



Massachusetts ENERGY STAR[®] Lighting Program: Early Impacts of EISA

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Executive Summary

The residential lighting market in both Massachusetts and the Nation is entering a period of rapid change. The new lighting efficiency standards mandated by the Energy Independence and Security Act of 2007 (EISA) effectively phases out the manufacture and import of traditional filament incandescent light bulbs over a three year period that began in January 2012. As a result, when consumers enter a retail store to buy light bulbs, they face a lighting aisle stocked with a diverse array of technologies and packages that describe the bulbs using unfamiliar terms.

This report summarizes the results of four different research efforts meant, in part, to identify the current and likely effects of EISA on the residential lighting market in Massachusetts. The research activities occurred from December 2011 through April 2013 and were completed for the Energy Efficiency Advisory Council Consultants and the Massachusetts Program Administrators (PAs), including Cape Light Compact, National Grid, NSTAR, Unitil, and Western Massachusetts Electric (WMECO). NMR Group, Inc. (NMR) served as the primary contractor, and KEMA, The Cadmus Group, Inc. (Cadmus), and Tetra Tech (collectively referred to as the Team), served as sub-contractors for the effort.

The Team has previously submitted individual reports for each of these four research efforts, and these reports address a variety of lighting-related topics. This report, however, focuses specifically on the effects of EISA, addressing five major topics:

1. Retailer and consumer awareness of the EISA lighting efficiency standards
2. Effect of EISA on the availability of different types of general service light bulbs
3. Effect of EISA on the purchases and use of general service light bulbs
4. Potential stockpiling of incandescent bulbs in response to EISA
5. Consumer understanding of the terms “lumens” and “warm white and cool white”

Key Findings

The key findings of the studies as they relate to EISA are summarized below. More detail on these findings can be found in the main body of this report and the individual reports on each of the individual evaluation research activities.

Awareness of EISA

- Most consumers remained unaware of the increased lighting efficiency standards resulting from EISA and the subsequent phase-out of most general-service incandescent bulbs. Awareness of EISA is higher among households that self-report that they already use numerous CFLs. It also appears to rise and fall with the amount of media attention given to the incandescent phase-out.
- Two-thirds of managers at stores that take part in the program were aware of EISA. Awareness was highest among store managers with substantial lighting sales (e.g., home

improvement and hardware stores) and lowest among stores with fewer lighting sales (e.g., discount stores).

Changes in Bulb Availability

- Retail partners devoted 68% of their lighting shelf space to CFLs and another 5% to LEDs in 2012. This stands in contrast to 16% devoted to incandescents and 10% to halogen bulbs.
- Stores that participate in the program carry 23% more packages of CFLs and 4% more packages of LEDs than do stores that formerly participated; conversely, former participating stores carry 20% more packages of incandescent bulbs and 7% more packages of halogens than do participating stores.
- The shelf stocking survey still found numerous packages of 100-Watt incandescents on store shelves in August and September of 2012, nearly nine months after their initial phase-out in January of 2012.
- While consumers reported increasing difficulty in finding 100-Watt incandescent bulbs on store shelves between Winter 2011 and Winter 2012, one-half of those shopping for such bulbs could still find them during the last three months of 2012, nearly one year after the start of their phase-out.
- Among the participating store managers who say that their stores had changed stocking practices due to EISA (78 of 240 managers), most said that they had both increased their stock of CFLs and LEDs and reduced their stock of incandescents; they had not changed their stock of halogen bulbs.

Changes in Bulb Purchases and Use

- Households in Massachusetts did not exhibit substantial changes in their light bulb use between early 2012 and early 2013. In particular, socket saturations of incandescents and CFLs remained stable during this time period, and, in fact have been stable since 2009. LED saturation has increased from less than one percent in 2009 to 2% in 2013.
- The proportion of consumers who reported purchasing CFLs, incandescents, and halogen bulbs decreased between Winter 2011 and Winter 2012, while the proportion who said they bought LEDs increased over the same time period.
- When asked what type of bulb they would chose to replace 100-Watt incandescent bulbs, most consumers selected a lower wattage incandescent bulb followed by a CFL. In contrast, the CFL was most commonly selected to replace 75-Watt incandescents. Households already using numerous CFLs were significantly more likely to choose a CFL to replace either wattage incandescent bulb than were households already using fewer than five CFLs.
- The store managers who say that consumer purchase behavior has changed as a result of EISA (107 out of 240 store managers) report that, since the beginning of EISA implementation, consumers are buying more standard and A-line CFLs and LEDs and, at

the same time, about as many or fewer incandescents or halogens since the beginning of EISA implementation.

- Manufacturers and high-level retail buyers offered conflicting reports about the impact of EISA on halogen sales. Manufacturers and buyers tended to believe that continued program incentives would limit increases in halogen sales but feared that any step to remove incentives from CFLs and LEDs would lead consumers to choose halogens rather than more efficient bulb types to replace incandescents and could even lead to backsliding. However, other manufacturers and buyers thought that there was sufficient stockpiling of filament incandescents (even though the Team's onsite and telephone surveys revealed little evidence of it in practice) to suggest that consumers remained unfamiliar with incandescent halogens.

Stockpiling of Incandescent Bulbs

- The research found little evidence of widespread, EISA-induced stockpiling of incandescent bulbs. In fact, households currently storing incandescent bulbs reported that they did so because they like to have bulbs on hand and do not link their behavior to EISA legislation.
- Consumers who were already aware of EISA but used few CFLs were the most likely to say that they would stockpile incandescent bulbs, although we did not find much evidence of this when we went to a subset of their homes during the onsite visits.
- Some manufacturers reported that stockpiling was occurring, both among consumers and retailers; however, the stockpiling was not limited to the already phased-out 75-Watt and 100-Watt incandescent bulbs, but encompassed 40-Watt and 60-Watt bulbs as well. This suggests that consumers may not understand the phased approach of EISA implementation and that retailers are building their supplies of 60-Watt incandescents in anticipation of the January 2014 phase-out.

The Big Unknown – 60-Watt Incandescent Phase-out

- Sixty-Watt incandescent bulbs fill 22% of all sockets in Massachusetts homes, making this the most popular bulb in use in homes. Hence we will not be able fully to understand the effect of EISA on the lighting market—including on consumer lighting purchases and stockpiling behavior—until after the January 2014 phase-out of this bulb.

EISA-related Recommendations and Considerations

Based on the research findings the Team offers the following recommendations as well as some other possible actions the PAs may want to consider, but that do not constitute recommendations. We expand on these in the main body of the report, and many are also related to considerations offered in individual reports for each evaluation activity.

- **Recommendation 1:** Track the lighting markets in select comparison areas with varying levels and models of residential lighting programs.
- **Recommendation 2:** The PAs should continue rebates for standard CFLs and LEDs at least through 2015 (one year after 40- and 60-Watt incandescent phase-out) in order to keep more energy-efficient bulbs on shelves and prevent backsliding of the market to halogen incandescents.
- **Recommendation 3:** Continue efforts to educate consumers about new lighting terminology such as lumens and light temperature, how to select the best bulb, and the variety of highly energy-efficient light bulbs available to meet residential lighting needs.
- **Consideration 1:** The PAs may want to avoid spending program resources educating consumers about the existence of EISA and its implications for filament incandescent bulbs lest it prompt stockpiling on the part of consumers.
- **Consideration 2:** The PAs may also want to consider a variety of additional options to avoid consumer stockpiling of filament incandescents and switching to incandescent halogens that may result as EISA implementation continues; these options would also increase socket saturation of energy-efficient bulbs. Some of these options could include the following:
 - Market LED incentives and LEDs more heavily,¹ and examine the possibility of increasing LED subsidies, keeping in mind the overall decrease in unsupported LED prices
 - Produce marketing materials that include testimonials from CFL and LED converts about why they like these bulbs and how they improved over time
 - Promote CFLs and LEDs with other residential programs as well as bulb buyback programs, among others
- **Consideration 3:** In order to discourage stockpiling and backsliding to less efficient bulb choices, the PAs should consider incenting retail partners to carry fewer filament incandescent and halogen bulbs—particularly general service ones—on store shelves and to stock those they do carry in less prominent locations.

¹ The PAs may need to address dimmer compatibility issues and elevated temperature performance before making substantial changes in incentives to LEDs.

1 Introduction

The residential lighting market in both Massachusetts and the Nation is entering a period of rapid change. The new lighting efficiency standards mandated by the Energy Independence and Security Act of 2007 (EISA) effectively phase out the manufacture and import of traditional filament incandescent light bulbs over a three year period that began in January 2012. As a result consumers are now faced with a greater number and diversity of bulb choices for general service lighting—compact fluorescent lamps (CFLs), A-line incandescent halogens,² and A-line light emitting diodes (LEDs)—than in the past. They are also being confronted with new lighting concepts and terminology in the bulb-purchasing process; instead of buying solely based on wattage and price, consumers must now consider lumens (brightness), color temperature (light color), color rendition (how colors appear in the light), operating costs, bulb life, and other factors when choosing the best bulb for their needs.

