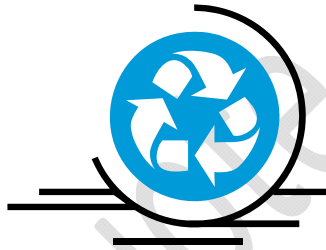


**Analysis of Household  
Compact Fluorescent Light (CFL) Recycling in Maine**

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Travis P. Wagner

## **EXECUTIVE SUMMARY**

Because of energy costs and a successful campaign by Efficiency Maine, compact fluorescent light bulbs (CFLs) are now used in a majority of Maine homes. Although CFLs provide many benefits, they contain small amounts of mercury which, given the large number of CFLs in use, can become an environmental contaminant of concern, unless recycled in an environmentally sound manner.

Despite a CFL disposal ban, the availability of free CFL recycling, and a statewide CFL recycling education campaign, indicators suggest that the CFL recycling rate remains very low. A study was undertaken to identify factors contributing to the low recycling rate by surveying Maine residents who use CFLs.

Based on the 520 respondents, 48% have 10 or more CFLs currently in use and the primary impetus cited (61%) for purchasing CFLs was energy conservation. While 29% claimed they recycle, which is not supported by the data, nearly 31% of respondents disposed of CFLs, 16% did not know what they did with their CFLs, and 7% placed them into storage even though most respondents knew CFLs contained mercury. The responses highlight that the lack of knowledge is likely the primary factor in low recycling participation; 63% did not know that CFLs are required to be recycled and nearly 10% said recycling is not required. As to the locations for CFL drop-off, 63% said they did not know. Finally, 72% of the respondents said they were unaware that CFL collection and recycling can be free. Regarding factors that would prompt CFL recycling, respondents were fairly even in selecting environmental responsibility, free or reduced recycling charges, and convenience.

In light of the requirements for CFL manufacturers in the recently enacted LD 973, "An Act to Provide for the Safe Collection and Recycling of Mercury-containing Lighting," this study suggests (1) modifying the educational focus and (2) expanding free collection. Based on the results, education efforts should be reoriented from highlighting the need to recycle CFLs to focus on educating the public on the specific locations for free CFL drop-off. To increase convenience, CFL collection facilities should be expanded specifically to include home improvement, warehouse, and mass market stores to coincide with primary CFL purchase locations and to offer free CFL collection at every municipal solid waste transfer station.

## **INTRODUCTION**

Compact fluorescent light bulbs (CFLs) are an increasingly popular lighting choice and are an important component in reducing electricity consumption for residential, commercial, and institutional lighting. CFLs have multiple benefits, including longer bulb life, reduced energy consumption, lower CO<sub>2</sub> emissions, and reduced electricity generation wastes. According to estimates by the U.S. Department of Energy, the current national market share of CFLs is approximately 25%.<sup>1</sup> The increasing market share is related to the decreasing retail mean price of CFLs, which has dropped approximately 200% since 2000.

### ***Compact Fluorescent Lights in Maine***

Maine has one of the highest residential usage rates of CFLs in the nation.<sup>2</sup> Approximately 67% of Maine households, or about 347,200 (2000 census data), have at least one CFL installed; the average Maine home that uses CFLs has 7 in use.<sup>3</sup> Instrumental in the state's usage rate is Efficiency Maine, a program that promotes the efficient use of electricity. A centerpiece of Efficiency Maine's effort is a concerted, statewide promotion and CFL instant rebate program directed at substantially increasing CFL purchase and use by Maine households and businesses. In 2008, Efficiency Maine announced the sale of its one millionth CFL through its CFL coupon program, more than the total sales of CFLs for 2004 through 2007 combined.<sup>4</sup> In 2008, Efficiency Maine mailed an additional 97,000 CFLs to lower income residents.

### ***Mercury and CFLs***

Although there are many positive benefits to CFL use, a negative aspect is that sealed within CFLs is a very small amount of mercury--an average of 5 milligrams (mg), which is equivalent to the tip of a ballpoint pen.<sup>5</sup> Assuming the above estimates regarding CFL usage in Maine are correct, currently there are about 2.43 million CFLs in use in Maine households, which equates to about 26.8 pounds of mercury (this amount does not include other sources of mercury in

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<sup>1</sup> U.S. Department of Energy. *Big Results, Bigger Potential. CFL Market Profile*. March 2009. Available from [http://www.energystar.gov/ia/products/downloads/CFL\\_Market\\_Profile.pdf](http://www.energystar.gov/ia/products/downloads/CFL_Market_Profile.pdf). Verified on August 13, 2009.

<sup>2</sup> *Big Results, Bigger Potential. CFL Market Profile*. March 2009.

<sup>3</sup> Ibid.

<sup>4</sup> *Efficiency Maine, 2008 Annual Report*. Available from [http://www.energystar.gov/ia/products/downloads/CFL\\_Market\\_Profile.pdf](http://www.energystar.gov/ia/products/downloads/CFL_Market_Profile.pdf). Verified on August 9, 2009.

<sup>5</sup> This figure is reported in: Maine Department of Environmental Protection. *Maine Compact Fluorescent Lamp Study*. February 2008, p. 9. According to the Northeast Waste Management Officials' Association, 66% of all CFLs sold in 2004 had a mercury content of 0-5 mg, 30% had between 5 and 10 mg, and 4% had between 10 and 50 mg. <http://www.newmoa.org/prevention/mercury/imerc/factsheets/lighting.cfm>. In addition, as of April 2007, the National Electrical Manufacturers Association established a voluntary cap of 5 mg for each CFL.

households including linear fluorescent lamps, thermostats, thermometers, batteries, and switches).

