DNV·GL

# Report

## California Residential Replacement Lamp Market Status Report: Upstream Lighting Program and Market Activities in California through 2015

**Prepared for:** California Public Utilities Commission, Energy Division
ED_I_LTG_4: 2013-15 Lighting Impact Evaluation and Market Research Studies

**Prepared by:** **DNV GL- Energy**
Oakland, CA

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| Contact person: | Jenna Canseco, DNV GL |
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# 0. EXECUTIVE SUMMARY

DNV GL developed this report as part of the California Public Utilities Commission (CPUC) Evaluation, Measurement, and Verification (EM&V) work order (WO) ED_I_LTG_4 (LTG4): 2013-15 Lighting Impact Evaluation and Market Research Studies. This report reviews and summarizes the results of data collection efforts conducted in support of other lighting studies conducted in 2013-14 and prior, and provides additional context for the results.

## 0.1 Purpose

This document provides an update on California's rapidly-changing residential retail lamp market in California as of 2015, including supply- and demand-side market activities as well as Upstream[1] Lighting Program (ULP) activities. This serves as an update to the report titled "California Residential Replacement Lamp Market Status Report: Upstream Lighting Program and Market Activities in California through 2013," which the CPUC published in 2014.[2] The findings presented herein draw heavily from research conducted in support of the impact evaluation of the IOUs' 2013-14 upstream and residential downstream lighting programs.[3] This research gathered detailed data related to the replacement lamp market in California and to ULP activities during the 2013-14 program period. In many cases, the impact evaluation did not report on these results because they were not directly relevant to the impact evaluation's objective (i.e., estimating specific impact parameters). This report provides an opportunity to ensure that this valuable information is shared. It is not intended to be a comprehensive review of California's residential and/or upstream lighting markets, historic market activity, or ULP activity, but rather a summary of market- and program-related information gleaned from research conducted primarily for other purposes. The report occasionally cites national data, standards, and regulations in an effort to place the California-specific results within the broader market context. However, findings are California-centric unless explicitly noted otherwise.

## 0.2 Data sources

As described above, this report leverages the results of numerous data collection activities and research efforts to provide a status update on California's residential replacement lamp market activities and ULP activities through 2015. We describe these research efforts in more detail below.

### 0.2.1 Consumer telephone surveys

In support of the 2013-14 impact evaluation, DNV GL conducted more than 1,000 telephone surveys with residential electric customers of Pacific Gas & Electric Company (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric Company (SDG&E) during the summer of 2015. These surveys address consumer awareness, purchase, installation and storage of various lamp technologies including basic spiral compact fluorescent lamps (CFLs)[4]; globe and reflector CFLs; LED lamps; and incandescent lamps that comply with the efficacy standards set forth in the Energy Independence and Security Act of 2007 (EISA) and California Assembly Bill 1109 (AB 1109, the California Lighting Efficiency and Toxics Reductions Act).

1 Upstream programs provide incentives to manufacturers (and in some cases, retailers) to reduce the ultimate price that consumers pay for products.

2 DNV GL, 2014c.

3 DNV GL, 2016.

4 The CPUC defines basic CFLs as single-wattage, non-dimmable, bare spiral CFLs of up to (and including) 30 watts and all other CFL and LED lamps as "advanced lamps."

Where possible, the report also draws upon consumer telephone surveys conducted in support of 2006-08 and 2010-12 ULP evaluation efforts to compare results over time. DNV GL also collected these data in previous evaluation periods.

### 0.2.2 Lighting retail store shelf surveys

To support the 2015 impact evaluation, DNV GL field researchers conducted more than 400 in-store inventories of replacement lamp stock during the winters of 2014-15 and 2015-16. Researchers gathered details regarding the manufacturer, model number, lamp technology, form factor (lamp shape), quantity of lamps per package, price per package, wattage, lumens, and numerous other characteristics for all screw-based and pin-based replacement lamp models stocked in each store as well as a count of the number of lamp packages in stock for each lamp model. These data allowed us to estimate the percentage of California retail stores stocking lamps with various characteristics, the percentage of total lamp stock comprised by different lamp types, the average number of lamp models per store, and the average price per lamp. DNV GL also collected these data in previous evaluation periods.

### 0.2.3 Shopper intercept surveys

DNV GL staff intercepted shoppers who were purchasing replacement lamps and conducted brief surveys with them to discuss their purchasing decisions and installation intentions for the newly-purchased lamps. We conducted more than 800 intercept surveys concurrent with the winter 2014-15 and winter 2015-16 shelf surveys in more than 400 retail stores. DNV GL also collected these data in previous evaluation periods.

### 0.2.4 Supplier interviews

To support the 2013-14 impact evaluation, DNV GL staff conducted 24 in-depth telephone interviews with representatives of lamp suppliers in 2015. Interview participants included 18 representatives of lamp manufacturing organizations and 6 buyers from regional and national retail chain stores. Supplier representatives shared their perspectives on the influences of the ULP, regulations, and standards on California's residential replacement lamp market; their predictions regarding on the future of CFL and LED lighting sales; and their views on numerous other topics. DNV GL also collected these data in previous evaluation periods.

### 0.2.5 Lamp choice model

DNV GL developed a residential consumer Lamp Choice Model (LCM) as part of the 2010-12 upstream lighting program impact evaluation.[5] We used the LCM to examine how consumer's lamp purchasing decisions may have differed in 2015 under changed regulatory and market conditions. This model allows us to examine how changing lamp prices affect consumer choice. DNV GL also used the LCM in previous evaluation periods.

### 0.2.6 Other data sources

This report also draws upon numerous secondary sources including prior evaluations of California's residential lighting market and the California IOUs' residential and upstream lighting programs. We also leverage publications to compare California's market with others, where possible. We use these sources to

[5] DNV GL, 2014a.

help provide context for the data sources described above. In some cases, earlier sources also enable us to provide time-series comparisons of results.

## 0.3 Conclusions

This study yielded the following conclusions:

1. At the national level, the ENERGY STAR-qualified CFL manufacturing landscape has contracted while the LED lamp manufacturing landscape continues to expand. This trend is likely to continue, given that forthcoming changes to the ENERGY STAR standard (ENERGY STAR 2.0) will increase the number of LED lamps that qualify and potentially eliminate CFLs. These changes aligned with lamp manufacturers' outlook on California lamp sales. These manufacturers expect CFL sales to decline and LED lamp sales to increase over the next several years.
2. Smaller retail channels such as discount, drug, and grocery may not sell ENERGY STAR CFLs or LED lamps without ULP support. Big box channels are less limited in their ability to continue stocking ENERGY STAR lamps.
3. For lamps in the A-lamp replacement category, the lowest-cost option without IOU discounts in both 2014 and 2015 was the traditional incandescent A-lamp, followed by the EISA-compliant halogen lamp. When IOU discounts were available, however, the lowest-cost option shifted to CFLs (basic spirals in 2014 and A-lamps in 2015).
4. The retail stock mix for residential replacement lamps continues to shift away from incandescent lamps and toward LED lamps.
5. While the vast majority of lamp supplier representatives claimed that the CEC LED lamp specification caused negative market effects for LED lamps, some supplier representatives acknowledged that the specification pushed technological advancements and improved LED lamp quality. Additionally, retail stock data suggest that with discounts, LED lamps that meet the CEC specification are the least-cost LED option available.
6. Lamp quality is less of a concern among consumers who had not purchased LED lamps than price and lack of familiarity with the technology. For CFLs, however, quality and performance were the chief concerns among consumers who had not purchased CFLs as of 2015.
7. Awareness of LED lamps among California consumers was on par with CFLs in 2015 (85% each). Purchase rates for LED lamps remained low, however, as did awareness and purchase rates for EISA-compliant halogen lamps.
8. Aside from energy savings, price was the primary motivator among CFL purchasers in 2015 and expected useful life was the primary motivator among LED lamp purchasers.

# 1. INTRODUCTION

This section of the report provides an overview, purpose, and organization of this report.

## 1.1 Purpose

This document provides a status report on the residential retail lamp market in California, including supply- and demand-side market activities as well as Upstream Lighting Program (ULP) activities as of 2015. The findings presented herein draw heavily from research conducted in support of the 2013-14 impact evaluation.

Research activities related to the 2013-14 impact evaluation gathered detailed data related to the replacement lamp market in California and to ULP activities during the 2013-14 program. The impact evaluation did not report on these results because they are not directly relevant to the impact evaluation's objective (i.e., estimating specific impact parameters). This report provides an opportunity to ensure that this valuable information is shared. It is not intended to be a comprehensive review of California's residential and/or upstream lighting markets, historic market activity, or ULP activity, but rather a summary of market- and program-related information gleaned from research conducted primarily for other purposes. The report occasionally cites national data, standards, and regulations in an effort to place the California-specific results within the broader market context. However, findings are California-centric unless explicitly noted otherwise.

## 1.2 Report organization

This report is organized into seven sections following an Executive Summary. Section 2 provides an overview of the data sources leveraged in this report, and Section 3 through 6 summarize important findings. The remaining section (Section 6) provides DNV GL's conclusions based on the findings described in previous sections.

Report chapters include the following:

- Section 2 describes the data sources leveraged to produce this report.
- Section 3 provides an overview of the California replacement lamp market context, including key influences on the market (such as regulations, the California Long Term Energy Efficiency Strategic Plan, and California investor-owned utility [IOU] lighting programs).
- Section 4 summarizes the supply side of the California market for residential replacement lamps, including lamp manufacturer and retailer characteristics.
- Section 5 describes the demand side of the market, including key characteristics of energy-efficient lamp purchasers and non-purchasers.
- Section 6 provides projections of consumers' choices regarding various lamp technologies under changed regulatory and market conditions.
- Section 6 highlights conclusions based on the results presented in Chapters 3 through 6.

The report also includes five appendices:

- Appendix A includes the bibliography for this study;

- Appendix B includes a brief description of sample expansion weights used for the winter 2012-13, summer 2013, winter 2014-15 and winter 2015-16 shelf survey results;
- Appendix C includes additional results from analyses of California retail lighting shelf survey data from the winter 2012-13, summer 2013, winter 2014-15 and winter 2015-16 shelf survey periods;
- Appendix D provides the coefficients for the LCM leveraged in Chapter 6;
- Appendix E provides reviewer comments and author responses.