This report summarizes the impacts of EISA—and questions that remain—as revealed through residential lighting evaluation activities completed between December 2011 and April 2013 for the Energy Efficiency Advisory Council Consultants and the Massachusetts Program Administrators (PAs), including Cape Light Compact, National Grid, NSTAR, Unitil, and Western Massachusetts Electric (WMECO). NMR Group, Inc. (NMR) served as the primary contractor, and KEMA, The Cadmus Group, Inc. (Cadmus), and Tetra Tech (collectively referred to as the Team), served as sub-contractors for the effort. We present findings from four research efforts:

1. Three waves of consumer telephone surveys conducted every six months starting in December 2011 and ending in January 2013
2. Two waves of onsite lighting inventories taken in late Winter of 2012 and a year later in 2013
3. A retail shelf stocking study performed in the Fall of 2012 in conjunction with Lockheed Martin, the implementation contractor
4. Supplier interviews, consisting of two rounds of in-depth interviews with manufacturers and high-level retail buyers (conducted in Summer 2012 and Winter 2012) and one round of participating store manager³ surveys (conducted from December 2012 through January 2013)

The Team has previously submitted individual reports for each of these four research efforts. Note that the full reports for each research effort address many additional lighting related topics,

² The report refers to halogen bulbs with the A-line profile as either “incandescent halogen” bulbs or simply “halogens” throughout to avoid confusing them with filament incandescent bulbs.

³ For the sake of simplicity, throughout this report we will mostly refer to the survey respondents as “store managers.” We did ask the survey respondents for their job titles and 63 percent of them called themselves store managers, managers, assistant managers, general merchandise managers, or store directors. The remainder gave a variety of other job titles. When we asked them how many years they had been working with the sale of lighting products, the average response was 12.5 years.

including but not limited to awareness of and satisfaction with various lighting technologies, when households purchased energy-efficient bulbs found in their homes, hedonic pricing models for CFLs, the role of LEDs in the lighting market, hard-to-reach customer groups, and lighting NTG as related through supplier interviews and store manager surveys. This report, however, focuses directly on the impacts of EISA.

1.1 Lighting Efficiency Standards Under EISA

President George W. Bush signed the EISA legislation into law in December 2007. Although the legislation addresses numerous issues related to fuel economy, clean energy, and efficiency standards, the research addressed in this report focuses on the portion of the bill concerning increased lighting efficiency standards for general service lamps—or what the public usually refers to as light bulbs. The first round of lighting efficiency standards are being phased in over a three-year period according to the schedule described in Table 1-1. When the standard goes into effect for a particular lumen range, bulbs that do not meet the criteria can no longer be manufactured in or imported into the United States, although the sale of non-compliant bulbs may continue for those already in retailer or manufacturer warehouses. EISA also stipulates even more stringent standards beginning in 2020, which we do not address in detail in this report except to note that compact fluorescent lamps (CFLs) and light emitting diodes (LEDs) are the only general service bulbs currently on the market that will meet the 2020 standards.

Table 1-1: New Efficiency Standards Specified by EISA*

| Rated Lumen Ranges | Typical Incandescent Wattage | EISA Compliant | | Effective Date |
|--------------------|------------------------------|----------------------|------------------------|-----------------|
| | | Maximum Rate Wattage | Minimum Rated Lifetime | |
| 1,490 – 2,600 | 100 | 72 | 1,000 hours | January 1, 2012 |
| 1,050 – 1,489 | 75 | 53 | 1,000 hours | January 1, 2013 |
| 750 – 1,049 | 60 | 43 | 1,000 hours | January 1, 2014 |
| 310 – 749 | 40 | 29 | 1,000 hours | January 1, 2014 |

* Source: US Department of Energy, LED Lighting Facts. “Energy Independence and Security Act of 2007: Summary.” <http://www.lightingfacts.com/content/efficiency/summary>. Accessed May 2, 2013.

The implementation of EISA has raised numerous questions about the lighting market and how manufacturers, retailers, and consumers will respond to the increased lighting standards. One response is clear: manufacturers have expanded the diversity of bulb types they offer to replace general service incandescent bulbs.⁴ Along with spiral CFLs, which have been on the market for over 20 years, consumers can also now choose to buy incandescent halogen, LED, and CFL

⁴ In fact, manufacturers and retailers have also expanded their offering of specialty bulbs as well, but specialty products are not the focus of this report.

bulbs with an A-line profile—the profile of general service incandescent bulbs. Consumers, however, can also stock up on still available incandescent bulbs or choose incandescent bulbs that are currently EISA compliant; this includes not only the 40-Watt and 60-Watt bulbs that have not yet been phased-out but also bulbs rated above 2,600 lumens or those with specialty features such as clear glass.

The most important question about the lighting market, then, is, “What bulbs will consumers buy to replace incandescents?” An important related question involves the information consumers will consider when buying general service bulbs, now that the previous scheme of incandescent wattages will be becoming obsolete. These questions must also consider what the baseline conditions are in the absence of program activity and what the PAs can do to secure energy savings beyond these baseline conditions. The more likely consumers are to stockpile or purchase incandescent halogens in the absence of programs, the greater the energy savings the PAs achieve by instead convincing consumers not to stockpile and to opt for CFLs and LEDs over other bulb types.

This report focused on the Team’s attempts to answer these questions, at least as far as they could be answered one year into EISA implementation.

1.2 Research Approaches

The Team’s efforts focused on five major topics related to the effects of EISA:

1. Retailer and consumer awareness of the EISA lighting efficiency standards
2. Effect of EISA on the availability of different types of general service light bulbs
3. Effect of EISA on the purchase and use of general service light bulbs
4. Potential stockpiling of incandescent bulbs in response to EISA
5. Consumer understanding of the terms “lumens” and “warm white and cool white”⁵

As mentioned above and summarized in Table 1-2, we relied on four approaches to examine these topics. Most of the topics were addressed through multiple approaches and drew on different types of evidence. This allowed the Team to examine the issues from various angles and present a more complete picture of the impacts of EISA on the residential lighting market and PA programs in Massachusetts. The individual reports provide more detail on sample design, methods, and findings not directly related to EISA impacts.

⁵ The Team focused on these lighting terms because they are easily explained in a telephone survey. Another important concept—color rendition—is more difficult to explain over the telephone, so we excluded it from our efforts, but it may be worth exploring color rendition in future evaluation efforts.

Table 1-2: Data Collection Activities, Questions, and Evidence

| Data Collection Activity | Sample Sizes | EISA Topic Addressed | Evidence Used |
|---|--|--|--|
| Customer Telephone Survey | Unit of analysis = survey respondents <ul style="list-style-type: none"> • Wave 1 = 582 • Wave 2 = 604 • Wave 3 = 600 | <ul style="list-style-type: none"> • Awareness of EISA • Availability of incandescent bulbs • Bulb purchases post incandescent phase-out • Stockpiling of incandescent bulbs • Understanding of lighting term | <ul style="list-style-type: none"> • Responses to telephone survey questions |
| Onsite Lighting Inventories | Unit of analysis = occupied homes in Massachusetts <ul style="list-style-type: none"> • Wave 1 = 150 • Wave 2 = 150 | <ul style="list-style-type: none"> • Impact of EISA on bulb purchases and use • Stockpiling of incandescent bulbs | <ul style="list-style-type: none"> • Number and type of bulbs in use and storage • Socket saturation by bulb types • Reasons why storing bulbs |
| Shelf Stocking Survey | Unit of analysis = retail stores in Massachusetts <ul style="list-style-type: none"> • Participating stores = 70 • Formerly participating stores = 31 | <ul style="list-style-type: none"> • Impact of EISA on bulb availability | <ul style="list-style-type: none"> • Shelf space and number of packages devoted to different bulb types |
| Supplier Interviews and Store Manager Surveys | Unit of analysis = individual representatives of partner manufacturers, retailers as well as retail store managers <ul style="list-style-type: none"> • Interviews = 13 (over two waves) • Participating store manager surveys = 240 | <ul style="list-style-type: none"> • Retailer awareness of EISA • Impact of EISA on bulb availability • Impact of EISA on bulb purchases • Stockpiling of incandescent bulbs | <ul style="list-style-type: none"> • Responses of lighting manufacturers and high level buyers to in-depth interview questions • Responses of store managers to telephone survey questions |

2 Early Impacts of EISA

The four data collection activities yielded critical information about the early effects of the increased lighting efficiency standards mandated by EISA. While we have summarized findings in individual reports, this overall report brings the pertinent results together, facilitating identification of patterns—and of continued points of uncertainty—regarding the early impacts of EISA.

