributions to spillover results in the overall program spillover, which is thus set at 3.52%.

**Table 57. Program Spillover Contribution from CFLs[18]**

| Influence Rating | Influence Factor (A) | Number of respondents | CFLs Purchased and Using Since Participating (B) | Equivalent Spillover CFLs (C) | Spillover Contribution (D) |
|---|---|---|---|---|---|
| 1 | 0.0 | 3 | 51 | 0.0 | 0.00% |
| 2 | 0.1 | 1 | 3 | 0.3 | 0.03% |
| 3 | 0.2 | 0 | 0 | 0.0 | 0.00% |
| 4 | 0.3 | 0 | 0 | 0.0 | 0.00% |
| 5 | 0.4 | 2 | 1 | 0.4 | 0.04% |
| 6 | 0.6 | 0 | 0 | 0.0 | 0.00% |
| 7 | 0.7 | 0 | 0 | 0.0 | 0.00% |
| 8 | 0.8 | 1 | 3 | 2.4 | 0.24% |
| 9 | 0.9 | 1 | 1 | 0.9 | 0.09% |
| 10 | 1.0 | 5 | 26 | 26 | 2.62% |
| **TOTAL** | | **13** | **85** | **30** | **3.02%** |

**Table 58. Program Spillover Contribution from LEDs**

| Influence Rating | Influence Factor (A) | Number of respondents | LEDs Purchased and Using Since Participating (B) | Equivalent Spillover LEDs (C) | Spillover Contribution (D) |
|---|---|---|---|---|---|
| 1 | 0.0 | 1 | 2 | 0.0 | 0.00% |
| 2 | 0.1 | 0 | 0 | 0.0 | 0.00% |
| 3 | 0.2 | 0 | 0 | 0.0 | 0.00% |
| 4 | 0.3 | 0 | 0 | 0.0 | 0.00% |
| 5 | 0.4 | 0 | 0 | 0.0 | 0.00% |
| 6 | 0.6 | 0 | 0 | 0.0 | 0.00% |
| 7 | 0.7 | 0 | 0 | 0.0 | 0.00% |
| 8 | 0.8 | 1 | 2 | 1.8 | 0.18% |
| 9 | 0.9 | 1 | 1 | 1.0 | 0.10% |
| 10 | 1.0 | 1 | 2 | 2.2 | 0.22% |
| **TOTAL** | | **4** | **7** | **5** | **0.50%** |

[18] Table 58 presents the same data as Table 42 in the Participant Survey Results, except that three participants with 100% freeridership are not included in the spillover table.

The net to gross ratio is calculated as follows:

NTGR = (1-freeridership)*(1+spillover)
= (1 - 0.2509) * (1 + 0.0352)
= 0.775

Total Discounting to be Applied = 1 - NTGR
= 1- 0.775
= 0.225
= 22.5%

# Impact Analysis

Table 59 shows the savings per bulb distributed adjusted downward for the ISR of 70.7% and incorporating the self-reporting bias applied to the hours of use as well as the freeridership and spillover percentages computed from participants' survey responses. A mixture of 13-watt and 18-watt CFLs were distributed. Approximately 53% of the distributed bulbs were 13-watt and 47% were 18-watt.[19] Estimated energy savings were calculated using the weighted mean CFL wattage, 16.3. The mean wattage of a replaced bulb was 57 watts.

**Table 59. Adjusted Impact: kWh and Coincident kW per Bulb Distributed**

| Metric | Result |
|---|---|
| Number of bulbs distributed | 993 |
| In service rate | 70.7% |
| Gross kW per bulb | 0.0030 |
| Gross kWh per bulb | 25.3 |
| Freeridership rate | 25.09% |
| Spillover rate | 3.52% |
| Total discounting to be applied to gross values | 22.5% |
| Net kW per bulb | 0.0023 |
| Net kWh per bulb | 19.7 |
| Measure life[20] | 5 years |
| Effective useful life net kWh per bulb | 98.5 |

## Methodology

Primary data collected from survey participants was used to determine the number of CFL installations, mean wattage of bulb removed, and daily hours of use seen in Table 60. Baseline wattage is further adjusted to account for the effects of EISA as per Appendix I: EISA Schedule and CFL Baseline. From the CFL installation data, the in service rate (ISR) was calculated using the algorithm in the In Service Rate (ISR) Calculation section on page 71. Next, the unadjusted self-reported daily hours of use were adjusted downward as described in the Self-Reporting Bias section on page 72. Finally, this data was combined as per Appendix H: Impact Algorithms to calculate gross savings per bulb.

## Survey Data

Participants were asked how many CFLs ordered through Duke Energy's CFL direct mail program were currently installed in light fixtures. Additional, more specific information was collected for a maximum of three bulbs, including the location of the CFL, the type and wattage of the bulb that it replaced, and the mean hours per day that it is in use. The compilation of this data is presented in Table 60 in its unadjusted form, before the self-reporting bias is applied to the hours of use. The adjusted values appear in Table 62 and Table 63.

[19] The participation database contains distribution information indicating the number of CFLs a participant received. If a customer received a 3-pack or 15-pack of CFLs, they received 2 or 8 13-watt CFLs, respectively. Participants receiving 6-, 8-, or 12-packs of CFLs received an equal number of 13-watt and 18-watt bulbs.

[20] Consistent with prior evaluations of CFL programs for Duke Energy, a measure life of five years was used for installed CFLs. No derate was performed for post-EISA years.