# 2. DATA SOURCES

Below we provide an overview of the data sources leveraged in support of this study. Data sources from 2009 through 2015 include various evaluation and market research efforts performed by DNV GL (formerly DNV KEMA and KEMA, Inc.). This report primarily uses data gathered under the LTG4 contract for the purposes of evaluating the IOUs' 2013-14 upstream and residential downstream lighting programs. In addition, it leverages other CPUC-funded studies to track market changes over time. We describe relevant details for each of these sources below. Note that below, we summarize data sources that have become available since the CPUC published the prior California Residential Replacement Lamp Market Status Report in 2014.[6]

## 2.1 2015 DNV GL data sources

DNV GL (formerly DNV KEMA and KEMA, Inc.) conducted numerous data collection efforts in support of the impact evaluation of the IOUs' 2013-14 upstream and residential downstream lighting programs for the CPUC. Among these, the data sources leveraged in support of this report include:

- Telephone surveys of PG&E, SCE, and SDG&E residential electric customers;
- Retail store shelf surveys and shopper intercept surveys;
- In-depth telephone interviews with lamp suppliers; and
- Lamp choice model (LCM).[7]

### 2.1.1 PG&E, SCE, and SDG&E residential electric customer telephone surveys

DNV GL implemented telephone surveys with PG&E, SCE, and SDG&E residential electric customers in support of the 2013-14 impact evaluation in 2015. We also conducted similar surveys in support of prior evaluation periods. The surveys addressed awareness, purchase, installation and storage of various energy-efficient lamp technologies. Only respondents who were electric customers of PG&E, SCE, or SDG&E were eligible to complete the survey.

The surveys considered two distinct timeframes. We asked some questions to support the 2013-14 evaluation period in particular – for example, we asked for details regarding lamp purchases and installations relative to January 1, 2013 and later. We addressed other topics (such as technology awareness, lamp storage behaviors, and so on) with broader questions designed to capture activities to date.

Table 1 below summarizes the disposition of 2015 consumer telephone survey results by IOU service territory. Survey results are weighted to the population of residential electric customers in PG&E, SCE, and SDG&E territories.

6 DNV GL, 2014c.

7 We include the model as a "primary data source" as its inputs rely on primary data.

**Table 1: Disposition of LTG4 telephone surveys among PG&E, SCE, and SDG&E residential electric customers by IOU service territory, 2015**

| IOU | Number of Respondents (n) | Percent of Respondents |
|---|---|---|
| PG&E | 409 | 40% |
| SCE | 413 | 41% |
| SDG&E | 194 | 19% |
| **Overall** | **1,016** | **100%** |

### 2.1.2 Lighting retail store shelf surveys and shopper intercept surveys

DNV GL conducted shelf inventories of lamps for sale in California retail stores throughout PG&E, SCE and SDG&E service territories in support of the 2013-14 impact evaluation and prior evaluation periods. During the shelf inventories, we conducted shopper intercept surveys with consumers who were shopping for lamps. The shelf surveys gathered detailed information regarding all residential replacement lamps stocked in the stores other than linear fluorescent lamps. The shopper intercept surveys focused on shopper purchasing decisions and installation intentions for the newly-purchased lamps.[8]

DNV GL conducted the most recent phases of shelf surveys and shopper intercept surveys during the winter of 2015-16 and winter of 2014-15. Field staff spent a minimum of four hours in each store completing the shelf surveys and attempting to intercept shoppers. Field staff completed surveys opportunistically—that is, with individuals who were shopping during the time periods in which we conducted intercept surveys in specific stores. As such, results from the intercept surveys may not represent the broader population of shoppers purchasing replacement lamps at various stores throughout the year. Nonetheless, given the range in timeframes and store types in which we conducted these surveys, results provide general indications of shopper preferences, price sensitivity, lamp installation intentions, and so on.

The shelf survey sample targeted approximately 200 stores per survey phase. We stratified the sample by retail channel and IOU service territory (for PG&E, SCE, and SDG&E territories) and designed the sample to represent the retail market for residential replacement lamps in these areas. The sample design targeted roughly equal numbers of stores in each retail channel to ensure enough sample points per channel to enable channel-to-channel comparisons.[9]

Table 2 below provides details regarding the number of stores visited during each of the two most recent shelf survey phases, and Table 3 displays the number of lamp purchasers intercepted during the two most recent intercept survey phases.[10] Altogether, field staff conducted 407 shelf surveys and intercepted a total

8 Field researchers also conducted shopper intercept surveys with respondents who were not purchasing lamps (non-purchaser shopper intercept surveys), but the results in this report focus on surveys with lamp purchasers only because these surveys included detailed questions regarding lamp replacement intentions.

9 For a more detailed description of shelf survey and shopper intercept survey methods (including a more detailed description of the sampling approach), please refer to the WO28 report (DNV GL, 2014a).

10 Note that Table 3 includes all purchasers across all lamp technologies, base types, and lamp shapes. Of the total 822 intercepted lamp purchasers, only 12 reported that they were purchasing lamps with the intent to install them in nonresidential applications (approximately 1% of intercepted purchasers). Interviewers targeted shoppers of MSB lamps in twister, A-lamp, reflector/flood, and globe styles. However, staff did encounter and interview some purchasers of non-MSB lamps (18) as well purchasers outside of the targeted lamp styles (21).

of 894 lamp purchasers during these data collection periods.[11]

**Table 2: Number of shelf surveys conducted by retail channel and survey phase, winter 2014-15 and winter 2015-16**

| Retail Channel | Survey Phase | |
|---|---|---|
| | Winter 2014-15 | Winter 2015-16 |
| Discount | 29 | 29 |
| Drug | 29 | 30 |
| Grocery | 28 | 28 |
| Hardware | 29 | 29 |
| Home improvement | 28 | 31 |
| Mass merchandise | 29 | 29 |
| Wholesale club | 28 | 31 |
| **Total** | **200** | **207** |

**Table 3: Number of intercept surveys conducted with lamp purchasers by retail channel and survey phase, winter 2014-15 and winter 2015-16**

| Retail Channel | Survey Phase | |
|---|---|---|
| | Winter 2014-15 | Winter 2015-16 |
| Discount | 27 | 40 |
| Drug | 19 | 17 |
| Grocery | 9 | 6 |
| Hardware | 39 | 58 |
| Home improvement | 137 | 64 |
| Mass merchandise | 101 | 104 |
| Wholesale club | 131 | 142 |
| **Total** | **463** | **431** |

The DNV GL team applied sample expansion weights to each phase of shelf survey results such that each sample represents the population of retail stores that sell replacement lamps by retail channel in California. We based these results on a telephone sample of 800 retail stores in California stratified by retail channel.[12] Appendix B describes the development and application of the shelf survey weights.

[11] For the sake of simplicity, we refer to intercepted shoppers with lamps in their shopping carts or baskets as "purchasers." While each shopper has not yet purchased his or her lamp(s) at the time of the surveys, the expectation was that he or she would do so shortly after we completed the intercept survey.

[12] See DNV GL, 2014c for further detail.

### 2.1.3 In-depth telephone interviews with lamp supplier representatives

Experienced DNV GL interviewers conducted in-depth telephone interviews with lamp supplier representatives during the second quarter of 2015.[13] Individual respondents included representatives of lamp manufacturing organizations and buyers from national retail chain stores. All but two of the respondents represented organizations that either manufactured or sold replacement lamps discounted by the California IOUs' 2013-14 ULP according to program tracking data. (Two respondents represented organizations that participated in the 2010-12 ULP). The 2015 sample frame included 31 manufacturing organizations and the 13 retail chains to which manufacturers shipped the largest shares of total 2013-14 ULP lamps.[14]

Table 4 shows the number of in-depth interviews completed by supplier type (manufacturer versus retail buyer). It also shows the percentage of total 2013-14 ULP shipments represented by the 24 supplier representatives who completed interviews with us. As shown, manufacturing organizations that participated in the in-depth interviews represent a larger percentage of total ULP shipments than the retail organizations (97% versus 29%). Given this result, the summaries presented in this report focus primarily on results from interviews with manufacturers' representatives.

**Table 4: Disposition of in-depth telephone interviews with participating lamp supplier representatives by supplier type, 2015**

| Supplier Type | Number of Completed Interviews | % of 2013-14 ULP Lamp Shipments Represented by Interviewees |
|---|---|---|
| Lamp manufacturer | 18 | 97% |
| Retail lighting buyer | 6 | 29% |
| **Total** | **24** | |

### 2.1.4 Lamp Choice Model

The DNV GL team developed a residential consumer LCM as part of the impact evaluation of the IOUs' 2010-12 upstream and residential downstream lighting programs.[15] The model relies upon data from the retail store shelf surveys and in-store shopper intercept surveys to predict the probability that a consumer will choose a particular lamp. The intercept surveys collected information on consumer choices required for the model, while the shelf surveys captured information regarding the context for those choices, including details related to the selected lamp, its intended application, the retail channel in which the lamp was selected, and characteristics of the lamp purchaser. The LCM uses a nested logit model structure to predict consumer choices over a set of discrete alternatives.

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13 Throughout the report we use "lamp suppliers" to refer collectively to manufacturers and retailers. When results are applicable only to one group or the other, we refer to the relevant respondent group (lamp manufacturers' representatives or retail lighting buyers).

14 For a more detailed description of the supplier interview methods (including a more detailed description of the sampling approach), please refer to the WO28 report (DNV GL, 2014a).

15 DNV GL, 2014a.

Key model features include:

- **Market share predictions.** The model predicts changes in market shares as a response to price changes such as those that incentive programs introduce.
- **Heterogeneous price sensitivities.** Not all consumers have the same price sensitivity. The model design reflects that price sensitivities vary by consumer household income and whether the consumer is making an impulse or planned purchase.
- **Retail channel differences.** The model design recognizes that consumers have price sensitivities and choice sets that vary by retail channel. Specifically, the channels examined in the current study are: discount stores, drug stores, grocery chain stores, grocery independent stores, hardware stores, home improvement stores, mass merchandise stores and wholesale clubs.

Appendix D provides the coefficients for the LCM. For more background regarding the model, please refer to the 2010-12 ULP impact evaluation report.[16]

## 2.2 Other Data Sources

This report also draws upon numerous additional sources in addition to those described above. These include information gathered by DNV GL and other organizations including prior market research regarding residential lighting in California, evaluations of the California IOUs' residential and upstream lighting programs, and other industry publications. Appendix A provides complete citations for all sources cited in this report.

[16] DNV GL, 2014a.