It is important to note that some of the findings below draw distinctions between CFL experts and CFL novices. These categories are based on self-reported use of CFLs as identified in the winter 2012 consumer survey. Experts self-reported using five or more CFLs, while novices either said they were not aware of CFLs⁶ or self-reported using fewer than five of them, including no CFLs. The CFL expertise analyses track how lighting market indicators, opinions about bulbs, and lighting knowledge differ between the groups. Similar analyses conducted in other program areas showed noteworthy differences between experts and novices on these topics.⁷ The consumer survey classified 44% of the respondents as experts and 56% as novices (larger because it includes households not aware of CFLs); this translates into about 1.1 million expert households and 1.4 million novice households throughout the state.

2.1 Awareness of EISA

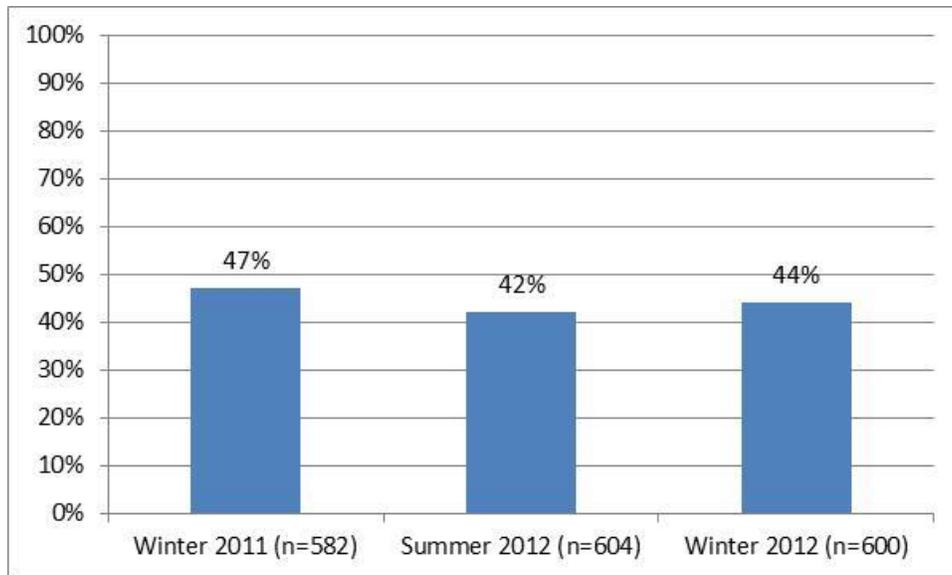
The increased lighting efficiency standards stemming from EISA represent a potentially substantial change in the lighting market. For this reason, the Team explored awareness of EISA through the consumer and store manager surveys.

⁶ Onsite saturation studies revealed that some of the respondents not aware of CFLs actually use them. They either did not realize they had CFLs (sometimes because a landlord or other person installed the bulb) or did not understand our description of CFLs.

⁷ These other reports are still under review at the time of writing (June 2013).

Less than one-half of respondents to all three waves of the lighting consumer survey reported being aware of the EISA legislation (Figure 2-1). In the Winter 2011 telephone survey 47% of respondents reported being aware of EISA. The percentage showed a statistically significant decrease to 42% in the Summer 2012 survey and then remained relatively stable at 44% in the Winter 2012 survey. Households defined as CFL experts voiced greater awareness of EISA (57%) than households defined as novices did (35%).

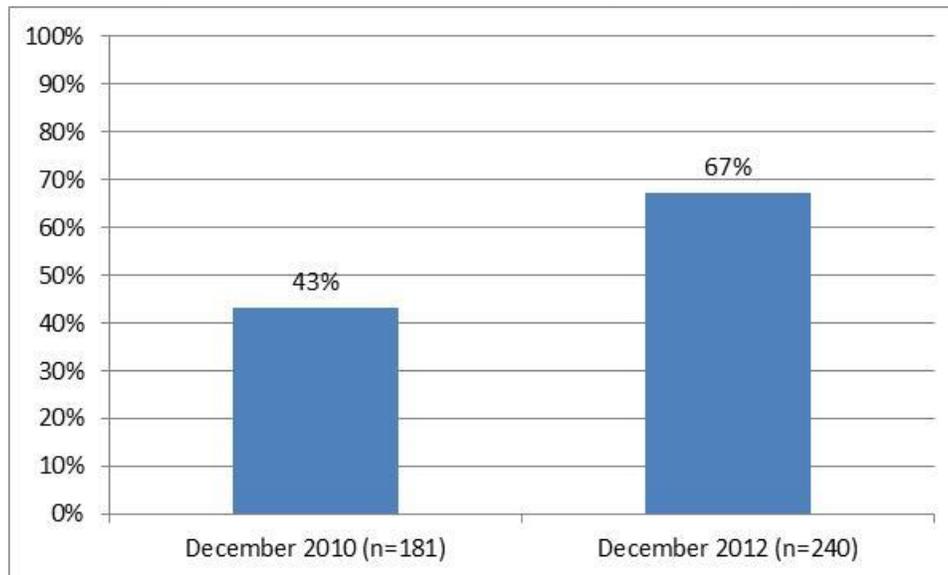
Figure 2-1: EISA Awareness among Consumers



Media attention to EISA appears to play a role in informing consumers about the incandescent phase-out. Forty-five percent of respondents to the Winter 2012 survey recalled hearing stories about light bulbs in the past year; 30% of these respondents said the lighting stories had discussed the fact that some light bulbs were being taken off the market or phased-out. Importantly, EISA garnered a fair amount of media—and Congressional—attention in late 2011 compared to late 2012 when the Presidential election and other stories dominated the news, likely explaining the somewhat higher levels of awareness reported by consumers in Winter 2011 compared to the other time periods.

In contrast to consumers, store managers have become increasingly aware of the EISA legislation, but many retailers were still unaware of the legislation (Figure 2-2). More specifically, 67% of the survey managers we surveyed in December 2012 claimed awareness of the legislation compared to 43% in December 2010. Awareness of EISA was highest among managers of stores—home improvement (92%) and small hardware (95%)—that will likely experience the greatest impact of the incandescent phase-out and the introduction of bulb types to replace them. In contrast, managers of stores that offer lighting but in which lighting is not a critical source of sales (e.g., discount stores with 41% awareness) are less likely to be aware of the legislation.

Figure 2-2: EISA Awareness among Store Managers



It is difficult to predict how consumer and retailer awareness of the EISA legislation will change in the months to come. It is possible that media attention and changes in bulb availability resulting from the phase-out of the common 60-Watt incandescent⁸ will increase consumer awareness of the legislation. However, it is also possible that the availability of the incandescent halogen, which looks and performs almost identically to a filament incandescent bulb, could mean that the phase-out will occur with very little additional change in consumer awareness of the legislation driving increased light bulb efficiency. Retailers currently unaware of the legislation may very well notice a change in the bulbs they are receiving from buying groups or that distributors are stocking on their shelves, but, like consumers, they may not ever connect this change to federal energy-efficiency legislation.

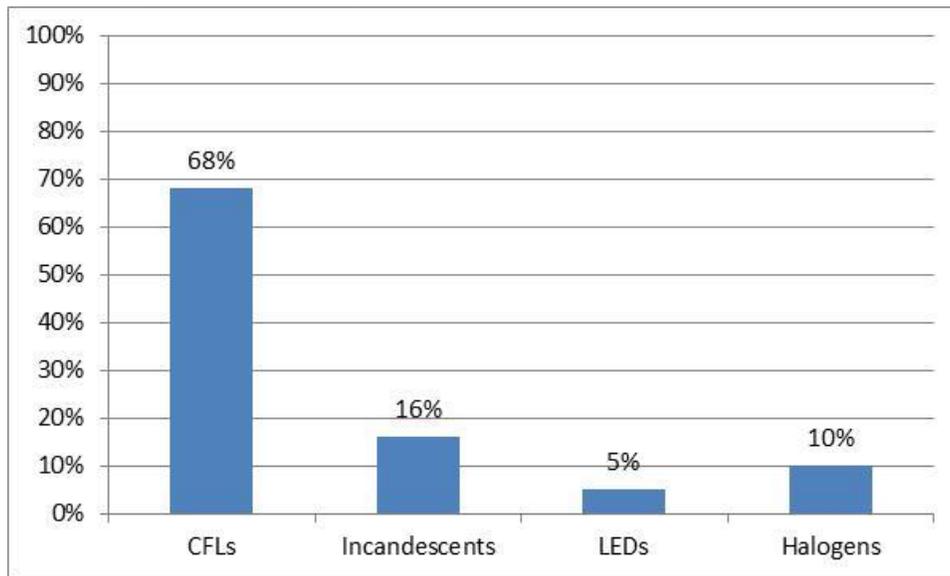
⁸ This is 22% of all sockets in Massachusetts homes in early 2013

2.2 Changes in Bulb Availability

Any casual visit to the lighting aisle of a home improvement store makes clear that there has been an explosion in the diversity of light bulbs available on the market. For now, general service filament incandescents share shelf space with EISA-compliant halogen incandescents, LEDs, and spiral and covered CFLs; soon these other bulb types will replace the phased-out incandescents.⁹ The Team explored bulb availability through the shelf-stocking survey, the consumer telephone survey, and supplier interviews and store manager surveys.