The reduction of mercury as an environmental contaminant has been a priority in Maine.<sup>6</sup> A major step was the adoption of a state law that bans the disposal of household generated mercury-added products beginning in January 2005. In support of the mercury disposal ban, Maine has promoted household CFL recycling. In Maine, 135 municipal facilities serving collectively more than 500 municipalities are equipped to collect mercury-containing lamps for recycling, generally for a fee of \$1 or less per CFL.<sup>7</sup> In 2007, the infamous case of the broken CFL in Prospect, Maine caused considerable negative press on CFLs.<sup>8</sup> In response, Efficiency Maine established a free household CFL recycling program. Beginning in 2007, residents could drop-off intact CFLs for free at some 214 participating retail stores throughout Maine.<sup>9</sup> Other retail stores recently have voluntarily initiated various forms of household CFL collection for recycling in Maine.

When managed and disposed of as municipal solid waste (MSW), CFLs are subject to breakage during handling, storage, transportation, processing, and disposal thereby potentially releasing the mercury into the environment. In Maine, intact CFLs are subjected to compaction in a trash receptacle and then packer trucks followed by further handling at a transfer station and finally arrival at a disposal facility. Of the CFLs that survive intact, about 32% will be incinerated and the remaining will be landfilled.<sup>10</sup> Both disposal activities are likely to cause a release of mercury through further compaction and volatilization necessitating costly mercury air-pollution capture technology for Maine's four waste-to-energy facilities. In a landfill, in addition to volatilization, mercury can contaminate landfill leachate.

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<sup>6</sup> The Maine Legislature has passed numerous bills related to reducing environmental releases of mercury. Major actions include a ban on the disposal and sale of mercury-containing button cell batteries, a ban on disposal or mercury-containing items, a ban on the sale of mercury fever thermometers and thermostats, and bounties on mercury thermostats and mercury switches from automobiles.

<sup>7</sup> *Report Regarding the Recycling of Fluorescent Lamps and Consumer Education Efforts*, January 2008, p. 4.

<sup>8</sup> The "Prospect incident" involved a homeowner with a broken CFL who was given an estimate of \$2,000 to clean up the mercury. The situation prompted national headlines. See for example, CFLs and Caution, 2007, March 24, *Bangor Daily News*, p. 12.

<sup>9</sup> Maine Department of Environmental Protection. Available from:

<http://www.maine.gov/dep/rwm/homeowner/fluorescent.htm>. Verified on August 1, 2009.

<sup>10</sup> In 2007, 32% of Maine's total municipal solid waste tonnage was delivered to the 4 waste-to-energy facilities operating in Maine. Maine State Planning Office. *Solid Waste Generation & Disposal Capacity Report for Calendar Year 2007*, January 2009. Available from <http://www.maine.gov/spo/recycle/docs/gencap%20report.FINAL.1.pdf>. Verified on August 1, 2009.

### **Recycling CFLs**

While it is illegal to dispose of CFLs, meaning that legitimate recycling is the only legal means of disposition, indications suggest that the majority of CFLs are not being recycled but disposed of as MSW. The Efficiency Maine's free CFL recycling program has had only minimal success in contrast to the sales and use of CFLs. Since its inception in May 2007, only 8,768 CFLs have been collected--a mean of 337 CFLs per month, which is contrast to the 30,000 to 40,000 sold per month through the Efficiency Maine coupon program. However, household CFL data is not collected at municipal transfer stations where residents can also bring CFLs for recycling. Consequently, a statewide residential recycling rate is unavailable for Maine and is highly problematic to obtain because only a small portion is tracked, sales data is incomplete, and there is a substantial time gap between date of purchase and a CFL's end-of-life (average lifespan of between 8 to 15 times longer than average incandescent bulbs).

Outside of Maine, accurate rates for household CFL recycling do not exist. In 2004, one organization estimated the national, household mercury-containing lamp recycling rate to be only 2%, which is the figure used by the U.S. Environmental Protection Agency.<sup>11</sup> A 2004-2005 pilot study in Lane County, Oregon estimated the household recycling rate to be about 6.7%.<sup>12</sup> In the absence of better or contradictory data, coupled with the low collection rate at Maine's free CFL recycling program, a Maine residential recycling rate of between 2% and 7% is assumed.

### **Education Efforts**

In Maine, there has been a concerted effort to educate the public about CFL recycling. Over 40,000 copies of a brochure on mercury and mercury added products were distributed to towns for public distribution. Program print ads are run that include the phrase "CFL lamps contain trace amounts of mercury and must be recycled at the end of their life;" the printing of this same phrase is on the back of Efficiency Maine instant-rebate coupons used to buy CFLs (30,000 to 40,000 coupons are filled out by customers each month). Efficiency Maine's CFL television advertising campaign continues to include an animated talking bulb that mentions the need to

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<sup>11</sup> Note that the sponsoring organization for the 2% figures stresses that the rate is not based on a scientific study. Association of Lighting and Mercury Recyclers, *National Mercury-Lamp Recycling Rate and Availability of Lamp Recycling Services in the U.S.*, November 2004. <http://www.lamprecycle.org>.

<sup>12</sup> *Review of Compact Fluorescent Lamp Recycling Initiatives in the U.S. & Internationally*, Northeast Waste Management Officials' Association, July 2009. Available from <http://www.newmoa.org/prevention/mercury/lamprecycle/CFLRecyclingReport.pdf>. Verified on August 9, 2009.

recycle CFLs; it is estimated that this commercial has been viewed more than a half million times across the state.<sup>13</sup>

### ***Environmental Impacts of Low Recycling Rates***

According to a 2008 study, if Maine recycled 21% of its CFLs, because of the low reliance on coal for electricity production, there would be a net, marginal decrease in atmospheric mercury from the disposal of CFLs.<sup>14</sup> Consequently, when the recycling rate is less than 21% as believed in Maine, there is a net increase in atmospheric mercury.<sup>15</sup> In this case, environmentally speaking, CFLs cause more harm than good from an area atmospheric mercury perspective. This, however, should not be interpreted as a condemnation of CFLs, but recognition of the negative environmental impact from too low a recycling rate.