# 3. MARKET CONTEXT

The purpose of this chapter is to summarize some of the influences on California's market for residential replacement lamps. Some of these observations relate, including national lamp efficacy regulations, and the ENERGY STAR quality standards are national findings that are influence the California market. As of mid-2016, key influences included:

- Lamp efficacy regulations
- Quality standards for CFLs and LED lamps
- California's Long-Term Energy Efficiency Strategic Plan
- Residential and upstream energy-efficiency programs operated by the California IOUs to support energy-efficient lamp adoption

Each of these elements has influenced California's market and/or the IOUs' market intervention strategies. This chapter introduces these market influences and (where possible) provides a high-level summary of market actor perspectives on them. We address supplier perspectives in more detail in chapter 4 (Market Supply) and consumer perspectives in chapter 5 (Market Demand).[17]

## 3.1 Lamp Efficacy Regulations

Below we describe two key regulations affecting California's residential replacement lamp market. Both of these regulate lamp efficacy, which is the amount of light produced for each unit of electricity consumed, and is typically measured in terms of lumens (lm; a measure of lamp brightness) per watt (W). The regulations include the Energy Independence and Security Act of 2007 (EISA) and California Assembly Bill (AB) 1109, the California Lighting Efficiency and Toxics Reductions Act.

### 3.1.1 EISA

The U.S. Congress passed EISA in 2007, requiring general purpose lamps[18] to meet the efficacy standards shown in Table 5. EISA does not ban incandescent lamps or lamps of specific wattages; these are common misconceptions regarding the legislation. Instead, it establishes minimum efficacy requirements that traditional incandescent lamps cannot meet, effectively pushing the most inefficient lamps out of the market. EISA's efficacy requirements target the most common general purpose lamps; thus, many lamp types are exempt from the standards (including three-way, high light output[19], shatter resistant, rough service, and vibration service lamps).[20]

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17 The supplier interviews asked respondents for their perspectives on lamp efficacy regulations, the LED quality specification, and the California IOUs' ULP. The consumer telephone surveys asked respondents about their familiarity with lamp efficacy regulations. Neither data collection effort addressed California's Long-Term Energy Efficiency Strategic Plan or the ENERGY STAR Program, but we describe these nonetheless because of their roles in helping to shape the California IOUs' market intervention strategies.

18 EISA defines a *general purpose lamp* as a standard incandescent or halogen type lamp that is intended for general service applications; has a medium screw base; falls within a lumen range of 310 to 2,600 lumens; and is capable of being operated at a voltage at least partially within 110 and 130 volts. We apply this definition of general purpose lamps throughout this report.

19 High light output lamps are defined by lumen levels greater than 2,600 lumens and are typically represented by 150-300W traditional incandescent bulbs.

20 According to the U.S. EPA (2011), the U.S. Department of Energy (DOE) will monitor sales of exempt lamp types going forward, and if sales increase substantially, the DOE has the authority to apply efficacy standards to those lamp types.

**Table 5: Summary of EISA efficacy requirements for general purpose lamps**

| EISA Effective Dates | Incandescent Lamp Wattage (W) | Typical Incandescent Light Output in Lumens (lm) | Typical Incandescent Efficacy (lm/W) | EISA Replacement Wattage (W) | EISA Light Output Ranges (lm) | EISA Minimum Efficacy Ranges (lm/W) |
|---|---|---|---|---|---|---|
| 1/1/2012 | 100 W | 1690 lm | 17 lm/W | 72 W | 1490-2600 lm | 21-36 lm/W |
| 1/1/2013 | 75 W | 1170 lm | 16 lm/W | 53 W | 1050-1489 lm | 20-28 lm/W |
| 1/1/2014 | 60 W | 840 lm | 14 lm/W | 43 W | 750-1049 lm | 17-24 lm/W |
| 1/1/2014 | 40 W | 490 lm | 12 lm/W | 29 W | 310-749 lm | 11-26 lm/W |

Source: U.S. Environmental Protection Agency (EPA), 2011.

As demonstrated in Table 5 above, EISA's standards affected the market in stages. On January 1, 2012, the legislation prohibited the manufacture and importation of general purpose incandescent lamps above 72 watts with light output in the 1,490 to 2,600 lumen range, beginning the phase-out of many traditional 100 watt incandescent lamps. After this date, it was illegal to manufacture or import lamps that did not meet the standard, but the standard allowed retailers to sell any existing stock. As of January 1, 2014, EISA's efficacy requirements were in effect for lamps affected by all stages of the regulation.

In addition to regulating the manufacture and importation of general purpose incandescent lamps, EISA also includes efficacy standards for reflector lamps and linear fluorescent lamps as well as a second phase of regulations (EISA Tier 2).[21] EISA Tier 2 directs the U.S. Department of Energy (DOE) to propose rules for general purpose lamps that exceed the efficiency standards set forth during the first phase of the legislation described above (see Table 2). If the DOE's rulemaking does not lead to a minimum efficiency of at least 45 lumens per watt, the "backstop" efficiency level established by EISA, then all general purpose lamps would be required to have an efficiency of 45 lumens per watt by 2020.[22] This would lead to the elimination of all of the lamps currently considered as EISA-compliant halogen lamps, since this technology would not be able to attain the required efficacy level.

However, the DOE is unlikely to finalize the rulemaking associated with EISA Tier 2 until the end of 2016, and there has been discussion about the efficacy requirement being regarded as a "fleet average" standard—in other words, one possible outcome is that lower-efficacy lamps (such as halogen lamps currently considered EISA-compliant) could still be sold as long as the average efficacy of general purpose lamp sales reached the level of 45 lumens per watt.[23] There are also noteworthy political and regulatory barriers to the full implementation of the EISA Tier 2 standard. In December 2011, the U.S. House of Representatives passed a last-minute rider (attached to the omnibus government spending bill) that prevents the U.S. Department of Energy (DOE) from enforcing EISA.[24] While this rider has not adversely impacted the first phase of EISA, it is possible, though unlikely, that it could adversely impact EISA Tier 2.

For instance, it is possible that some manufacturers would not comply with the efficiency standards set forth in EISA Tier 2, since there currently is no enforcement mechanism to ensure that general purpose lamps meet the higher efficiency standards. As such, manufacturers could, in theory, continue to manufacturer EISA-compliant halogen lamps beyond 2020 if there are no future rules or legislation for the enforcement of the higher efficiency standards. Given that the residential lighting market continues to move rapidly toward

21 *Ibid.*
22 NEEP, 2015.
23 *Ibid.*
24 Cardwell, 2011.

LED lamps, it is unlikely that manufacturers would continue to produce halogen lamps in 2020 and beyond. We should also note that the American Lighting Association and National Electrical Manufacturers Association did not support the 2011 rider that prevented the DOE from enforcing EISA, and there have been no indications that any manufacturers have plans to produce halogen lamps that are less than 45 lumens per watt beyond 2020.[25] We provide further detail on supplier expectations of the impacts of EISA Tier 2 in Section 4.1.3 below.

### 3.1.2 California Assembly Bill 1109

California AB 1109, the California Lighting Efficiency and Toxics Reductions Act, also passed in 2007. The bill required the California Energy Commission (CEC) to develop and implement a strategy that would reduce California's energy consumption related to general purpose indoor lighting by 50 percent by 2018.[26] California adopted the same efficacy standards as EISA, however, the effective dates for AB 1109 are one year earlier than for EISA (Table 6).[27] AB 1109 also requires the state to set up a recycling program for lighting products and prohibits the sale of general purpose lamps that exceed certain levels of hazardous substances.[28]

**Table 6: Timing comparison of lamp efficacy standards by light output range: EISA (U.S.) and AB 1109 (California)**

| Affected Light Output Ranges (lm) | Effective Dates of Regulation | |
|---|---|---|
| | EISA (United States) | AB 1109 (California) |
| 1490-2600 lm | 1/1/2012 | 1/1/2011 |
| 1050-1489 lm | 1/1/2013 | 1/1/2012 |
| 750-1049 lm | 1/1/2014 | 1/1/2013 |
| 310-749 lm | 1/1/2014 | 1/1/2013 |

Not surprisingly, most of the supplier representatives we interviewed report that EISA's most significant market impact has been the gradual phase-out of traditional incandescent lamps. Their perspectives on its other impacts were somewhat mixed. We provide more detail regarding supplier perspectives on these regulations in chapter 4.

As reported in the 2014 market update report,[29] consumer awareness of lamp efficacy regulations in California was moderate to low in recent years. Awareness of these regulations declined significantly between 2012 and 2013, and again declined significantly in 2015 (possibly because the phase-out is no longer "top of mind" for California consumers given the time since its adoption). More than half report that when traditional incandescent lamps are no longer available, they will switch to an alternate lamp technology.

25 Enlightenment News, 2012.

26 Huffman, 2007.

27 For example, efficacy standards for 100 Watt incandescent lamps went into effect in California on January 1, 2011, while these standards did not take effect nationally until January 1, 2012.

28 California prohibited the same levels of hazardous substances as the European Union pursuant to the Restriction of Hazardous Substances (RoHS) Directive. RoHS took effect in 2006 and restricts the use of six hazardous materials in electronics; lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ether.

29 DNV GL, 2014c.

## 3.2 Lamp quality standards

This section summarizes two key quality standards relevant to California's residential market for replacement lamps—the U.S. EPA's ENERGY STAR standard and the CEC's "California Quality" standard for LED lamps (CEC LED lamp specification).

### 3.2.1 ENERGY STAR

The U.S. EPA established ENERGY STAR in 1992 as a voluntary program to protect the climate and save individuals and businesses money by promoting energy efficiency. The focus of the ENERGY STAR program was further defined in 2005 when Congress enacted the Energy Policy Act and "established at the Department of Energy and the Environmental Protection Agency a voluntary program to identify and promote energy–efficient products and buildings in order to reduce energy consumption, improve energy security, and reduce pollution through voluntary labelling of or other forms of communication about products and buildings that meet the highest energy efficiency standards."[30]

ENERGY STAR launched its first lighting specification for residential fixtures in 1997 with the goal of offering consumers a more efficient lighting option without compromising performance. In 1999, the U.S. DOE launched the first stand-alone ENERGY STAR specifications for CFLs, setting the first benchmark for energy efficiency, quality and performance for CFLs and requiring product testing by an accredited laboratory.[31] Since introducing the first set of specifications, ENERGY STAR has collaborated with the lighting industry and other key stakeholders to introduce numerous revisions focused on a wide range of quality and performance issues including warm-up time, light quality, sound, lamp life, mercury content, and minimum warranty requirements.

As of 2016, there were more than 1,500 ENERGY STAR -qualified CFL models for sale in the U.S. market, more than three-quarters of which were general purpose replacement models including basic spiral CFLs and A-lamps (82%).[32] We provide additional detail regarding the ENERGY STAR CFLs available in the U.S. as of 2016 in chapter 4 below. As discussed in Section 3.4 below, the IOUs' energy-efficiency programs required CFLs to meet ENERGY STAR specifications to qualify for incentives beginning in the earliest years of program activity.