The shelf stocking survey directly measured the availability of different types of light bulbs on store shelves in Massachusetts, and the signals point to reduced availability of incandescent bulbs and increased availability of other bulb types. Stores that participate in the Program devoted 68% of shelf space in 2012 to CFLs and another 5% to LEDs (Figure 2-3).¹⁰ In contrast, they allocated only 16% of their shelf space to incandescent bulbs and 10% to halogens.

Figure 2-3: Shelf Space Devoted to CFLs: 2010 and 2012

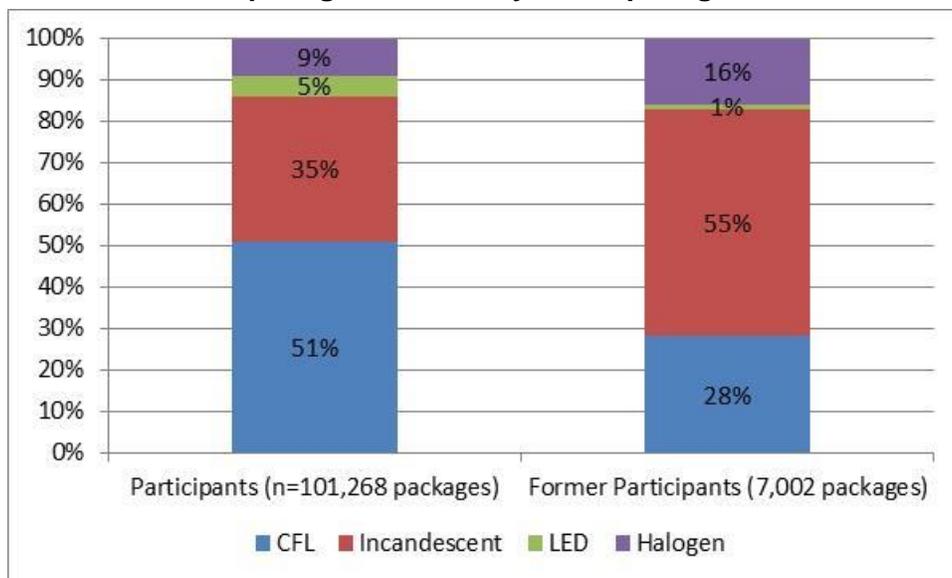


⁹ Specialty bulbs have experienced a similar increase in diversity, but they are not subject to EISA. One could make an argument, however, that research and development spurred by EISA for general service bulbs has contributed to the increase in specialty bulb diversity as well.

¹⁰ The Team did not collect shelf space information from formerly participating stores; these percentages are inclusive of all bulb types, not just general service bulbs.

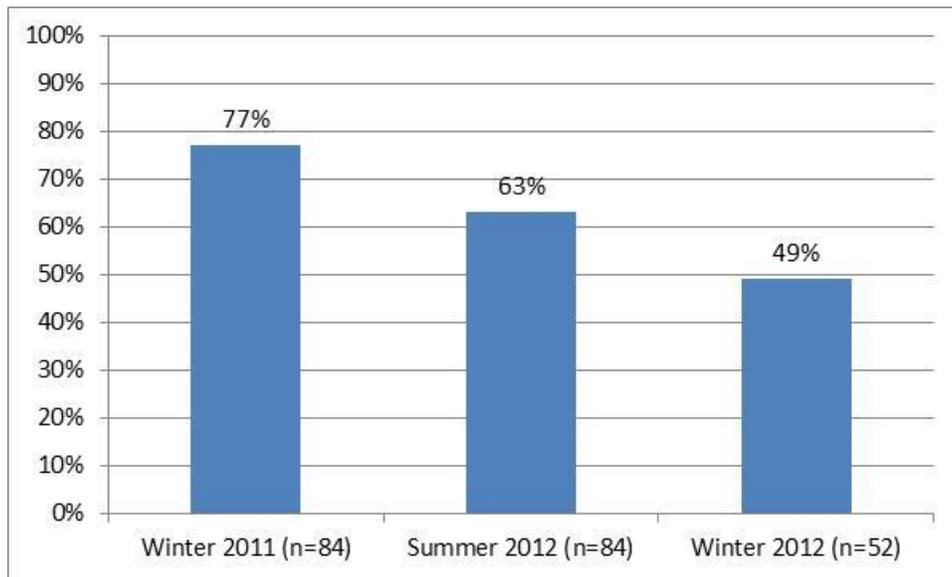
Moreover, the Program is also associated with a greater number of CFL and LED packages available in stores. Participating stores carried 23% more CFL packages and 4% more LED packages than formerly participating stores did, while they carried 20% fewer packages of incandescent bulbs and 7% fewer packages of halogens (Figure 2-4). Although the exact percentages differed, the greater concentration of CFLs and LEDs in participating stores held true for all retail channels included in the survey. These results certainly point to a positive impact of the program on the availability of energy-efficient lighting on store shelves, but we must recognize that there is a possible alternative explanation: stores predisposed to carrying energy-efficient lighting may be more willing to take part in the program. The most likely explanation is a mixture of program impact and predisposition to sell energy-efficient lighting.

Figure 2-4: Percentage of Packages by Bulb Type: Participating and Formerly Participating Stores



The consumer survey results present evidence that 100-Watt incandescent bulbs were available throughout 2012, but their availability decreased over the year. In Winter of 2011, 77% of households shopping for 100-Watt incandescent bulbs were able to find them on store shelves; this number decreased to 63% in the Summer of 2012 and again to 49% in the Winter of 2013 (Figure 2-5). The point must be stressed, however, that one-half of the consumers shopping for 100-Watt incandescent bulb still found them on store shelves a year after EISA banned their manufacture in and import into the United States. Clearly, retailers have stocks of 100-Watt incandescent bulbs that they have not yet sold, a point to which we return in Section 2.4

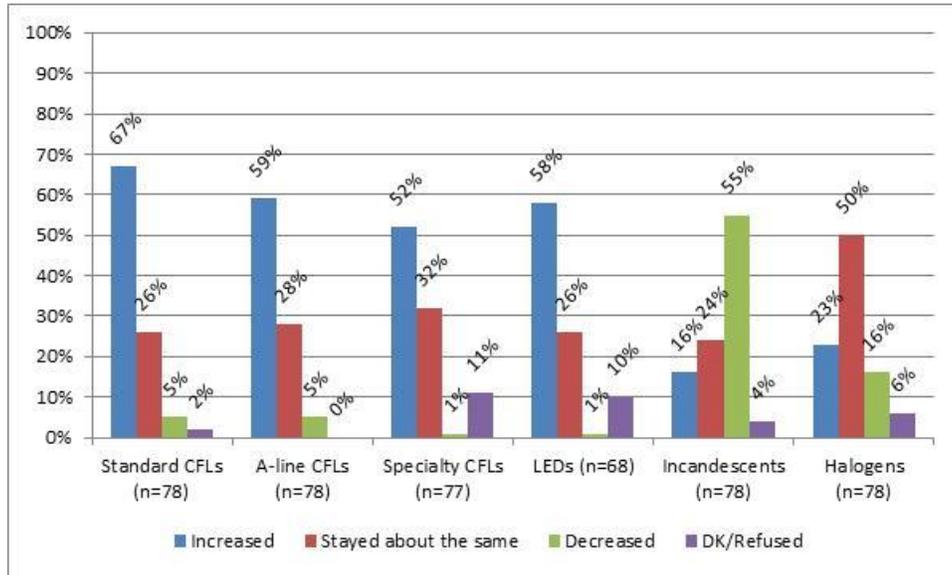
Figure 2-5: Shoppers Ability to Find 100-Watt Incandescents



Like the shelf stocking and consumer surveys, the store manager surveys also point to changing bulb availability, but the evidence is less conclusive. In particular, of the 174 store managers aware of EISA, only 40% of them said that the legislation had led them to change their stocking practices. Moreover, only in two retail channels—Home Improvement (64% of 33 respondents) and Lighting/Electronics (54% of 10)—did a majority of the store managers say that the EISA legislation had changed their stocking practices. It is worth noting, however, that the shelf-stocking study contradicts the recollections of these store managers; that study demonstrated a change in the overall bulb stocking mix between 2010 and 2012. Therefore, either the store managers do not tie changes in shelf stocking directly to EISA—the question did ask about EISA-induced changes—or they have forgotten the nature of the product mix that was on shelves prior to January 2012.