### ***Study Problem***

Despite a general knowledge in Maine of the negative environmental/public health impacts of mercury, the ban on disposal of CFLs, a free recycling program, a statewide education outreach on the need to recycle CFLs, and increasing use of CFLs, available evidence suggests that the household CFL recycling rate is less than 7%. Because of this low rate and the prevalence and increasing use of CFLs, it is estimated that there is or will be a net increase of atmospheric mercury in Maine until a recycling rate of greater than 21% is achieved. In an attempt to identify factors that explain why the Maine household recycling rate is so low, a study was conducted.

## **STUDY METHODS**

An online survey was conducted between March 28 and May 1, 2009. The population targeted was Maine residents, 18 years or older who have at least one CFL in use in their home. Because this was an online survey, the sampling frame established the additional constraints of access to a computer, Internet access, and basic computer skills. Although the sampling frame size is extremely difficult to determine, one indicator is Internet access: in 2007, 72.7% of Maine

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<sup>13</sup> Maine Department of Environmental Protection and Maine Public Utilities Commission. *Report Regarding the Recycling of Fluorescent Lamps and Consumer Education Efforts*, January 2008.

<sup>14</sup> The effect of CFLs on an area's atmospheric emissions of mercury is a direct function of the area's reliance on coal for electricity generation, which accounts for 99% of power-generated atmospheric mercury emissions.

<sup>15</sup> This conclusion is based on certain assumptions regarding breakage and release of mercury in addition to reliance on coal for power generation. See, Eckleman, M.J., Anastas, P.J., and Zimmerman, J.B. (2008). Spatial assessment of net mercury emissions from the use of fluorescent bulbs. *Environmental Science & Technology*, 42, 8564-8570.

households had access.<sup>16</sup> Sampling was non-randomized haphazard and snowball (referral by participants of other potential participants). Recruitment was cross-sectional through the distribution of materials containing the exact same language as presented in Figure 1.<sup>17</sup> Participation was self-selected. No incentives were offered for participation or completion.

The survey instrument was created and managed through Survey Monkey. Because the URL for the survey was excessively long, a dedicated website was created to serve as a portal to the survey ([www.mainescflsurvey.net](http://www.mainescflsurvey.net)). There were 26 multiple choice, ranking, and fill-in-the-blank questions (see Appendix I). The order of response options to each question was randomized, except for questions related to scale ranking, to reduce order bias. All responses were anonymous and no personal information was requested. Data was analyzed using SPSS statistical software.

**Figure 1. Survey Recruitment Language**

Are you a Maine resident & do you use Compact Fluorescent Lights (CFLs)?

If yes, please participate in an anonymous online survey developed by the University of Southern Maine's Department of Environmental Science. This brief (7-8 minute) online survey will help us understand how the needs of your community can be served better.

Please go to: [www.mainescflsurvey.net](http://www.mainescflsurvey.net)

## STUDY RESULTS

Respondents who did not satisfy the population criteria (Maine resident defined as a Maine zip code, 18 years or older, resided in a housing unit other than a dorm room, and who had at least one CFL in use) were dropped. This yielded a sample of 520. The sample demographics as compared to Maine demographics are presented in Appendix II. As shown, while some of the sample demographics approximate state demographics, there are a few notable differences

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<sup>16</sup> U.S. Census Bureau, Computer and Internet Use in the United States: October 2007, Table 3. Available from <http://www.census.gov/population/www/socdemo/computer/2007.html>, verified on August 1, 2009.

<sup>17</sup> Cross sectional participation recruitment was done only during the survey period through the following channels: 3x5 inch fliers distributed or posted at various commercial parking lots, rest areas, retail stores, municipal libraries, municipal town offices, and distributed by hand in municipal centers; Maine DEP website from March 20 to April 20; Face Book group and Face Book advertisement; local Public Access Television announcements, Craig's List, Press Releases; and email lists.

that highlight a study sampling error.<sup>18</sup> First, the sampling was skewed slightly toward middle-age individuals and failed to capture a sufficient number of younger (18-25) individuals. Based on the political affiliation, the sample did not capture enough registered Republicans and correspondingly too many registered Democrats. Finally, regarding education, the sample was heavily skewed toward college and graduate education. However, the age and education demographics reflect national household Internet access trends, which was this study's sampling frame; as presented in Appendix I, according to the U.S. Census Bureau, individuals with less formal education and those over 55 years of age are less likely to have Internet access.

Studies have found that age, political affiliation, and education are correlated to recycling in that younger, more formally educated, and registered Democrats tend to recycle at higher rates.<sup>19</sup> Consequently, given the subject matter and demographics, the study results should be viewed as an upper-bound estimate of recycling knowledge, attitudes, and actions. Recognizing the limitations, the study still provides valuable insight regarding household CFL recycling behavior.