In 2010, DOE introduced the first ENERGY STAR specifications for LED lamps and fixtures, focusing on quality and performance using the lessons learned from its years of experience with the CFL market. To qualify for the ENERGY STAR label, LED lighting products must have:

- Brightness equal to or greater than existing lighting technologies (incandescent or fluorescent) and light is well distributed over the area lighted by the fixture
- Light output that remains constant over time, only decreasing towards the end of the rated lifetime (at least 35,000 hours or 12 years based on use of 8 hours per day)
- Excellent color quality (i.e., the shade of white light appears clear and consistent over time)
- Efficiency as good as or better than fluorescent lighting

30 U.S. EPA, n.d.(a).

31 U.S. EPA, 2012a.

32 U.S. EPA, 2016. Roughly 82 percent were general purpose replacement lamps, 10 percent were reflector lamps, 4 percent were globe lamps, 3 percent were reflector lamps, and the remaining 1 percent were comprised of other lamp shapes.

- Light that comes on instantly when turned on
- No flicker when dimmed
- No off-state power draw (i.e., the fixture does not use power when it is turned off[33])[34]

As of 2012, there were nearly 1,300 ENERGY STAR –qualified LED lamp models for sale in the United States.[35] By mid-2013, the number of qualified models increased by more than 1,000 models to over 2,300 qualifying LED lamp models.[36] And in mid-2016, that number climbed to just over 7,800 lamp models available.[37] In contrast, while there were more than five times as many ENERGY STAR –qualified CFL models available in 2012 and 2013 (nearly 5,900 models), this number fell to 1,500 models in 2016. These data demonstrate the rapid expansion of the range of LED lamp models available as compared to a decreasing numbers of CFL models.[38] As with CFLs, we provide additional detail regarding the ENERGY STAR LED lamps available in the U.S. in chapter 4.

The requirements for ENERGY STAR certification have changed over time. The current version of ENERGY STAR is called ENERGY STAR version 1.1, which was finalized in 2014. The EPA proposed changes to ENERGY STAR 1.1 in 2015 and finalized these changes in February 2016. The new requirements for ENERGY STAR certification (ENERGY STAR 2.0) are set to take full effect in January 2017. ENERGY STAR Version 2.0 requires a minimum lamp efficacy of 70 lumens per watt for omnidirectional lamps with a Color Rendering Index (CRI) of 90 or greater and a minimum efficacy of 80 lumens per watt for omnidirectional lamps with a CRI of less than 90.[39] ENERGY STAR 2.0 also lowers the required rated life for omnidirectional lamps to 15,000 from 25,000. The new specification will allow some LED lamps that are currently not ENERGY STAR qualified to become eligible for ENERGY STAR qualification under ENERGY STAR 2.0 (many of these LED lamps are so-called “value LEDs”; see NEEP, 2016 for further details). ENERGY STAR 2.0 will also impact CFLs—currently no CFLs meet ENERGY STAR 2.0 requirements. However, ENERGY STAR plans to host a list of CFLs models that qualified for ENERGY STAR 1.1, which lighting program sponsors could use if they choose to provide incentives for CFLs after ENERGY STAR 2.0 goes into effect.

### 3.2.2 CEC LED Lamp Specification

In 2012, the CEC published a voluntary quality specification for LED lamps “to support policymakers and the lighting industry in their collective goal to move consumers away from the inefficient incandescent light of the past century to more efficient LED lighting technology.”[40] In that document, the CEC acknowledges that meeting this goal would require not only efficient lamps but also lamps that meet consumer expectations with regard to quality and performance.

Because of the residential sector’s high concentration of incandescent lamps, the CEC focused on household applications in which LED lamps are suitable replacements for typical incandescent lamps. As such, the

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33 Qualifications include an the exception regarding off-state power draw for external controls. With external controls, fixture power draw should not exceed 0.5 watts in the “off” state.

34 U.S. EPA, n.d.(b).

35 U.S. EPA, 2012b.

36 U.S. EPA, 2013. Seventy-one percent were reflector lamp models, 16 percent were “nonstandard” shapes, 6 percent were A-lamps, 4 percent were globe shaped, 3 percent were decorative (candle shaped), and 1 percent were other LED Aamp shapes.

37 U.S. EPA, 2016b. Sixty-six percent were reflector lamp models, 23 percent were “General Purpose Replacement”, 8 percent were decorative (candle shaped), and 3 percent were glob shaped.

38 The supplier interviews did not address ENERGY STAR’s influence on California’s residential market for replacement lamps.

39 U.S. EPA, 2016a.

40 CEC, 2012.

specification applies to screw-base and bi-pin A-lamp, flame-tip, globe, floodlight, and spotlight lamps.[41] It excludes the following products: "colored LED lamps; LED light strips; linear LED pin-based lamps; LED rope lights; LED fully integrated luminaries; LED luminaire housings; or LED light engines not having American National Standards Institute (ANSI) standardized screw bases."[42]

The CEC based its specifications on enhancements to the ENERGY STAR standard with a particular focus on improvements to the color temperature, consistency, and color rendering (with requirements for Color Rendering Index [CRI] greater than or equal to 90), dimmability, length of life/warranty, and light distribution. For light distribution in particular, the specification includes different requirements for omnidirectional lamps (such as A-lamps), floodlights, and spotlights.[43]

The CPUC issued a decision in November, 2012, that required the California IOUs to provide incentives only for LED lamps that meet the CEC specification within one year of the standard's adoption by the CEC.[44] The CEC adopted the standard on December 11, 2012. During the "transition period" of up to one year from that date, the CPUC allowed the IOUs to continue to provide incentives for LED lamps that met the ENERGY STAR standards. After December 11, 2013, compliance with the CEC specification for LED lamps became mandatory for IOU incentive program eligibility.

Although our supplier interviews did not specifically ask for supplier perspectives regarding the CEC specification, many interview participants offered their unsolicited opinions. Of these, most expressed negative reactions, but a few stated that the CEC specification represented a positive development. We provide more detail on supplier reactions to the specification in chapter 4.

## 3.3 California Long-Term Energy Efficiency Strategic Plan

In 2008, the CPUC published the California Long-Term Energy Efficiency Strategic Plan.[45] Relying on input from a broad range of stakeholders, the CPUC developed the plan to guide the state in its efforts related to energy efficiency through 2020. The Plan's primary objectives are to achieve zero net energy homes in California as standard practice by 2020 and zero net energy commercial buildings by 2030.[46] The Strategic Plan is organized around eleven chapters (in addition to an introductory chapter), each of which includes goals and strategies related to a specific sector or end-use. The 2008 version of the Strategic Plan did not include a chapter focused on lighting, but did address some lighting-related issues in the residential and commercial chapters.

In 2009, CPUC Decision 09-09-047 directed Energy Division to develop a lighting chapter for the Strategic Plan.[47] The CPUC ED convened a series of stakeholder workshops to obtain input regarding the specific initiatives to include in the chapter, which was adopted by the Commission in late 2010.[48] The lighting chapter is organized around a central vision which suggests that, "by 2020, advanced products and best

41 Base types included in the specification are E12, E17, E26, GU-10, GU-24, G8, G9, and GX5.3. Lamp shapes (form factors) include A-lamp (A); flame-tip (F); globe (B, BA, C, CA, G); reflector lamps (bulged reflector BR20 BR30, and BR40; multifaceted reflector MR; parabolic reflector PAR16, PAR20, PAR30, and PAR38; and reflector R16, R20, R30, R40) and a handful of others.

42 CEC, 2012.

43 Note that the CEC specification standard defines an additional lamp type not included in the ENERGY STAR specification ("floodlamp").

44 CPUC, 2012.

45 CPUC, 2008b.

46 CPUC, 2008c.

47 CPUC, 2009.

48 CPUC, 2010.

practices will transform the California lighting market. This transformation will achieve a 60-80% reduction in statewide electrical lighting energy consumption by delivering advanced lighting systems to all buildings."[49]

The same CPUC decision that directed ED to create the lighting chapter also approved the IOUs' proposed energy-efficiency programs for the 2010-12 cycle. The decision articulated the CPUC's commitment to "ensuring ratepayer funded utility programs align with the Strategic Plan" and, because IOU representatives were among the stakeholders who participated in the process of developing the lighting chapter, many of the programs included in the 2010-12 cycle were designed with the lighting chapter in mind.[50] The IOUs described one program in particular—the Statewide Lighting Market Transformation Program (described below in Section 3.4.5)—as "an element of the California IOUs' efforts to actualize the goals contained within the Lighting Chapter of the Strategic Plan."[51] The lighting chapter of the Plan helped the IOUs shape their lighting programs during both the 2010-12 and 2013-14 program cycles.[52]

## 3.4 California IOU residential lighting energy-efficiency programs

In this section of the report we provide an overview of the history of the residential lighting programs implemented by California's IOUs, summarize the current residential lighting programs (for the 2013-14 program cycle), and provide a synopsis of a pending CPUC proceeding that could affect the structure of future residential lighting programs. We broadly characterize the program periods as:

- The first generation of CFL programs in California (1989-97)
- The era of market transformation programs (1998-2000)
- The era of resource acquisition programs (2001-08)[53]
- A bridge year (2009)
- The beginning of a shift in program support away from basic spiral CFLs (2010-12)[54]
- Continued integration of LED lamps into the programs (2013-14)
- Current programs (2015 and 2016)

Note that the previous market update report[55] (published in 2014) includes details regarding the IOUs' programs through 2014. Rather than referring the reader to that document for details regarding earlier programs, we repeat these sections below to provide a more comprehensive history of the IOUs' programs in this document.

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49 *Ibid.*, page 1.

50 CPUC, 2009, page 6.

51 SCE, PG&E, and SDG&E, 2013, page 1.

52 Note that the 2012 and 2013 lighting supplier interviews did not elicit supplier perspectives on the Strategic Plan.

53 The CFL Market Effects Study (Cadmus Group *et al.*, 2009) provides detailed information regarding the IOUs' residential lighting energy-efficiency programs through 2008. This report summarizes that information.

54 As described above, "basic CFLs" are defined as single-wattage, non-dimmable, medium screw-base spiral CFLs up to (and including) 30 watt lamps.

55 DNV GL, 2014c.

### 3.4.1 First generation CFL programs (1989-97)

In 1989, the California IOUs created the first generation of programs to introduce CFLs to the California marketplace, educate consumers, and generate energy savings. The CA IOUs promoted CFLs to their residential customers through a wide range of programs using direct installation, direct mail coupons, direct mail CFL sales, and incentives to retailers and/or manufacturers.