Yet, the 78 store managers who said that EISA had had an effect on their stocking practices corroborate the story told in the shelf-stocking and consumer surveys—that is, they were generally stocking a greater number of CFLs and LEDs and a decreasing or stable number of incandescent and halogen bulbs (Figure 2-6).

Figure 2-6: Store Managers Assessment of Changes in Stocking Practices



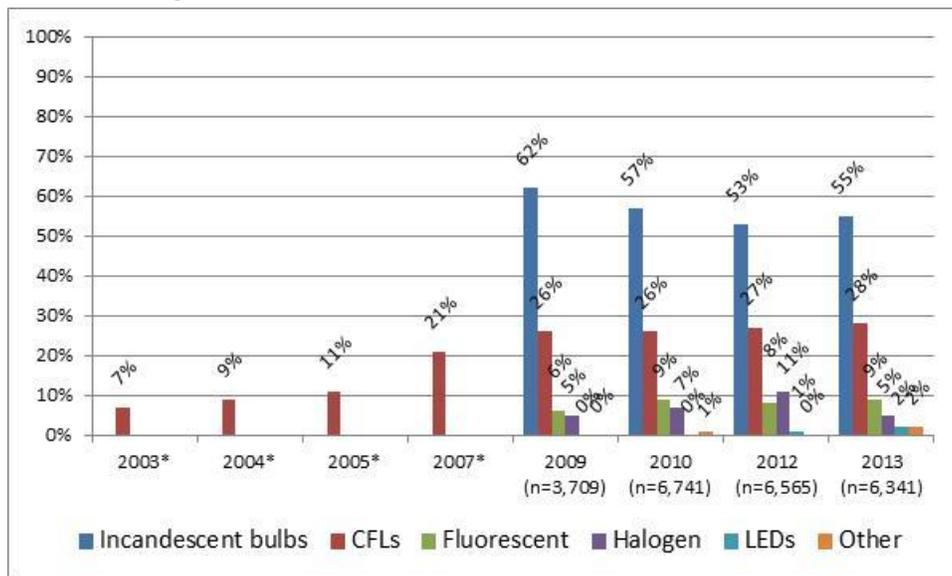
2.3 Changes in Bulb Purchases and Use

The 2011 through 2013 lighting evaluation activities provided mixed evidence about the actual and likely effects of EISA on light bulb purchases and use. This likely reflects the fact that much of the research was conducted within the first year of EISA implementation, when only 100-Watt incandescents had been phased-out. Therefore, more time—and ultimately more research—will be needed before we fully understand the effect of EISA on the residential lighting market.

2.3.1 Socket Saturations

Massachusetts evaluators have been performing regular lighting inventories in Massachusetts homes since 2003; prior to 2009, tracking focused only on CFLs, but since 2009, the NMR Team has also been following trends in saturations of other bulb types. These data suggest that CFL saturation increased rapidly between 2003 and 2009 but has changed very little (Figure 2-7). In fact, both incandescent and CFL saturations have not changed from a statistical standpoint between 2009 and 2013. Thus, the saturation data did not exhibit any effects from the first year of EISA implementation. This perhaps should not come as a surprise—only about 3% of sockets in 2010 were filled with incandescent bulbs subject to EISA at the start of 2012 and another 5% with bulbs phased-out in 2013.^{11,12} In contrast, in 2010 29% of sockets were filled with 40- to 60-Watt incandescent bulbs, which will be phased-out in 2014. Therefore, it is likely that the effects of EISA may not become fully manifest in onsite saturation data until 2015.

Figure 2-7: Onsite Socket Saturation 2009 to 2013



* Evaluators tracked only CFL saturation and did not track the number of sockets prior to 2009.

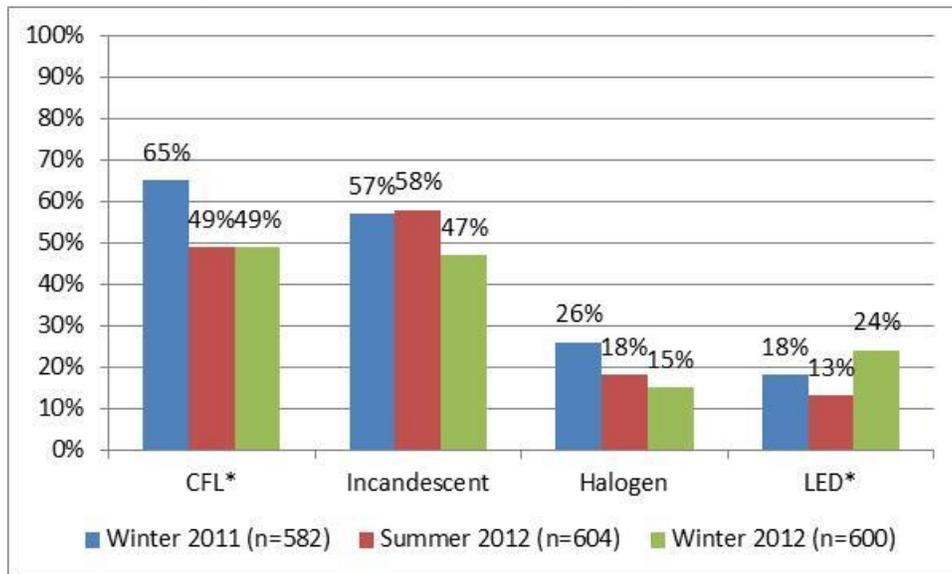
¹¹ We use 2010 as the baseline here because the Team did not perform a socket saturation study in 2011; we do not want to use more recent data as it may reflect EISA impacts.

¹² The individual onsite lighting inventory reports discuss likely reasons for the stability of saturation over time, but the tendency for households to replace bulbs that burn out with the same type of bulb—including CFLs replacing CFLs—seems to be among the most likely reasons for the stability.

2.3.2 Consumer Self-reported Bulb Purchase Behavior

The consumer telephone survey provided insight into self-reported consumers purchases from fall 2011 through fall 2012 as well as likely purchases after the EISA phase-outs of 75-Watt and 100-Watt incandescent bulbs. Each wave of the consumer survey asked respondents whether they had purchased light bulbs in the last three months (i.e., fall 2011, spring 2012, and fall 2012). Figure 2-8 demonstrates that the percentage saying they had purchased incandescents decreased over 2012 (from 58% in the Summer survey to 47% in the Winter survey), but the percentage of respondents self-reporting purchases of CFLs (65% to 49%) and halogen bulbs (26% to 18%) had also decreased and did earlier in the Summer 2012 survey. In contrast, the number of respondents reporting that they purchased LEDs increased over 2012 (13% in the Summer survey to 24% in the Winter survey). The LED purchase rate is somewhat contrary to the observed socket saturation rates of no more than 2%, which is most likely attributable to self-reporting error but could also reflect tentativeness among consumers who elect to try one or two LEDs even as they continue to buy and install many bulbs of other types. The changes in reported purchases were statistically significant. Anecdotal evidence from open-ended responses to the survey is that customers like LEDs; they say that they plan to adopt them in greater numbers as prices continue to come down.