#### ***Prevalence and Use of CFLs***

As presented in Figure 2, 48.3% of the respondents have 10 or more CFLs currently in use. The primary (73.4%) purchase location for CFLs are home improvement (i.e., Home Depot, Lowes), warehouse (e.g., Sam's Club), and mass merchant stores (e.g., Wal-Mart). Only 18% of respondents indicated that their local hardware store is their primary source for CFLs, which is consistent with other studies.<sup>20</sup>

As presented in Figure 3, respondents indicated that conserving energy (61.5%) was the primary factor influencing their decision to purchase CFLs, which was followed by long-term cost savings (31.3%) and global warming (5.2%). Only 2% selected the Efficiency Maine coupon as the primary reason for CFL purchase.

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<sup>18</sup> Sampling error is the difference, due to sampling, between the population and the corresponding sample.

<sup>19</sup> See for example, Nixon, H. & Saphores, J. D., 2007. Financing electronic waste recycling: Californian households' willingness to pay advanced recycling fees. *Journal of Environmental Management*, 84, 547–559; Kipperberg, G., 2007. A comparison of household recycling behaviors in Norway and the United States. *Environmental & Resource Economics*, 36, 215–235; and Tucker, P. & Speirs, D., 2003. Attitudes and behavioural change in household waste management behaviours. *Journal of Environmental Planning and Management*, 46, 289-307.

<sup>20</sup> *Big Results, Bigger Potential. CFL Market Profile*. March 2009.



Figure 2. Number of CFLs in Use, N=520

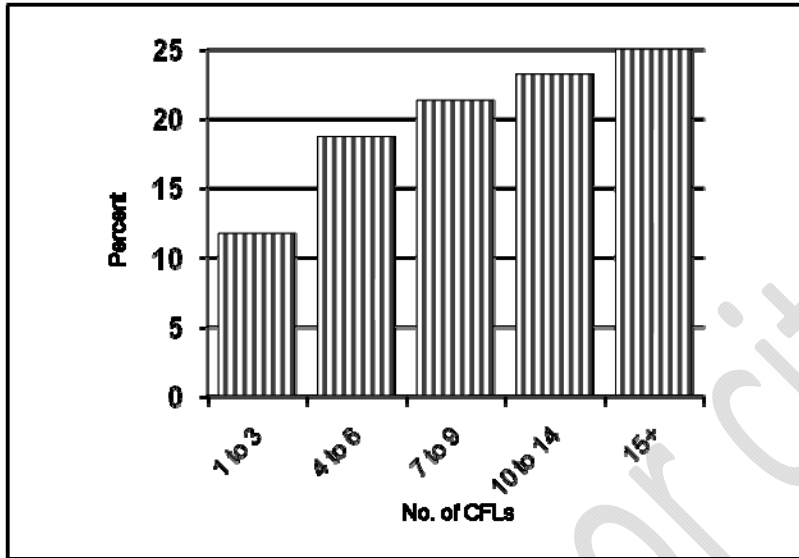
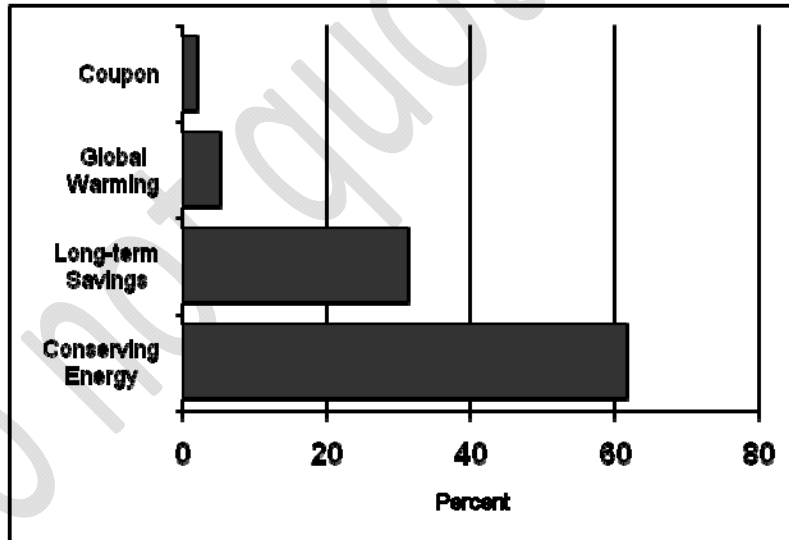


Figure 3. Most Important Factor Influencing Purchase of CFLs, N=501



Regarding the installation or purchase of additional CFLs, 44.1% stated that they were not discouraged, price was selected as a discouragement by 22.8%, difficulty of disposal by 21.5%, toxic ingredients by 17.8%, poor light quality or performance by 11.5%, and the disposal cost was a discouragement by 5.8% (multiple options could be selected for this question). Of those respondents who selected one or more factors as a discouragement, 63.5% did not know

the specific CFL recycling location and 46.9% did not know about Maine's requirement to recycle CFLs.

### ***Disposition of Spent CFLs***

As shown in Figure 4, pertaining to the disposition of intact, non-working CFLs, 30.8% admitted that they disposed of CFLs; of these respondents, 23.6% throw them into the trash and 7.2% brought them to a municipal facility for disposal. Regarding recycling, 23.8% said they either brought them to a store or municipal facility for recycling. Of the remaining 45.9%, they either did not yet have a spent CFL (21.6%), the CFLs currently are in storage (7.6%), or they did not know what they did (16%). Because recycling requires a special trip to a select location and would be more memorable, it is likely that the 16% who did not know what they did either placed them in storage or disposed of them.