- **PG&E** focused on direct-mail coupon campaigns and retailer incentives between 1989 and 1991. Together, these programs resulted in sales of more than 340,000 CFLs. In 1991, PG&E began a direct-install CFL campaign (as part of in-home energy audits) and installed nearly 250,000 CFLs in single-family and multifamily homes via this mechanism through 1994. In 1992, PG&E began its first manufacturer buy-down program in non- big box channels (including hardware, grocery, drug, discount, and lighting specialty stores) and sold approximately 500,000 CFLs through 1993. The utility discontinued its manufacturer incentive program in 1994 and replaced it with a consumer education campaign focused on the economic benefits of CFLs.
- **SCE** introduced a $5 manufacturer buy-down program in 1994 which facilitated shipment of over 600,000 CFLs to retailers. Through a similar buy-down program in 1996, SCE offered incentives for an additional 90,000 CFLs through participating retailers. SCE also offered limited marketing support services during this timeframe.
- **SDG&E** distributed more than 200,000 CFLs to customers via direct installation and through customer contacts with field staff between 1990 and 1992. SDG&E also introduced a retail program in 1992, partnering with a CFL manufacturer to sell more than 55,000 CFLs at a $5.99 price point. Between 1990 and 1997, SDG&E's CFL giveaways, direct installations, and ongoing retail efforts resulted in the distribution of almost 1.6 million CFLs to residential customers.

### 3.4.2 Market transformation programs (1998-2000)

Following direction provided by the CPUC in 1997 that the purpose of energy-efficiency programs should be to transform the market for energy-efficient goods and services, the California IOUs developed the California Residential Lighting and Appliance Program to address the barriers to adoption of energy-efficient appliances and lighting products in California. The program focused on the supply-side of the market with goals of increasing production, stocking, promotion, and sales of energy-efficient lighting and appliances. Although limited downstream activities continued, the market transformation programs shifted their emphasis upstream with a more concentrated focus on manufacturer incentives, retailer salesperson training and incentives, cooperative advertising, and in-store merchandising support.

### 3.4.3 Resource acquisition programs (2001-08)

In 2001, spurred by the California energy crisis, the IOUs shifted their residential lighting program focus from long-term market transformation to immediate energy and peak demand savings. In response to this shift in California's energy policy, the IOUs together provided incentives for more than 7 million CFLs in 2001. In 2002, the IOUs continued to push large volumes of CFLs through manufacturer buy-down and point-of-sale (POS) discount programs. Both large and small lighting retailers were eligible to participate in the 2002 program and for the first time, a percentage of the program's budget was earmarked for hard-to-reach targets. The 2002 program provided incentives for another 3.5 million compact fluorescent products (mostly lamps but also a relatively small number of fixtures).

The basic structure of the 2003 and 2004-05 lighting programs remained largely the same as the 2002 programs. However, in 2004, the Residential Lighting Program and the Home Energy Efficiency Rebate (HEER) Program combined to form the Statewide Single-Family Energy Efficiency Rebate (SFEER) Program in an effort to streamline internal operations for the IOUs. In response to the state's return to energy efficiency as a resource and additional funding for the public goods charge pool, the 2004-05 programs' budget nearly doubled from the prior program cycle. The majority of the programs' incentives were allocated to the upstream component which paid lighting manufacturers directly. Several manufacturers partnered with grocery store chains, which were responsible for over 40% of the upstream incentive dollars during the 2004-05 programs.

The 2006-08 programs continued the prior program strategy of offering both manufacturer buy-downs and POS incentives to California's energy-efficient lighting suppliers and, similar to 2004, manufacturer buy-downs comprised the vast majority of CFLs for which the programs provided incentives. The key drivers for the 2006-08 programs were California's focus on global warming and the passing of an associated Assembly Bill (AB 32), the California Global Warming Solutions Act of 2006, which resulted in the CPUC dramatically increasing the energy savings goals for the state's IOUs.

To achieve the new goals, the IOUs significantly increased their budget allocations to the ULP, which allowed the IOUs to expand the number of retailers participating and offer incentives for a much greater volume of CFLs. The IOUs provided incentives for approximately 56 million CFLs and fixtures during the first two years of the 2006-08 program period. Evaluation results indicated that the 2006-08 ULP accounted for more than half (56%) of the expected net kWh savings and 42%of the expected net KW reductions across California's entire energy-efficiency portfolio.[56] Estimated statewide annual net savings for the ULP were approximately 1.325 GWh and net peak demand reductions were nearly 134 MW.[57] As expected, screw-base CFLs accounted for the vast majority of savings in the ULP, contributing 92% of net energy savings and 96% of net peak demand reductions.[58]

### 3.4.4 Bridge year (2009)

The 2009 Program was a "bridge year" in between the 2006-08 programs and 2010-12 programs with program design and activities continuing with little change from 2006-08. In D.08-10-027, the CPUC authorized California IOUs to continue to expend funds for 2008 energy-efficiency programs into 2009 to avoid interruptions in the market until the CPUC reached a final decision regarding the next program portfolio proposal.[59] IOUs were authorized to increase program spending proportionally during the bridge year to proposed increases in energy savings goals.[60] For example, if the 2009 IOU energy savings goals were 10% higher than annual goals in the 2006-08 portfolio, average monthly program expenditures were authorized to also be 10% higher. The bridge year facilitated the ongoing implementation of programs while giving the CPUC, IOUS, and key stakeholders time to vet the next multiyear portfolio proposal and ensure that it satisfied the goals of California's (then new) Long Term Energy Efficiency Strategic Plan.

56 KEMA, Inc., 2010.
57 *Ibid.*
58 *Ibid.*
59 CPUC, 2008a.
60 *Ibid.*

### 3.4.5 Beginning of a shift away from basic CFL programs (2010-12)

After 9 years of supporting mass-market CFL programs that incentivized tens of millions of CFLs, the CPUC issued a decision calling for the IOUs to begin ramping down their traditional CFL programs in the 2010-12 portfolio. The decision directed the IOUs to focus instead on "new lighting technologies and other innovative programs that focus on lasting energy savings and improved consumer uptake." [61] The CPUC's direction to shift programs away from basic CFLs—which provided low-cost, easy to obtain energy savings that historically constituted the majority of IOU portfolio spending and savings achievements—was largely in response to increased CFL availability, improved lamp quality, declining lamp costs, and dramatically increased consumer uptake (i.e., sales). On top of these positive CFL market developments, improvements in lighting efficacy dictated by state and national legislation (AB 1109 and EISA) further changed the landscape and pushed the need to transition lighting programs away from providing incentives for basic CFLs.

The CPUC required the IOUs to propose separate budgets for three programs during the 2010-12 period:

- **Residential Lighting Incentive Program for Basic CFLs.** This program was intended to provide incentives for single-wattage, non-dimmable, medium screw-base (MSB) spiral CFLs of less than 30 watts. The basic CFL program initially proposed by the IOUs was essentially a continuation of 2006-08 residential upstream lighting program activities, including a manufacturer buy-down component with identical incentive levels and a proposed budget of $108 million. The CPUC rejected this initial proposal. Ultimately the CPUC authorized a basic CFL program budget of $78 million, a 28% reduction to the IOU's proposed funding level, underscoring the CPUC's direction to shift away from incentives for basic CFLs.
- **Residential Advanced Consumer Lighting Program.** This program was intended to encourage consumers to use high-efficiency specialty lamps versus incandescent specialty lamps. The program focused on products other than basic spiral CFLs (as described above) and included dimmable CFLs, three-way CFLs, other specialty and "super" CFLs, LED lamps, and other lighting products. Similar to the basic CFL program, the advanced program included upstream incentives as well as midstream incentives for products typically purchased by lighting contractors. All together, the IOUs initially proposed an Advanced Lighting Program budget of $78 million that the CPUC determined was insufficient. To offset the reduction in the Basic CFL Program budget, the CPUC authorized a budget of $89 million for the Advanced Lighting Program, a 14% increase from the IOUs' initial proposal. The Advanced Consumer Lighting Program and Residential Lighting Incentive Program for Basic CFLs comprised the IOUs' ULP efforts for the 2010-12 program period.
- **Statewide Lighting Market Transformation Program.** Borne largely from the strategies discussed in the lighting chapter of the Strategic Plan, this non-resource program was intended to establish a statewide, integrated process for the development and testing of market transformation strategies for various lighting technologies. The program included funding for activities such as market research, coordination, and educational outreach intended to inform market actors about new lighting technologies. The IOUs proposed (and the CPUC approved) total funding for the program of approximately $1.5 million for PG&E and SCE; SDG&E did not include a proposal to fund the Statewide Lighting Market Transformation Program.

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61 The information in this section of the report is largely based on CPUC Decision 09-09-047 (CPUC, 2009).

### 3.4.6 Continued integration of LED lamps (2013-14)

The IOUs designed the 2013-14 Statewide Lighting Program to promote energy-efficient lighting products across market segments and retail channels. They also designed the program to facilitate long-term lighting market transformation. The CPUC's direction to phase out support for basic CFLs (which began in the 2010-12 program cycle) was further demonstrated in the overall program budget allocated to lighting in the 2013-14 period. The 2013-14 budget for lighting programs was approximately $70 million (roughly $35 million per year),[62] a substantial reduction from the 2010-12 lighting program budget ($168 million over three years, or approximately $56 million per year). The majority of the budget reduction for lighting programs was related to the IOUs' ramping down their incentive support for basic CFLs.

As with the 2010-12 residential lighting incentive programs, the 2013-14 Statewide Lighting Program was separated into three main components. The IOUs continued their Lighting Market Transformation Program and developed a Primary Lighting Program and Lighting Innovation Program for the 2013-14 period:

- **Lighting Market Transformation Program.** This program continued in largely the same form in 2013-14 as in the previous program cycle. The program provided oversight for new lighting technology advancement to the Primary Lighting and Lighting Innovation programs and supported Codes and Standards Program activities. The two-year statewide budget for the lighting market transformation program was approximately $2.6 million.
- **Primary Lighting Program.** This program basically combined the 2010-12 Basic and Advanced CFL programs with a reduced emphasis on basic CFLs. The program employed upstream, midstream, and downstream incentives for commercially-viable energy-efficient lighting products including CFLs, LED lamps and fixtures, and dimmable fluorescent ballasts as well as other efficient technologies. The two-year budget for this component of the Statewide Lighting Program was just under $48 million across IOUs for 2013-14.
- **Lighting Innovation Program.** The goal of the Lighting Innovation Program was to identify new products or program design elements which have the potential to eventually migrate to the Primary Lighting Program. The IOUs designed the Innovation Program to serve as an incubator for the Primary Lighting Program by conducting demonstration or pilot projects and trial studies of lighting measures in the early stages of commercialization. The Lighting Innovation Program also sought to identify and test promising new program design strategies. The two-year budget for this component of the Statewide Lighting Program was approximately $19 million across IOUs.