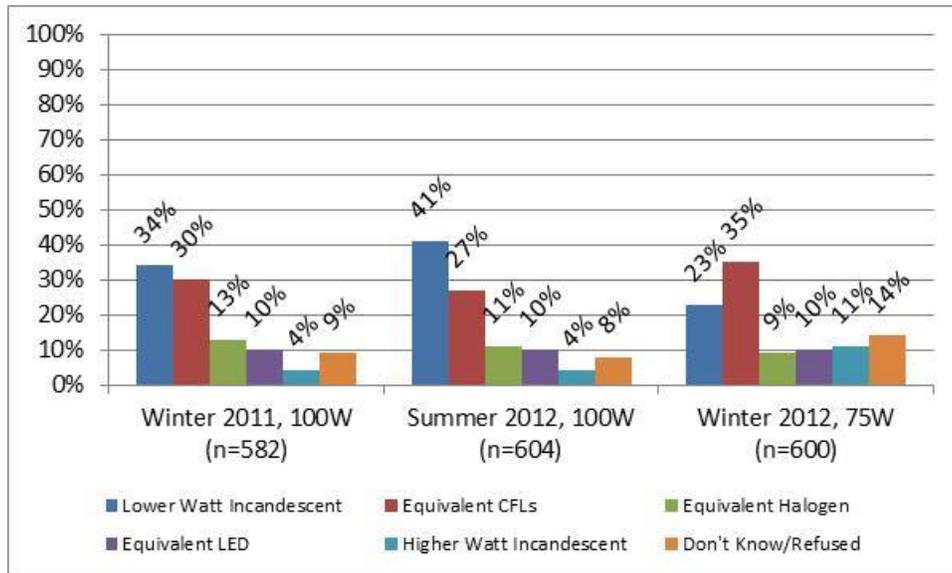
Figure 2-8: Percentage of Consumers Self-reporting Purchases of Each Bulb Type



*Screw-in CFLs and LEDs

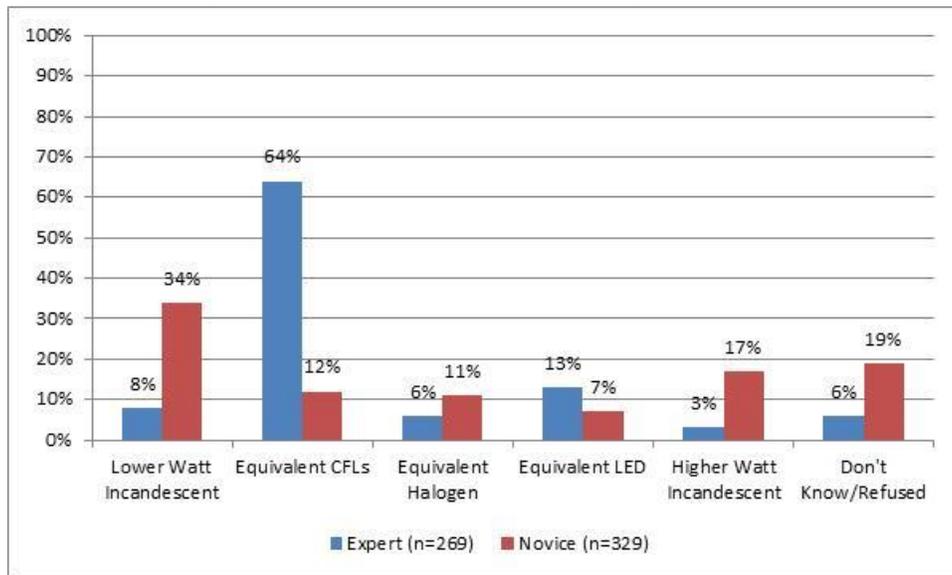
During the consumer survey, interviewers described a scenario to respondents in which either 100-Watt incandescents (Winter 2011 and Summer 2012) or 75-Watt incandescents (Winter 2012) were no longer available on store shelves; respondents then chose which bulb type they would use instead of the phased-out incandescent. Figure 2-9 describes the results of this question. Across the three surveys and for both wattages of incandescent bulbs, about 30% of respondents would use an equivalent brightness CFL and 10% would use an equivalent LED, collectively bringing the percentage choosing the most efficient bulbs to around 40%. Moreover, the CFL was the most popular choice for replacing the 75-Watt incandescent in winter 2012 (35%). However, more than one-half of respondents would make less efficient choices. In fact, a lower wattage incandescent bulb (34% in winter 2011 and 41% in summer 2012) was the most popular choice for replacing 100-Watt incandescents. The Team offers three important caveats about these results, though. First, the results represent responses to hypothetical situations described in a survey and actual bulb-selection behavior may differ. Second, even though many consumers think they will opt for a lower wattage incandescent, it is likely that they will not be satisfied with replacing a 100-Watt incandescent with an incandescent bulb of less than 40-Watts, which is the situation they will face in the future when 40-Watt incandescent bulbs sell through. Therefore, these consumers will have to make a different bulb choice than the one stated in the survey. Third, halogen incandescent bulbs are virtually indistinguishable from filament incandescents, and consumers may very well believe they are buying the same type of bulb they always have, not recognizing the difference in the technology used to make the bulb glow.

Figure 2-9: Percentage of Consumers Who Would Choose Each Bulb Type to Replace 100-Watt or 75-Watt Incandescents



The Team also examined which light bulbs respondents said they would use instead of a 75-Watt incandescent for CFL experts and novices.¹³ Although it is perhaps not surprising that CFL experts would chose a CFL more than other light bulb types, the degree to which experts prefer CFLs (and to a lesser extent LEDs) and novices prefer incandescents (and to a lesser extent halogen) bulbs is striking (Figure 2-10). More than three out of four experts would choose a very efficient bulb to replace a 75-Watt incandescent, but only one out of five novices would. All of the differences presented in the figure are statistically significant. It is also worth noting that novices voiced less certainty about their bulb choice; this could reflect the fact that many novices were renters whose landlords likely made many lighting decisions for them.

Figure 2-10: Percentage of Consumers Self-reporting Purchases of Each Bulb Type

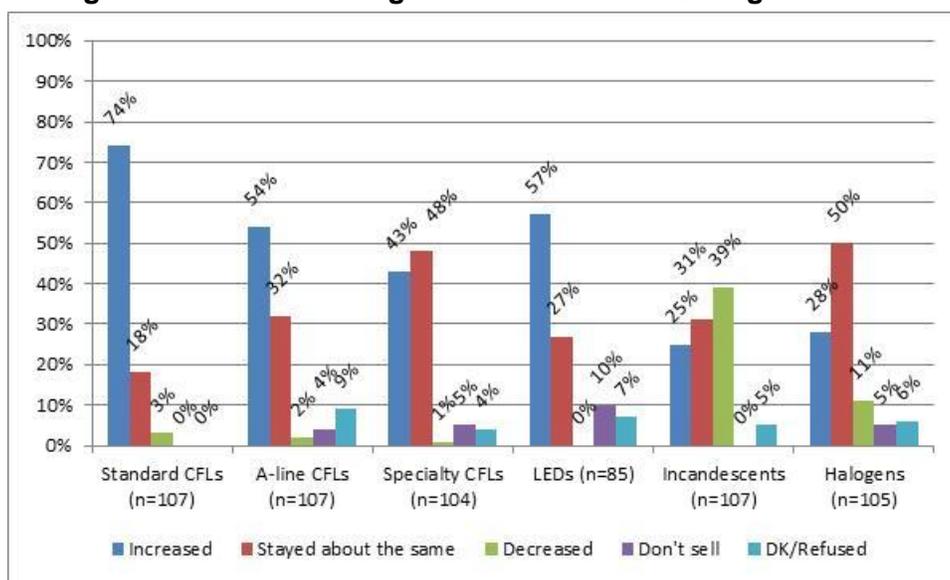


¹³ As noted earlier, novices self-reported using fewer than five CFLs and experts using more than five CFLs. We did not begin to determine expert/novice status until the Winter 2012 survey, so we do not have comparable data for 100-Watt incandescents.

2.3.3 Store Manager Assessment of Change in Sales

Turning to the store manager surveys, 56% of store managers aware of EISA said that they had noticed changes in their customers’ purchasing behavior resulting from the legislation. As shown in Figure 2-11, three-fourths of the managers noticing differences said that their sales of standard CFLs had increased and more than one-half said that sales of A-line CFLs or LEDs had increased. In contrast, only about one-quarter of the managers thought that incandescent or halogen sales had increased; most of the managers thought that sales of these less efficient bulb types had stayed the same (50% for halogens, 31% for incandescents) or decreased (11% for halogens and 39% for incandescents). Store managers were certainly more split on whether EISA had produced an increase in specialty CFL purchases (43%) or if purchases of this bulb type had remained stable (48%). The lack of clarity of EISA’s impact on specialty CFLs likely reflects the fact that the legislation does not phase-out specialty incandescent bulbs.

Figure 2-11: Store Managers Assessment of Changes in Sales



It is also worth noting that the supplier interviews indicated that the net-to-gross ratio was somewhat higher in the post-EISA period (in the 60% to 80% depending on the bulb type) than the ratio the Team recommended 2010 (47% for standard CFLs and 60% for specialty). However, because these results have not been triangulated with other net impact approaches nor have they been subject to the scrutiny of panel of experts as occurred in 2010, the Team presents these results only as indicative of a possible increase in program-induced sales in this early post-EISA phase.