While the above results suggest that the recycling rate may be higher than the assumed 7%, there are two major problems with the data that likely overestimate the results. First, as described earlier, the sample demographics are skewed toward the population most likely to recycle and such, most likely represents an upper-bound estimate of recycling rather than the mean. If the sample were truly representative of the state population, the recycling rate would likely be lower. Second, studies on recycling have found that self-reported and actual behavior can be different leading to over-estimation of recycling when relying on self-reported behavior due to social desirability bias, which is the tendency of survey respondents to over-report the performance of socially desirable behavior (i.e., recycling) and/or underreport socially undesirable behavior (i.e., disposal).<sup>21</sup> Consequently, the 23.8% reported recycling rate is likely to be higher than actual practice for this particular population. Based on these survey results, acknowledged sample bias, and absent convincing evidence, these results fail to reject the assumed 7% household recycling rate.

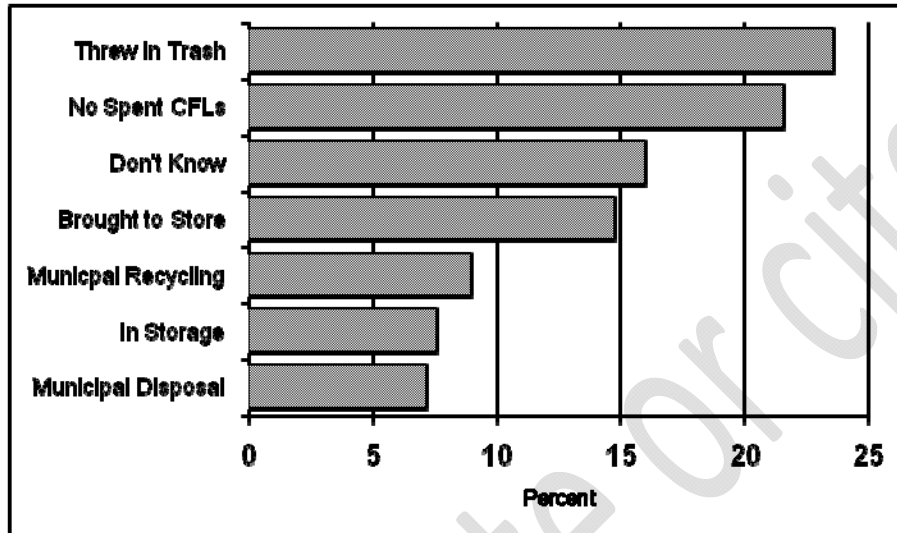
Respondents expressed a high degree of recognition that CFLs contain mercury. In response to the question, "Which of the following toxic components are commonly found in CFLs," 76.3% of the 469 respondents correctly identified mercury. Interestingly, of those with

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<sup>21</sup> See for example, Victor Corral-Verdugo, "Dual Realities of Conservation Behavior: Self-reports vs. observations of Re-use and Recycling," *Behavior Journal of Environmental Psychology*, Vol. 17, 1997, pp. 135–145; K. Barker et al., "Comparison of Self-Reported Recycling Attitudes and Behaviors with Actual Behaviors," *Psychological Reports*, Vol. 75, 1994, pp. 571–577.

knowledge of mercury in CFLs, 9.6% stated they threw CFLs in the trash and 7.5% did not know what they did.

Figure 4. Disposition of Intact, Non-working CFLs, N=499

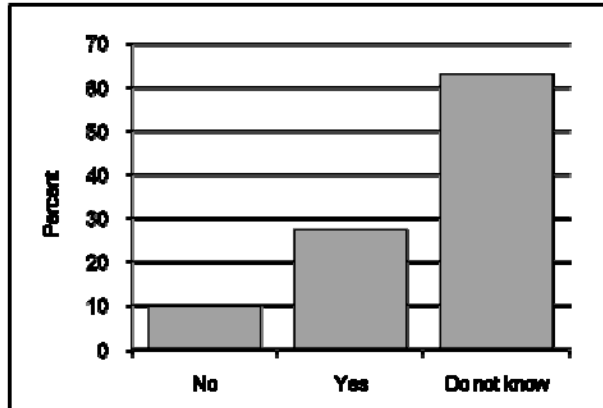


#### ***Knowledge of Maine's CFL Recycling Program***

As shown in Figure 5, only 27.3% of respondents knew that CFLs are required to be recycled; 9.7% said they were not, and 63% said they did not know. Interestingly, 17.4% of the respondents who said they threw their CFLs in the trash or brought them to a municipal facility for disposal also stated that they knew CFLs are required to be recycled. Similarly, 17.2% of those who disposed of CFLs stated that they had seen Efficiency Maine's television advertisements about CFL recycling. In this case, respondents chose not to recycle in spite of knowledge, indicating that other factors are influential (e.g., convenience).

When asked whether the respondent knew the specific location where CFLs can be recycled, 64.4% said no and 35.6% said yes. Respondents who answered yes were requested to specify the location. Of the respondents who said yes, 66% provided locations; however, approximately 15% of these locations were too generic, not known to accept CFLs for recycling, or have participated in only one-time collection events.