### 3.4.7 Current IOU lighting programs (2015 and 2016)

In November, 2013, the CPUC opened a Rulemaking to establish a proceeding to accomplish three objectives:

- To fund the current energy-efficiency portfolios through 2015;
- To implement "rolling" energy-efficiency portfolios; and
- To address various related policy issues.[63]

62 CPUC, 2013b.

63 CPUC, 2013a.

The goal of a “rolling portfolio” approach is to help avoid disruptions to long-running programs (like the Statewide Lighting Program) and to allow program administrators to adjust funding and programs based on the needs of the market rather than the fixed two-year schedule of the current portfolio approval process. This approach is also intended to facilitate long-term planning and investments by administrators and implementers, respectively. The 2015 programs marked the beginning of the rolling portfolio approach.

In 2015, the IOUs provided incentives for approximately 15 million lamps through their upstream program with more than 14 million allocated to the residential sector. Of these, approximately 55% were CFLs and 45% were LED lamps. LED A-lamps accounted for 25% of all ULP-discounted lamps in 2015, and basic spiral CFLs comprised only 4% of total ULP-discounted lamps. The program was similar to the 2013-14 program. It consisted of same three programs as in 2013-14: the Lighting Market Transformation Program, the Primary Lighting Program, and the Lighting Innovation Program. The IOUs continued to phase out support for basic CFLs and increase support for LED lamps.

# 4. MARKET SUPPLY

This chapter provides an overview of the supply side of California's market for residential replacement lamps based on in-depth telephone interviews with participating lamp suppliers, retail lighting shelf surveys, and available data from secondary research. We characterize the lamp suppliers active in California's market and detail supplier perspectives on various elements of the supply side of the market (including market barriers). We also summarize the availability, diversity, and pricing of lamps sold in California retail stores in 2014 and 2015.

This is the first report chapter that introduces results from primary research conducted in support of other CPUC EM&V studies for the 2013-14 program cycle (including analyses of program tracking data). Because of the volume of material covered, we include an overview of key findings to highlight noteworthy results from major subsections of the report. We include these key findings as relevant within Chapters 4 through 6 of the report.

## 4.1 Lamp suppliers

Below we provide details regarding lamp suppliers (manufacturers and retailers) in general and the suppliers that participated in the 2013-14 ULP specifically. We also provide supplier representatives' perspectives regarding lamp efficacy regulations, the CEC LED lamp specification, and the ULP on California's residential replacement lamp market.

### 4.1.1 Lamp manufacturers

Key findings regarding lamp manufacturers include:

- ENERGY STAR listed 241 lamp manufacturing organizations as "ENERGY STAR partners" who had LED lamps and/or CFLs available as of April 2016. Sixty-six percent of these manufactured LED lamps exclusively and 11% manufactured CFLs exclusively. Twenty-three percent of manufacturers produced both lamp technologies. The number of participating ENERGY STAR CFL and LED lamp manufacturers, and the number of model numbers that qualify for the ENERGY STAR quality standard are valuable national market indicators. Our review of these national data helps define the context surrounding California's lighting market.
- The majority of ENERGY STAR CFL manufacturing was concentrated among a small group of 10 to 15 top firms, with the top 10 CFL manufacturers accounting for a majority of the ENERGY STAR CFL model numbers. The number of ENERGY STAR partners who manufactured CFLs dropped from 144 in 2013 to 82 in 2016.
- A larger group of manufacturers produce ENERGY STAR LED lamps, and the top 10 LED manufacturers produce less than one-third of the total number of ENERGY STAR LED model numbers available in the U.S. in 2016. The number of ENERGY STAR partners who produced LED lamps increased from 175 in 2013 to 215 in 2016.
- More than 25 lamp manufacturers participated in the 2013-14 ULP.

We provide more details regarding these findings below.

#### 4.1.1.1 Role of manufacturers

Lamp manufacturers are a major influencer in determining which lamps—the technologies, models, packaging configurations, and so on—will appear in retail stores. Manufacturers typically have close relationships with their retail partners, and retailers typically have close relationships with one key manufacturer or a small number of manufacturers. The manufacturers exert their influence on lamp positioning in the stores (e.g., on an end-cap or in the lighting aisle), how the lamp is priced, and special promotional or marketing efforts specific to an individual model or group of models. As mentioned in the 2014 market update report, a 2012 report[64] suggests that manufacturers typically meet with retailers once a year for "comprehensive product reviews" in which they review all of the distinguishing characteristics of each model but may also have less formal discussions throughout the year to address specific issues or special promotional opportunities as they arise.

#### 4.1.1.2 Market size

A large number of manufacturers are active in the residential replacement lamp market.[65] ENERGY STAR's lists of qualified CFLs and LED lamps for sale in the U.S. include details regarding lamp manufacturers.[66] Our national review of these data helps define the context surrounding California's lighting market. While these lists do not represent all CFLs and LED lamps for sale in the U.S., the data provide a sense of market size and the scale of manufacturing operations for these products. Additionally, we compare these data to prior years to identify the direction and momentum of the CFL and LED lamp markets. As of April 2016, there were 241 lamp manufacturing organizations listed as "ENERGY STAR partners" who had LED and/or CFLs bearing the ENERGY STAR label.[67] Of these organizations, 26 manufactured exclusively CFLs (11%) and 159 manufactured LED lamps exclusively (66%). Approximately 56 ENERGY STAR partners manufactured both CFLs and LED lamps (23%). While the number of organizations manufacturing ENERGY STAR LED lamps increased by more than 20% between 2013 and 2016 (from 175 organizations to 215 organizations), the number of organizations manufacturing ENERGY STAR CFLs declined by more than 40% in the same period (from 144 to 82).

Table 7 below shows the number of total ENERGY STAR CFL models listed as ENERGY STAR partners as of April 8, 2016. As shown, 20 partners accounted for nearly three quarters of all CFL models available (71%). The remaining 62 partners each accounted for less than 2% of all CFL models listed. The manufacturing landscape for LED lamps is far broader than that for CFLs, with a much larger number of total manufacturers each responsible for smaller shares of the overall quantity of ENERGY STAR LED lamp models available (Table 8). The top 17 LED lamp manufacturing partners accounted for less than half of all LED lamp models listed by ENERGY STAR in early 2016 (43%), and the remaining 198 partners each accounted for less than 2% of total models listed.

Three of the ENERGY STAR partners with the top five most CFL models also had the top five most LED models: OSRAM SYLVANIA, Technical Consumer Products, Inc. (TCP), and GE Lighting. TCP had the fourth most LED models and the second most CFL models listed by ENERGY STAR in 2016. Of the so-called "big three" lighting manufacturers—GE, OSRAM SYLVANIA, and Philips—all were among the top five producers

64 D&R International, 2012.

65 Note that lamp sales data for California are not available. As such, we rely on other types of information (including details regarding the number of firms active in lamp manufacturing nationally and shipments of program-discounted lamps through the ULP) to provide information regarding market size.

66 Note that there are comparable lists for other lamp technologies (e.g., incandescent lamps).

67 ENERGY STAR Certified Light Bulbs. 2016. https://www.energystar.gov/productfinder/product/certified-light-bulbs/results.

for both CFLs and LED lamps with the exception of Philips, which ranked 20 out of more than 80 CFL manufacturers in terms of the number of ENERGY STAR CFL models available in the U.S. in 2016.

**Table 7: Number of ENERGY STAR CFL models available in the U.S by ENERGY STAR partner, 2016**

| ENERGY STAR Partner | CFL Models Listed | |
|---|---|---|
| | n | Percent of All Models |
| OSRAM SYLVANIA | 120 | 8% |
| Technical Consumer Products, Inc. (TCP) | 110 | 7% |
| Globe Electric Inc. | 109 | 7% |
| Feit Electric | 81 | 5% |
| GE Lighting | 69 | 5% |
| Lowe's Home Improvement | 69 | 5% |
| Fujian YDJ Light Co., Ltd. | 65 | 4% |
| Maxlite | 56 | 4% |
| The Home Depot | 49 | 3% |
| Hengdian Group Tospo Lighting Co., Ltd. | 45 | 3% |
| EarthTronics, Inc. | 41 | 3% |
| Litetronics International Inc. | 33 | 2% |
| Homelite Technology Co. Ltd. | 33 | 2% |
| Canadian Tire | 31 | 2% |
| Xiamen Yankon Energetic Lighting Co., Ltd. | 30 | 2% |
| Standard Products, Inc. | 30 | 2% |
| Xiamen Longstar Lighting Company, Ltd. | 27 | 2% |
| SATCO/NUVO | 27 | 2% |
| Bulbrite Industries | 25 | 2% |
| Philips Lighting North America Corporation | 23 | 2% |
| All other partners (n=62; each accounts for <2% total models) | 447 | 29% |
| **Total** | **1,520** | **100%** |

Source: U.S. EPA, 2016.
Note: Results may not total 100% because of rounding.

**Table 8: Number of ENERGY STAR LED lamp models available in the U.S. by ENERGY STAR partner, 2016**

| ENERGY STAR Partner | LED Lamp Models Listed | |
|---|---|---|
| | n | Percent of All Models |
| GE Lighting | 336 | 4% |
| Philips Lighting North America Corporation | 332 | 4% |
| OSRAM SYLVANIA | 328 | 4% |
| Technical Consumer Products, Inc. (TCP) | 298 | 4% |
| Hengdian Group Tospo Lighting Co., Ltd. | 211 | 3% |
| Feit Electric | 207 | 3% |
| SATCO/NUVO | 199 | 3% |
| Standard Products, Inc. | 186 | 2% |
| Green Creative | 175 | 2% |
| The Home Depot | 164 | 2% |
| Halco Lighting Technologies | 159 | 2% |
| EiKO Global, LLC | 144 | 2% |
| Ansen Lighting Technology Co., Ltd | 142 | 2% |
| Energetic Lighting Inc. | 139 | 2% |
| Conglom, Inc. | 127 | 2% |
| Lighting Science Group, Corp | 127 | 2% |
| EarthTronics, Inc. | 126 | 2% |
| All other partners (n=198; each accounts for <2% total models) | 4,484 | 57% |
| **Total** | **7,884** | **100%** |

Source: U.S. EPA, 2016.