Interestingly, the manufacturers and high-level retail buyers did not speak with one voice about how well EISA-compliant halogen bulbs were selling. Some manufacturers thought that recent decisions by many upstream lighting programs to limit buydown discounts for standard spiral CFLs created a risk that consumers would switch to the less expensive but much less efficient halogens. They argued that continued PA incentives for CFLs and LEDs were necessary to

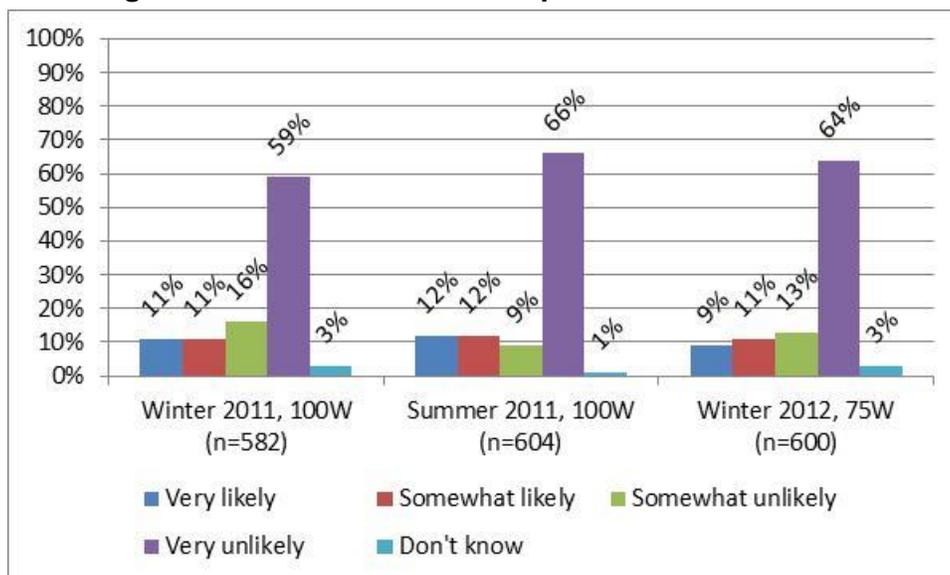
prevent consumers from defaulting to halogens as a result of their low price and similar appearance to filament incandescent bulbs. Indeed, many consumers may not even realize they are buying a halogen and not a filament incandescent bulb. However, other manufacturers thought that stockpiling of incandescent bulbs (see more in Section 2.4 below) was evidence that consumers had not been adequately educated about these halogens. Given that consumers did not report increased use of halogens—although they may have bought them unwittingly—and that three-fourths of store managers did not believe that halogen sales had increased, the Team cannot offer any conclusive evidence at this time about how EISA will affect sales of halogens or if they will become the “new standard bulb” over CFLs or LEDs. As stated elsewhere in this report, more time and the implementation of the 60-Watt incandescent phase-out will likely have to pass before the impact of EISA on halogen bulbs becomes clear, although if the program is to have an effect on Massachusetts consumers’ choice for the *de facto* standard bulb, the time to exert such influence is now, during the transition

2.4 Stockpiling of Incandescent Bulbs

Collectively, the consumer surveys, onsite lighting inventories, and supplier interviews confirm that some consumers and retailers are stockpiling incandescent light bulbs, but such stockpiling is limited and not happening on a large scale.

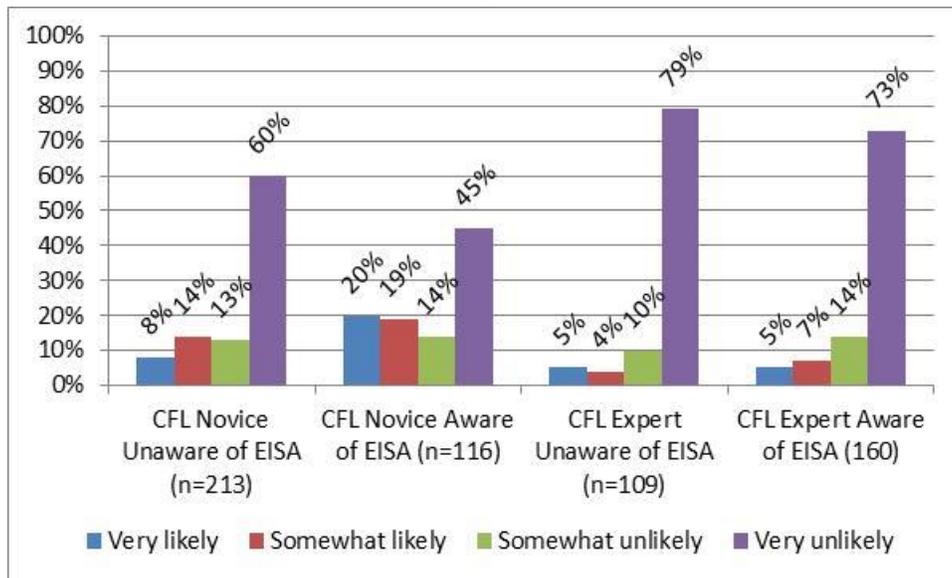
The Team asked consumer survey respondents if they were likely to stockpile incandescent bulbs—specifically 100-Watt bulbs in the Winter 2011 and the Summer 2011 surveys and 75-Watt bulbs in the Winter 2012 survey. The majority of respondents in each survey (59% to 64%) reported that they were “very unlikely” to stockpile incandescent bulbs (Figure 2-12). Furthermore, fewer than 25% of respondents in each survey said that they were “very likely” or even “somewhat likely” to stockpile incandescent bulbs.

Figure 2-12: Likelihood to Stockpile Incandescent Bulbs



The likelihood to stockpile, however, did vary by CFL expertise: CFL experts were less likely than novices to say that they would stockpile. Even within the group of novices, however, we found important differences; novices aware of EISA were statistically more likely to say that they would stockpile incandescent bulbs than were novices not aware of EISA or than experts in either awareness group. Still, only 40% of aware novices said they were “very likely” or “somewhat likely” to stockpile. This supports our overall conclusion that stockpiling is occurring and will continue to occur, but, thus far, it has not been a widespread practice.

Figure 2-13: Likelihood to Stockpile 75-Watt Incandescent Bulbs by EISA Awareness and CFL Expertise*



* Remaining respondents said they did not know their likelihood to stockpile.

The low levels of self-reported likelihood to stockpile were accompanied by very little evidence that EISA had brought about large amounts of *actual* incandescent stockpiling. Only 9% of telephone survey households reported that they had actually stockpiled 100-Watt incandescents, and the average number of 100-Watt incandescents stockpiled was less than one bulb per household overall but more than eight bulbs per household among those who said they had stockpiled. The onsite studies found only about four incandescents in storage, on average, in either the 2012 or 2013 surveys. Because we did not track incandescent storage prior to 2012, we cannot be certain if the observed storage rates differ from those prior to the implementation of EISA. It is also interesting to note that very few of those stored bulbs were 75-Watt or 100-Watt—the phased-out bulbs associated with those time periods; instead, most were 60-Watt incandescents, which implies that, if driven by EISA, consumers have already been stocking up on the most popular incandescent and are not waiting until closer to its phase-out date, perhaps because they were aware of EISA but not aware of the phasing.

The Team also considered whether self-reported likelihood to stockpile was related to actual incandescent stockpiling in respondents’ homes. In 2012, the Team found evidence that storage of incandescents was indeed higher among those who said they would be likely to stockpile, but

in 2013 there was no pattern between actual storage behavior and self-reported likelihood to stockpile. In fact, some people who said they were “very unlikely” to stockpile had dozens of incandescent bulbs in storage. When asked why they had those bulbs they said they liked to have them on hand and did not tie their storage to EISA.

However, some lighting manufacturers and retail buyers did report hoarding of incandescent bulbs. When asked what changes they had observed in consumer behavior post-EISA, one-fifth (22%) said that they had noticed stockpiling of incandescents.¹⁴ In addition, one buyer for a major retailer indicated that his company had experienced a spike in their sales of incandescent bulbs soon after the legislation went into effect. He indicated that this sales spike encompassed not only the 100 and 75-Watt bulbs that were the initial targets of the phase-out, but also included other incandescent wattages that were not yet subject to the phase-out. In fact, Team members have observed “stock up now” campaigns in partner stores that feature all A-line incandescent bulbs, not just those subject to the 2012 and 2013 phase-outs. Furthermore, some of the bulb manufacturers also reported a spike in demand for incandescent bulbs which they attributed to hoarding by retailers in anticipation of post-EISA demand for the products. A number of suppliers also indicated that EISA was motivating many consumers to move to lower-wattage incandescent bulbs—for example, move from 100-Watt bulbs to 60-Watt bulbs, rather than switch to wattage-equivalent CFLs or LEDs. Of course, as mentioned above, this practice has limited viability as the EISA implementation continues and affects 40- and 60-Watt bulbs.