Figure 5. Knowledge of Maine’s CFL Recycling Requirement, N=506

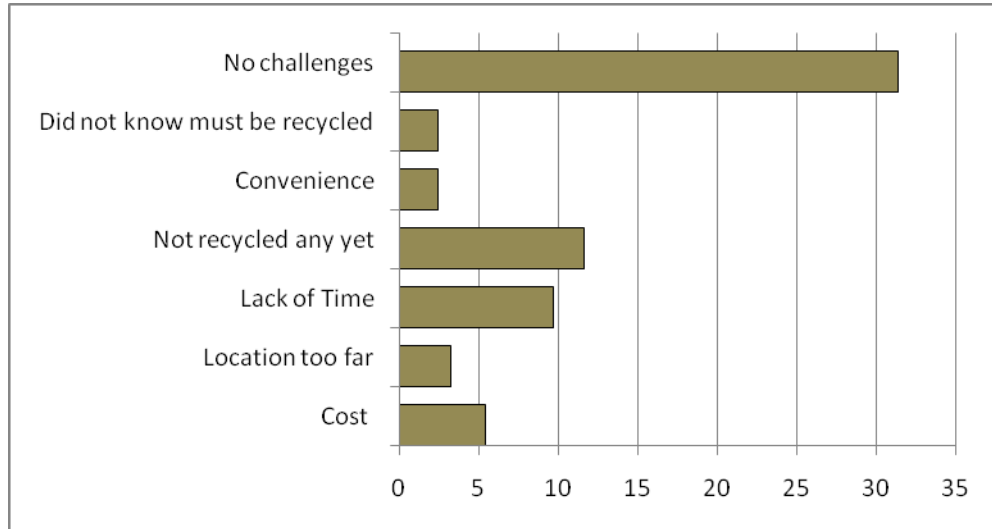


When asked about the cost to recycle a CFL at a participating retail store, 71.8% said they did not know and 25% correctly selected \$0. However, this question may have been poorly worded as respondents may not have known what was meant by a “participating retail store;” the question intended retail stores participating in Efficiency Maine’s free household CFL recycling program.

***Challenges in CFL Recycling***

As presented in Figure 6, respondents were asked to select all the challenges experienced in recycling CFLs. The most prevalent response was no challenges. While some respondent who recycled may not have faced any challenges, it is likely that other respondents selected this response even though they had not recycled or have not yet had a spent CFL. Otherwise, the responses were within the expected range for recycling programs, such as inconvenience, lack of knowledge, or have not recycled.

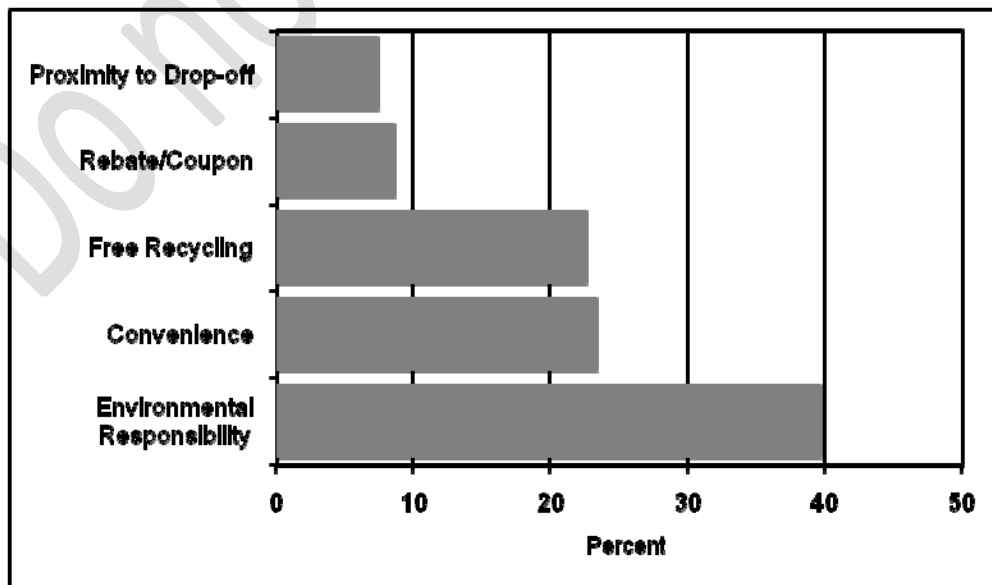
**Figure 6. Challenges Faced in Recycling CFLs (multiple responses allowed), N=462**



**Promoting Recycling**

When asked which factors would most prompt the respondent to recycle CFLs, environmental responsibility, economic, and convenience were fairly even, as shown in Figure 7. Environmental responsibility was selected by 39.6%. The other factors can be grouped into economic and convenience. Cost was cited by 31.2% of the respondents (Free recycling = 22.6% and Recycling Rebates/Coupons = 8.6%). And 30.4% selected convenience (Convenience = 23% and Proximity to Drop-off = 7.4%).

**Figure 7. Factors that Would Prompt CFL Recycling (N=487)**



## CONCLUSION

CFLs are in wide use and sales are increasing primarily for energy and cost savings. It is reasonable to assume that as energy prices climb, and the retail price of CFLs continues to remain stable or drop, CFL usage will increase. This means that the collective amount of mercury in household CFLs will be increasing. Assuming that the recycling rate remains far below 21%, as is the current case, there will be a net increase in atmospheric mercury from the disposal of CFLs. As a result, the CFL recycling rate must increase to reduce atmospheric mercury emissions in Maine.

While it was not the intent of this study to determine a quantifiable recycling rate, the results fail to refute previous studies suggesting that household-generated CFL recycling is very low (2% to 7%). Instead, this study sought to identify factors that are likely causes of a low recycling rate in spite of state law, education efforts, and free recycling locations. Based on this study, the following two conclusions are the most relevant:

- While the state's multi-media education and outreach efforts have focused on the need to recycle CFLs and that they contain mercury, the survey results suggest that a lack of knowledge is the most influential factor in the low recycling rate. In spite of the education efforts and the comparatively high level of education of the survey respondents, most were unaware of the state CFL recycling requirement and there was a high degree of unawareness as to where CFLs can be recycled. In addition, most respondents were also unaware of the no-cost, statewide recycling option. Yet, the majority of respondents for which environmental responsibility was identified as an important factor that prompts them to recycle, knew that CFLs contain mercury.
- While the findings point to a lack of knowledge, a common factor found in many studies that reduces recycling participation is convenience. While Maine's program has attempted to promote recycling through statewide education and offering a free recycling drop-off program, household recycling of CFLs remains inconvenient for the general public. For example, the free CFL drop-off system was limited to local hardware stores, but the majority of respondents do not purchase CFLs at local hardware stores nor do they likely shop there on a routine basis. This means a special trip to recycle a CFL would be necessary. In addition, a special trip to the transfer station would be

necessary for any individual in a municipality served by curbside collection of recyclables. Consequently, in addition to continuing education and outreach, the focus must be on reducing real or perceived inconvenience to dropping off CFLs.