Note: Results may not total 100% because of rounding.

#### 4.1.1.3 Lamp manufacturers in the 2013-14 ULP

During California's 2013-14 energy-efficiency program cycle, at least 30 manufacturers sold discounted lamps through the ULP.[68] Of these:

- Fifteen received incentives for basic CFLs
- Twenty received incentives for specialty CFLs
- Nine received incentives for LED A-lamps
- Twelve received incentives for specialty LED lamps

These 30 manufacturers partnered with approximately 850 retailers including hundreds of independent stores (primarily in the discount, grocery, and hardware channels) and dozens of major retail chains.

[68] A small quantity of units listed in the ULP tracking data is not associated with manufacturer names. As such, it is possible that the ULP provided incentives to one or more manufacturers that are not listed by name in the tracking data.

### 4.1.2 Lamp Retailers

Key findings regarding lamp retailers include:

- At least 8 retail channels sold replacement lamps to California consumers (either through the ULP or without program discounts) in 2015. Wholesale club stores received approximately 20% of lamps discounted through the 2013-14 ULP, discount stores received roughly 24%, and grocery stores received 23%. Overall, non-big box channels accounted for roughly half of 2013-14 program lamps shipped to participating retailers (53%).
- CFLs represented 84% of lamps and fixtures discounted through the 2013-14 ULP. Thirty percent of these were high-wattage spiral lamps and 25% were basic spiral lamps. In the 2010-12 ULP, 90% of lamps discounted through the program were CFLs and nearly two-thirds of CFLs were basic spiral lamps.
- LED replacement lamps represented 16% of all discounted lamps in the 2013-14 ULP. These were concentrated in wholesale clubs (66%) and home improvement stores (26%). Across most channels, LED A-lamps comprised the largest share of program-discounted lamps. However, large shipments of LED reflector lamps to wholesale club stores resulted in reflector lamps making up the majority of overall program-discounted LED lamps (55%).
- The discount, drug, and grocery channels received nearly 60% of all ULP-discounted CFLs and less than 1% of the LED lamps during the 2013-14 period. These channels typically do not serve as destinations for energy-efficient lamp purchases and dedicate minimal shelf space to replacement lamps. The IOUs have historically targeted these channels for reaching hard-to-reach customers, and many of the manufacturers that supply these channels reported they would not sell ENERGY STAR CFLs or LED lamps in these channels without support from the ULP.
- The home improvement and hardware channels received approximately 23% of all program-discounted CFLs and 30% of all LED lamps during the 2013-14 period. These channels are typically destinations for shoppers who seek energy-efficient lamps, dedicate a relatively large amount of shelf space to replacement lamps, and sell replacement lamps year-round. Most manufacturers report that they would continue to sell ENERGY STAR CFLs and LED lamps through these channels without the ULP discount. Unlike discount and some drug and grocery stores, nearly all home improvement stores and roughly three-quarters of hardware stores stocked LED lamps in 2015.
- Mass merchandise stores, wholesale clubs, and lighting and electronics stores received 15% of all program-discounted CFLs and 66% of all program-discounted LED lamps in the 2013-14 period. These channels share some characteristics with other channels dominated by large chains, such as the home improvement channel. All suppliers to the mass merchandise and wholesale channels report that they would continue to supply ENERGY STAR CFLs to these channels in the absence of ULP discounts. Most suppliers to mass merchandise stores and wholesale clubs reported that they would continue to supply ENERGY STAR LED lamps in absence of ULP discounts, but suppliers to the lighting and electronics channel said that they would not continue to supply ENERGY STAR LED lamps without ULP discounts.

We provide more details regarding these findings below.

#### 4.1.2.1 Retail channel overview

In California, there are at least eight retail channels that typically sell replacement lamps to consumers. These include:

1. **Discount.** Discount stores typically sell products at prices lower than those of traditional retail outlets and may obtain these products through resellers and discount aggregators. Examples of discount chains include 99 Cents Only, Big Lots, and Dollar Tree.
2. **Drug.** Drug stores typically sell over-the-counter medications, first aid supplies, and prescription pharmaceuticals. Many drug stores also sell paper products, beverages, and a selection of grocery dry goods. Examples of drug store chains include CVS, Rite Aid, and Walgreens.
3. **Grocery.** Grocery stores typically sell perishable and non-perishable food items and stock a small selection of household goods such as paper products and cleaning supplies. This category includes produce markets and convenience stores. Examples of California grocery store chains include Albertsons, Food 4 Less, and Safeway.
4. **Hardware.** Hardware stores sell a variety of home repair, maintenance, and improvement products such as fasteners, tools, and plumbing and electrical supplies, and may stock cleaning products, paint, and lawn and garden products. Some may also stock goods that are regionally appropriate, such as hunting and fishing supplies or swimming pool chemicals. Hardware stores are similar to home improvement stores except hardware stores are typically much smaller. Examples include Ace Hardware and True Value Hardware.
5. **Home improvement.** Home improvement stores are a class of hardware stores that typically occupy warehouse-style spaces. They have large footprints of over 30,000 square feet and often over 100,000 square feet, many with additional square footage dedicated to outdoor garden centers. The home improvement channel includes chains such as The Home Depot, Lowe's and Orchard Supply.
6. **Mass merchandise.** Mass merchandisers typically stock a large assortment of goods (including clothing and housewares and sometimes food products and medications) at competitive prices. Stores in this category include large mass merchandise chains as well as smaller “mom and pop” variety stores. Examples of mass merchandise chains include K-Mart, Target, and Wal-Mart.
7. **Wholesale club.** Wholesale clubs are typically warehouse-style stores that stock a wide variety of grocery and household items at lower prices than typically available in most other retail channels. These chains typically require shoppers to carry membership cards. Examples of wholesale club stores include retail chains such as Costco and Sam’s Club.
8. **Lighting and electronics.** This category groups lighting retailers with electronics retailers. The former typically stock light fixtures, ceiling fans, and replacement lamps, while the latter sell home electronics and appliances. Examples of lighting and electronics stores include retail chains such as Lamps Plus and Best Buy.

The 2013-14 ULP provided incentives for replacement lamps in each of these retail channels. In addition, the ULP also provided incentives through “other” channels such military commissaries and other retail stores that do not fit well into the categories described above.

#### 4.1.2.2 Retailers in the 2013-14 ULP

PG&E, SCE, and SDG&E provided discounts for nearly 18 million lamps and fixtures through the 2013-14 ULP. CFLs and CF fixtures comprised the majority of 2013-14 ULP shipments at 84% of all ULP-discounted products shipped, and LED lamps and fixtures comprised the remaining 16%. In contrast, in the 2015 program, CFLs and CF fixtures comprised 55% of all discounted lamps and LED lamps and fixtures comprised 45%.[69]

When we examine the products discounted by the ULP in 2013-14 by retail channel and lamp shape (Table 9 and Table 10), approximately 30% of program-discounted CFLs and CF fixtures were high-wattage CFLs, followed by basic spiral CFLs (25%), CFL A-lamps (21%), and CFL reflector lamps (21%). Discount and grocery stores together received more than half of the CFL products discounted through the 2013-14 ULP (56%). Approximately half of the CFLs and CF fixtures shipped to grocery stores were high-wattage spiral CFLs (52%), while in the discount channel, high-wattage CFLs comprised 37% of shipments and CFL A-lamps comprised 36% of shipments.

More than half of program-discounted LED products in the 2013-14 ULP were reflector lamps (55%). Approximately two-thirds of LED product shipments went to the wholesale club channel (66%), and another one-quarter of LED products went to the home improvement channel (26%). All other channels received less than 5% of LED product shipments through the 2013-14 ULP. LED shipments to wholesale clubs were predominantly reflector lamps (70%), while LED product shipments to the home improvement channel were predominantly LED A-lamps (52%).

Note that because this report relies on data that were collected in 2014 and 2015, and pertain to the 2013-14 ULP, we focus on the 2013-14 program cycle. Table 34 and Table 35 in Appendix C provide details on the 2015 ULP program cycle.

69 Note that the impact evaluation team has not yet cleaned the 2015 upstream lighting program tracking data and thus 2015 program results are not available by channel at the time of this report's publication.

**Table 9: Number of units discounted by the 2013-14 ULP by technology, unit type, and retail channel**

| Tech | Unit Type | Retail Channel | | | | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Discount | Drug | Grocery | Hardware | Home Improv | Ltg & Electronics | Mass Merch. | Wholesale Club | Other / Unknown | |
| CFL | Spiral lamp >30W | 1,550,204 | 21,677 | 2,160,412 | 140,842 | 154,524 | 14,350 | 4,350 | 439,971 | 34,150 | 4,520,479 |
| | Basic spiral lamp | 250,335 | 38,202 | 18,756 | 86,217 | 2,013,107 | 553 | 406,343 | 751,655 | 198,633 | 3,763,801 |
| | A-lamp | 1,508,936 | 189,043 | 1,005,968 | 105,986 | 225,009 | 6,760 | 33,384 | 363 | 136,236 | 3,211,685 |
| | Reflector lamp | 808,394 | 131,766 | 770,673 | 124,968 | 578,865 | 9,364 | 21,225 | 601,208 | 125,680 | 3,172,143 |
| | Globe lamp | 59,646 | 400 | 138,178 | 10,950 | 30,150 | 2,500 | 21,073 | 0 | 5,476 | 268,372 |
| | 3-Way lamp | 53,513 | 400 | 93,030 | 4,850 | 11,152 | 48 | 123 | 50 | 2,350 | 165,516 |
| | Indoor fixture | 0 | 0 | 0 | 0 | 7,351 | 0 | 3 | 0 | 0 | 7,354 |
| | Other lamp | 0 | 0 | 0 | 0 | 4,459 | 0 | 0 | 0 | 92 | 4,551 |
| | Dimmable lamp | 0 | 0 | 16 | 0 | 3,519 | 0 | 0 | 0 | 0 | 3,535 |
| **CFL Subtotal** | | **4,231,028** | **381,488** | **4,187,033** | **473,813** | **3,028,135** | **33,575** | **486,501** | **1,793,247** | **502,617** | **15,117,436** |
| LED | Reflector lamp | 813 | 0 | 5,588 | 49,206 | 180,926 | 3,495 | 2 | 1,312,320 | 19,176 | 1,571,525 |
| | A-lamp | 2,538 | 0 | 6,786 | 59,164 | 388,653 | 2,160 | 15 | 214,985 | 83,788 | 758,090 |
| | Indoor fixture | 0 | 0 | 0 | 5,328 | 176,484 | 0 | 0 | 351,406 | 225 | 533,443 |
| **LED Subtotal** | | **3,351** | **0** | **12,374** | **113,698** | **746,063** | **5,655** | **17** | **1,878,712** | **103,189** | **2,863,058** |
| **Grand Total** | | **4,234,379** | **381,488** | **4,199,407** | **587,511** | **3,774,198** | **39,230** | **486,518** | **3,671,958** | **605,806** | **17,980,494** |

Source: 2013-14 ULP tracking data.