2.5 The Big Unknown – 60-Watt Incandescent Phase-out

Much of the difficulty in understanding the effect of EISA and the likely future influence of the legislation is that the phase-out of incandescent bulbs does not yet apply to the most popular light bulb: the 60-Watt incandescent. As previously discussed, 60-Watt incandescent bulbs had the highest saturation of any single bulb type, filling 22% of all (not just 60-Watt equivalent) sockets in respondents’ homes. Thus, the two most critical questions about EISA—namely, which bulb will consumers choose to replace incandescents and will consumers stockpile incandescents—cannot yet be answered because an ample supply of 60-Watt incandescents remain on store shelves. Unfortunately, then, we must wait still longer—likely until 2015—to gain a clear understanding of the effect of EISA on the lighting market. A number of factors, however, will affect how the market reacts to the 60-Watt phase-out.

First, consumer awareness of EISA legislation will likely influence reactions to it. The 100-Watt phase-out received a fair amount of media and legislative attention and EISA awareness among consumers was highest in the Winter 2011 survey. In contrast, the 75-Watt phase-out did not receive as much attention as the period just prior to its implementation coincided with the Presidential election and national tragedies that dominated media attention in late 2012, and awareness of EISA was significantly lower in the Winter 2012 survey. Because it is the most

¹⁴ This question was asked of the 107 store managers (out of 240 total) that had observed changes in consumer purchasing behavior post-EISA.

commonly used bulb, the 60-Watt phase-out scheduled for implementation on January 1, 2014 is likely to rekindle media attention. This may raise awareness of EISA in potentially both positive and negative ways. From an optimistic perspective, rekindled attention may lead to increased efforts to educate consumers about energy-efficient bulb replacement options. Alternatively, increased attention may lead some consumers—particularly CFL novices—to stockpile 60-Watt incandescents as they realize this favored bulb type will soon not be available.

The second factor will be the selection of bulbs that are stocked on store shelves. Because it is the most common bulb type, the lighting market already offers numerous replacements for the 60-Watt incandescent bulb, both in terms of technology types (CFLs, LEDs, and halogens) and manufacturer/brand names under which they are available. Therefore, it is likely that stores will respond to waning 60-Watt incandescent supplies by expanding the shelf space devoted to existing alternatives. Such diversification of bulb offerings, however, may come after a temporary expansion in space devoted to 60-Watt incandescents in late 2013 and early 2014 as retailers respond to consumer demand for the bulbs or attempt to sell down their own stockpile of these popular incandescents.

Bulb packaging offers a third factor that may affect consumer reactions. Currently, manufacturers are packaging incandescent halogen bulbs in almost identical ways to filament incandescents. The halogen packages note that the bulbs are a lower wattage but equivalent brightness, yet they are otherwise indistinguishable from filament incandescents. Consumers may not even realize that they are buying a different type of light bulb. Also related to bulb packaging will be whether consumers read the new Lighting Facts label and gain a better understanding of the information conveyed in the label.

Finally, the price and quality of incandescent halogens and of LEDs will play an important role in consumer response to EISA. Both halogens and LEDs meet consumer demands to brighten quickly and work with various controls (although some issues with LED dimmability are still being addressed); neither contains mercury. However, the low price point of halogens will likely give them an edge—at least initially. In contrast, complaints about lumens output and short bulb life for halogens—often rated shorter than for filament incandescents—could send consumers searching for an alternative. Many may choose CFLs—the next lowest in price—but the continued concerns about mercury, slowness to brighten, light quality, and inability to dim could push still other consumers to give LEDs a try. In fact, our current research suggests that even households that have embraced CFLs are giving LEDs a try, in part because of their concerns about mercury and persistent quality concerns with CFLs.

3 EISA-related Recommendations and Considerations

Based on the research findings the Team offers the following recommendations as well as some other possible actions the PAs may want to consider but that do not constitute recommendations. Note that these are in addition to recommendations made in the individual reports for each evaluation activity.

Recommendation 1: Track the lighting markets in select comparison areas with varying levels and models of residential lighting programs. Historically, the PAs have turned to non-program comparison areas to describe baseline conditions of what the lighting market in Massachusetts might be like if it did not have a lighting program. However, difficulties in identifying non-program areas for the 2010 multistate modeling effort¹⁵ and the fact that no net-to-gross studies were performed in 2011 and 2012 meant that the Team has not explored the lighting markets in comparison areas since spring 2010. Such research will be needed to assess the effects of EISA. In particular, comparison areas with no or limited program activity or different program models (e.g., those that do not support standard CFLs) will help to determine what type of bulb consumers will choose as the new standard to replace filament incandescent bulbs, and whether their choice in Massachusetts differs from the choice in states without programs or with less active programs. If consumers adopt halogen bulbs at greater rates in these comparison areas—as manufacturers and retailers suggest they do—then the PAs will have evidence to support their program intervention to limit consumer adoption of halogens and their continued use of halogens as the baseline for calculating energy savings.

Recommendation 2: The PAs should continue rebates for standard CFLs and LEDs at least through 2015 (one year after 40- and 60-Watt incandescent phase-out) in order to keep more energy-efficient bulbs on shelves and prevent backsliding of the market to halogen incandescents. Evidence from the shelf-stocking study suggests that the PAs support of standard CFLs and LEDs limits the number of filament incandescent and incandescent halogen bulbs available on store shelves. Likewise at least some manufacturers and retailers believe that halogen sales have been stronger in places that do not support—or stopped supporting—standard CFLs. Although systematic comparison area research will be needed to answer this question definitively, right now it seems prudent to continue support of standard CFLs and LEDs.

Recommendation 3: Continue efforts to educate consumers about new lighting terminology such as lumens and light temperature, how to select the best bulb, and the variety of highly energy-efficient light bulbs available to meet residential lighting needs. The lighting section of retail stores offers a wide array of choices to consumers, and without guidance, many may opt for the easy choice—the least expensive bulb that looks the most familiar. For many consumers, the incandescent halogen bulb will be this easy choice. In order to steer consumers towards more efficient lighting, the PAs should continue to work with retailers to provide point-of-sale and

¹⁵ NMR. 2011. *Massachusetts ENERGY STAR® Lighting Program: 2010 Annual Report – Appendix C*. Delivered to the PAs and EEAC Consultants June 2011. Available at <http://www.ma-eeac.org/EMV.html>.

online materials that explain unfamiliar lighting terms and that offer suggestions on how to select the best and most efficient bulb for various residential lighting applications.

Consideration 1: The PAs may want to avoid spending program resources educating consumers about the existence of EISA and its implications for filament incandescent bulbs, lest it prompt stockpiling on the part of consumers. Households that are both aware of EISA but use few CFLs appear to be the most likely to hoard incandescent bulbs. Therefore, it is not in the best interest of the PAs to spend program resources to raise awareness about EISA and the incandescent phase-out. As mentioned earlier, the PAs should focus instead on educating consumers on the options they do have available and how to choose the best—and ideally most efficient—bulb for their lighting needs from among these options, which would mean continued efforts to educate them about lumens and color temperature

Consideration 2: The PAs may also want to consider a variety of additional options to avoid consumer stockpiling of filament incandescents and switching to incandescent halogens that may result as EISA implementation continues; these options would also increase socket saturation of energy-efficient bulbs. Program planners and implementers may want to examine the feasibility and cost-effectiveness of these possible program ideas:

- Market LED incentives and LEDs more heavily,¹⁶ and examine the possibility of increasing LED subsidies, keeping in mind the overall decrease in unsupported LED prices
- Produce marketing materials that include testimonials from CFL and LED converts about why they like these bulbs and how they improved over time
- Promote CFLs and LEDs with other residential programs as well as bulb buyback programs, among others

Consideration 3: In order to discourage stockpiling and backsliding to less efficient bulb choices, the PAs should consider incenting retail partners to carry fewer filament incandescent and halogen bulbs—particularly general service ones—on store shelves and to stock those they do carry in less prominent locations. The research identified at least some stockpiling of incandescent bulbs among both consumers and retailers; moreover, much of the stockpiling involved 60-Watt incandescent bulbs, even though they have yet to be phased-out. As the phase-out of these bulbs approaches, retailers may very well increase the shelf space devoted to popular 60-Watt incandescents with signage urging them to “stock up now.” Some consumers will respond by doing just that and likely in greater numbers than has been observed for the less common 75-Watt and 100-Watt incandescent bulbs. Incenting retailers to carry fewer incandescent bulbs and make their placement less prominent may reduce the amount of stockpiling that occurs. Likewise, incenting them to carry fewer incandescent halogens and reduce the prominence of their display may help prevent consumers from choosing halogens

¹⁶ The PAs may need to address dimmer compatibility issues and elevated temperature performance before making substantial changes in incentives to LEDs.

over more efficient CFLs and LEDs. While, on the surface, this consideration may appear to go beyond the toolbox of typical program activity, it is very similar to what will occur in the market lift approach: retailers will likely stock fewer filament incandescent and incandescent halogen bulbs in their efforts to increase sales of CFLs and LEDs and reach their market lift sales goals.