## **RECOMMENDATIONS**

On June 8, 2009, Governor Baldacci signed into law LD 973, “An Act to Provide for the Safe Collection and Recycling of Mercury-containing Lighting.”<sup>22</sup> Effective September 12, 2009, this is the nation’s first law that requires CFL bulb manufacturers to share the costs and responsibility for recycling mercury-containing CFLs. In addition to requiring the DEP to establish maximum limits of mercury in lamps sold in Maine and to the improvement of the state’s procurement policy to purchase low-mercury fluorescent lighting, the bill also mandates a producer-financed collection and recycling program, which must include an education component.

### ***Collection and Recycling***

Maine’s new law, LD 973, requires manufacturers of household mercury-containing lamps to establish a producer-financed, shared-responsibility collection and recycling system to include free collection systems at municipal and retail locations by January 2011.

Real or perceived inconvenience must be reduced by increasing the opportunities to drop-off CFLs. For example, because most (73%) respondents purchase CFLs from home improvement, warehouse, or mass merchant stores, these point-of-sale locations should also be required or encouraged to have free CFL collection facilities in addition to local hardware stores. Also, free collection containers should be made available at municipal solid waste transfer stations or town offices (if a municipality is served by a regional transfer station). Because CFL recycling mail-in kits are already available, CFL point-of sale locations should offer these kits directly for free, through a mail-in coupon, or through an online request. Periodic (e.g., quarterly) curbside recycling of special CFL collection containers would also significantly reduce inconvenience and is worthy of consideration.

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<sup>22</sup> The act can be found at:  
<http://www.productstewardship.us/associations/6596/files/Maine%20Fluorescents%20PUBLIC272.pdf>

## **Education**

Maine’s new law also requires producer-financed recycling programs to include, “Effective education and outreach, including, but not limited to, point-of-purchase signs and other materials provided to retail establishments without cost.” Education should continue to be a component, but should be modified to address the study findings. Education efforts should be modified to reorient the message from the need to recycle to focus on educating the public about the locations for free CFL recycling. By focusing on free CFL recycling as the primary message, the secondary message conveyed is that CFLs need to be recycled. While additional research should be conducted on effective messaging and social marketing techniques to deliver the primary message, the following important steps should be taken:

1. Create a dedicated, simplified website specifically for CFL recycling information and a user-friendly map of drop-off locations (there currently are two websites related to CFL issues: Maine DEP and Efficiency Maine, with the latter being confusing and not user-friendly).
2. Select a simple, short, and memorable URL, such as [www.recyclecfls.xxx](http://www.recyclecfls.xxx) or [www.maine.cfl.xxx](http://www.maine.cfl.xxx).
3. Label each CFL package with a vibrant sticker that includes the words “Maine CFL Recycling Information” and the CFL recycling URL.
4. Post and continuously distribute the CFL URL through municipal transfer stations, utility bills, Efficiency Maine ads, and on a tear-off section (which could be retained by the purchaser) of Efficiency Maine CFL coupons.

## **ACKNOWLEDGEMENTS**

To be added.



**Appendix I**  
**CFL Survey Questions**

The following are the questions as presented in the survey. Note that the order of the response choices was randomized.

1. What is your zip code?
2. How many compact fluorescent lights (CFLs) are installed in your home?
  - a. 0
  - b. 1-3
  - c. 4-6
  - d. 7-9
  - e. 10-14
  - f. 15+
3. Do you currently reside in a...?
  - a. House
  - b. Apartment
  - c. Condo
  - d. Dorm Room
  - e. Mobile Home
4. Where have you purchased most CFLs?
  - a. Home Depot/Lowes
  - b. Local Hardware Store
  - c. Grocery Store
  - d. Wal-Mart
  - e. Department Store
  - f. Other (please specify)
5. What was the most important factor influencing your purchase of CFLs?
  - a. Conserving Energy
  - b. Long-term Cost Savings
  - c. Global Warming
  - d. Coupon
  - e. Other (please specify)
6. Has any of the following discouraged purchasing/installing more CFLs (select all that apply)?
  - a. Not discouraged
  - b. Price
  - c. Toxic Ingredients
  - d. Disposal Cost
  - e. Difficulty of Disposal
  - f. Other (please specify)
7. How have you gotten rid of non-working CFLs that are still intact?

- a. Threw in the trash
  - b. Brought to solid waste facility for disposal
  - c. Brought to solid waste facility for recycling
  - d. Brought to local store for recycling
  - e. Don't know
  - f. Other (please specify)
8. Do you know the specific location of where you can recycle CFLs?
- a. Yes
  - b. No
  - c. If yes, please specify
9. Have you brought any used CFLs to your local solid waste facility? If yes, please rate your experience?
- a. Very convenient
  - b. Convenient
  - c. Neutral
  - d. Inconvenient
  - e. Very Inconvenient
  - f. N/A
10. What challenges have you experienced in recycling your old CFLs (select all that apply)?
- a. Cost
  - b. Did not know where to recycle
  - c. Location too far
  - d. Lack of time
  - e. No Challenges
  - f. Other (please specify)
11. Which of the following factors would most prompt you to recycle CFLs?
- a. Rebate/Cost Incentive
  - b. Environmental Responsibility
  - c. Proximity to Recycling Center
  - d. Free Recycling
  - e. Convenience
  - f. Other (please specify)
12. Have you brought any used CFLs for recycling to your local retail store where you purchased them?
- a. Yes
  - b. No
13. Which of the following toxic components are commonly found in CFLs (select all that apply)?
- a. Mercury
  - b. Lead
  - c. Cadmium
  - d. Arsenic
  - e. 1,4-Butadiene
  - f. Other (please specify)
14. In Maine, how much does it cost a homeowner to recycle a CFL at a participating retail store?
- a. \$0

- b. \$1
  - c. \$2-5
  - d. \$6+
  - e. Do not know
15. Should Maine adopt a deposit/refund system for CFLs? (Pay deposit at time of purchase, get refund when recycled.)
- a. Strongly agree
  - b. Agree
  - c. Somewhat agree
  - d. No Opinion
  - e. Somewhat disagree
  - f. Disagree
  - g. Strongly Disagree
16. Does Maine law require CFLs to be recycled?
- a. Yes
  - b. No
  - c. Do not know
17. How satisfied are you with Maine's household CFL recycling program?
- a. Extremely Satisfied
  - b. Satisfied
  - c. Somewhat Satisfied
  - d. Do not recycle CFLs
  - e. Somewhat Dissatisfied
  - f. Dissatisfied
  - g. Extremely Dissatisfied
18. Have you seen any Efficiency Maine television ads about CFL recycling?
- a. Yes
  - b. No
19. If you have had a question about recycling whom have you contacted in the past (select all that apply)?
- a. Town Office/City Hall
  - b. Solid Waste Facility/Transfer Station
  - c. Maine DEP
  - d. Friends/Family
  - e. Efficiency Maine
  - f. Do not Know
  - g. Retail Store where CFL was purchased
  - h. Other (please specify)
20. How much do you rely on each of the following for Maine information/news?
- a. Television: Very close Attention – Close Attention – Moderate Attention-Some Attention – No Attention
  - b. Radio: Very close Attention – Close Attention – Moderate Attention-Some Attention – No Attention
  - c. Newspaper: Very close Attention – Close Attention – Moderate Attention-Some Attention – No Attention
  - d. Magazine: Very close Attention – Close Attention – Moderate Attention-Some Attention – No Attention
  - e. Internet: Very close Attention – Close Attention – Moderate Attention-Some Attention – No Attention
  - f. Other (please specify)

21. How did you find out about this survey?

- a. Maine DEP Website
- b. Email
- c. Flier
- d. Family/Friend
- e. Store
- f. Other (please specify)

22. Are you male or female?

23. What is your age?

- a. 18-25
- b. 16-29
- c. 30-34
- d. 35-39
- e. 40-44
- f. 45-49
- g. 50-54
- h. 55-59
- i. 60-64
- j. 65-69
- k. 70+

24. What is the highest level of education you have attained?

- a. Some high school
- b. High School diploma/GED
- c. Some college
- d. College diploma
- e. Graduate school diploma

25. How would you describe your political affiliation?

- a. Republican
- b. Democrat
- c. Independent
- d. Green
- e. Not registered

26. How would you describe your race?

- a. Caucasian
- b. Black or African American
- c. Hispanic or Latino
- d. Native American
- e. Asian
- f. Other

## Appendix II

**Table IIa. CFL Study Sample and Maine Statewide Demographics**

	<b>CFL Study Sample (2009)</b>	<b>Maine (2007)</b>
<b>Gender</b> (N=496)	Male = 41.9% Female = 58.1%	Male = 48.8% Female = 51.2%
<b>Age</b> <sup>23</sup> (N=491)	18-25 = 4.9% 26-34 = 15.7% 35-44 = 10% 45-54 = 27.3% 55-64 = 28.3% 65+ = 13.8%	18-25 = 12.3% 26-34 = 12.9% 35-44 = 18.2% 45-54 = 21.1% 55-64 = 16.7% 65+ = 18.8%
<b>Education</b> <sup>24</sup> (N=502)	High School or less = 13.1% Some College = 22.5% College grad = 36.5% Graduate School grad = 27.9%	High School or less = 35.8% Some College = 19.4% College grad = 18.3% Graduate School grad = 8.6%
<b>Political Party</b> (N=483)	Democrat = 45.8% Republican = 14.9% Green = 3.9% Independent/unaffiliated = 35.4%	Democrat = 31.4% Republican = 28.1.9% Green = 2.9% Independent/unaffiliated = 37.8%
<b>Ethnicity</b> (N=498)	White = 92.4% Non-White = 7.6%	White = 96.5% Non-White = 3.5%

**Table IIb. National Household Internet Access Data**<sup>25</sup>

Percent households with no Internet use at home based on householder characteristics	
<b>Education Attained</b>	<b>Age</b>
Less than high school graduate = 76.0%	Under 25 = 42.3%
High school graduate. = 50.5%	25-34 = 34.4%
Some college or associate's degree = 31.1%	35-44 = 28.2%
Bachelor's degree or higher degree = 16.0%	45-55 = 29.3%
	55 and older = 49.8%

<sup>23</sup> The Maine 2007 census data is adjusted, the categories reflect the percent population excluding persons <18 years old to match the survey population.

<sup>24</sup> The Maine census data for highest education attained is from 2005.

<sup>25</sup> U.S. Census Bureau, Computer and Internet Use in the United States: October 2007, Table 1. Available from <http://www.census.gov/population/www/socdemo/computer/2007.html>, verified on August 1, 2009.