**Table 10: Percent of units discounted by the 2013-14 ULP by technology, unit type, and retail channel**

| Tech | Unit type | Retail Channel | | | | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Discount | Drug | Grocery | Hardware | Home Improv | Ltg & Electronics | Mass Merch. | Wholesale Club | Other / Unknown | |
| CFL | Spiral lamp >30W | 37% | 6% | 52% | 30% | 5% | 43% | <1% | 25% | 7% | 30% |
| | Basic spiral lamp | 6% | 10% | <1% | 18% | 66% | 2% | 84% | 42% | 40% | 25% |
| | A-lamp | 36% | 50% | 24% | 22% | 7% | 20% | 7% | <1% | 27% | 21% |
| | Reflector lamp | 19% | 35% | 18% | 26% | 19% | 28% | 4% | 34% | 25% | 21% |
| | Globe lamp | 1% | <1% | 3% | 2% | <1% | 7% | 4% | 0% | 1% | 2% |
| | 3-way lamp | 1% | <1% | 2% | 1% | <1% | <1% | <1% | <1% | <1% | 1% |
| | Indoor fixture | 0% | 0% | 0% | 0% | <1% | 0% | <1% | 0% | 0% | <1% |
| | Other lamp | 0% | 0% | 0% | 0% | <1% | 0% | 0% | 0% | <1% | <1% |
| | Dimmable lamp | 0% | 0% | <1% | 0% | <1% | 0% | 0% | 0% | 0% | <1% |
| **CFL Subtotal** | | **28%** | **3%** | **28%** | **3%** | **20%** | **<1%** | **3%** | **12%** | **3%** | **100%** |
| LED | Reflector lamp | 24% | N/A | 45% | 43% | 24% | 62% | 12% | 70% | 19% | 55% |
| | A-lamp | 76% | N/A | 55% | 52% | 52% | 38% | 88% | 11% | 81% | 26% |
| | Indoor fixture | 0% | N/A | 0% | 5% | 24% | 0% | 0% | 19% | <1% | 19% |
| **LED Subtotal** | | **<1%** | **<1%** | **<1%** | **4%** | **26%** | **<1%** | **<1%** | **66%** | **4%** | **100%** |
| **Grand Total** | | **24%** | **2%** | **23%** | **3%** | **21%** | **<1%** | **3%** | **20%** | **3%** | **100%** |

Source: 2013-14 ULP tracking data.

#### 4.1.2.2.1 Differences between 2010-12 and 2013-14 ULP

The overall volume of lamps in the ULP declined dramatically between the 2010-12 and 2013-14 program periods from nearly 71.7 million CFLs and LED lamps down to 16.8 million lamps. Although 2010-12 was a three-year period and 2013-14 was a four-year period, the volume of lamps during 2013-14 was still far smaller than in 2010-12 when lamp quantities are annualized.

Table 11 below shows that during the 2010-12 program period, basic spiral CFLs comprised roughly 65% of CFLs shipped through the program, and approximately 24% of CFLs shipped through the 2013-14 ULP. The 2013-14 ULP shipped approximately 14.6 million CFLs to retailers, while the 2010-12 ULP shipped approximately 71.6 million CFLs to retailers. To allow for comparability between these two program periods, we show the average number of CFLs shipped per year and base the percentage change in Table 11 on the annual average of CFL shipments in each of the two program periods. This represents roughly an 80% reduction in the quantity of CFLs discounted by the ULP between program periods.

As shown, the average number of CFLs shipped per year during the 2013-14 ULP declined by nearly 70% compared to the 2010-12 ULP. The table also demonstrates a shift in the type of CFL shipped during the 2013-14 ULP; in the 2010-12 ULP, basic CFLs comprised nearly two-thirds of ULP CFL shipments (65%), while basic CFLs only comprised one-quarter of CFLs discounted during the 2013-14 ULP (24%). Furthermore, the average number of basic CFLs shipped per year declined 88% during the 2013-14 ULP compared to the 2010-12 ULP. While specialty CFLs comprised approximately three-quarters of the CFLs discounted during the 2013-14 ULP (compared to 35% during the 2010-12 ULP), the average number of specialty CFLs shipped per year during the 2013-14 ULP declined by 34% when compared to the 2010-12 ULP.

During the 2010-12 ULP, 70% of all CFL shipments went to non-big box stores (discount, drug, grocery, hardware, and lighting and electronics stores). During the 2013-14 ULP, a similar proportion of CFL shipments went to non-big box stores (64%). These results suggest that the IOUs are continuing to focus their CFL allocations toward non-big box stores. However, the average number of CFLs shipped per year to non-big box stores declined by 72% during the 2013-14 ULP when compared to the 2010-12 ULP. The average number of basic CFL shipped per year declined by 98% in the non-big box stores during the 2013-14 ULP compared to the 2010-12 ULP. The decline in the average number of specialty CFLs shipped per year was less dramatic in non-big box stores. While the average number of specialty CFLs shipped per year during the 2013-14 ULP declined in the hardware channel by more than 60% compared to 2010-12, the declines in specialty CFLs shipped to drug and grocery stores declined by less than 40%. The average number of specialty CFLs sent to discount stores during the 2013-14 ULP actually increased by 16% when compared to the 2010-12 ULP.

**Table 11: CFL shipments by CFL type, retail channel, and program period (2010-12 and 2013-14)**

| Lamp Type | Program Period | Retail Channel | | | | | | | | Total* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Discount | Drug | Grocery | Hardware | Home Improv | Ltg & Electronics | Mass Merch. | Wholesale Club | |
| All CFL | 2010-12 | 14,373,887 | 3,184,069 | 28,427,309 | 3,492,319 | 5,785,813 | 702,428 | 2,083,924 | 13,548,928 | 71,598,679 |
| | 2013-14 | 4,231,028 | 381,488 | 4,187,033 | 473,813 | 3,020,785 | 33,575 | 486,498 | 1,793,247 | 14,607,467 |
| Avg/Yr | 2010-12 | 4,791,296 | 1,061,356 | 9,475,770 | 1,164,106 | 1,928,604 | 234,143 | 694,641 | 4,516,309 | 23,866,226 |
| Avg/Yr | 2013-14 | 2,115,514 | 190,744 | 2,093,517 | 236,907 | 1,510,393 | 16,788 | 243,249 | 896,624 | 7,303,734 |
| **% Change in Annual Avg** | | **-56%** | **-82%** | **-78%** | **-80%** | **-22%** | **-93%** | **-65%** | **-80%** | **-69%** |
| Basic CFL | 2010-12 | 9,239,055 | 2,405,216 | 18,096,100 | 1,970,236 | 4,045,751 | 483,575 | 1,753,983 | 8,369,776 | 46,363,692 |
| | 2013-14 | 250,335 | 38,202 | 18,756 | 86,217 | 2,013,107 | 553 | 406,343 | 751,655 | 3,565,168 |
| Avg/Yr | 2010-12 | 3,079,685 | 801,739 | 6,032,033 | 656,745 | 1,348,584 | 161,192 | 584,661 | 2,789,925 | 15,454,564 |
| Avg/Yr | 2013-14 | 125,168 | 19,101 | 9,378 | 43,109 | 1,006,554 | 277 | 203,172 | 375,828 | 1,782,584 |
| **% Change in Annual Avg** | | **-96%** | **-98%** | **-100%** | **-93%** | **-25%** | **-100%** | **-65%** | **-87%** | **-88%** |
| Specialty CFL | 2010-12 | 5,134,832 | 778,853 | 10,331,209 | 1,522,083 | 1,740,063 | 218,853 | 329,942 | 5,179,152 | 25,234,987 |
| | 2013-14 | 3,980,693 | 343,286 | 4,168,277 | 387,596 | 1,007,678 | 33,022 | 80,155 | 1,041,592 | 11,042,299 |
| Avg/Yr | 2010-12 | 1,711,611 | 259,618 | 3,443,736 | 507,361 | 580,021 | 72,951 | 109,981 | 1,726,384 | 8,411,662 |
| Avg/Yr | 2013-14 | 1,990,347 | 171,643 | 2,084,139 | 193,798 | 503,839 | 16,511 | 40,078 | 520,796 | 5,521,150 |
| **% Change in Annual Avg** | | **16%** | **-34%** | **-39%** | **-62%** | **-13%** | **-77%** | **-64%** | **-70%** | **-34%** |

* Excludes all CF fixtures as well as CFLs shipped to “unknown/other” channels.
Source: 2010-12 and 2013-14 ULP tracking data.

Table 12 below shows that LED A-lamps comprised approximately 30% of LED replacement lamps shipped through the 2013-14 ULP, and LED specialty lamps comprised 70%. During the 2010-12 program, specialty LED lamps comprised 100% of ULP incentives for LED replacement lamps. As we presented above for CFLs, we calculated the average number of LED lamps shipped per year within the 2010-12 and 2013-14 programs to aid comparisons between the two periods. We base the percentage change in shipments between the 2010-12 ULP and the 2013-14 ULP in Table 12 on the annual average LED shipments in each period. The average number of LED lamps shipped per year increased from approximately 36,000 LED lamps during the 2010-12 ULP to 1.1 million LED lamps during the 2013-14 ULP; this represents nearly a 3,000% increase in the number of LED lamps shipped per year through the ULP.

The average number of LED lamps shipped per year to big box stores increased by approximately 3,500% from the 2010-12 ULP to the 2013-14 ULP, while the quantity of LED lamps shipped to non-big box stores increased more than 750% between program periods. During the 2010-12 ULP, 79% of LED lamp shipments went to big box stores compared to 21% of LED lamp shipments that went to non-big box stores. During the 2013-14 ULP, LED lamp shipments were even more concentrated in big box stores with approximately 94% of LED lamps shipped to big box stores. LED lamp shipments were highest in wholesale club stores with an average of more than 760,000 LED lamps per year during the 2013-14 ULP; this represents an average annual increase in LED lamp shipments of more than 3,100% from the 2010-12 ULP to the 2013-14 ULP.

**Table 12: LED lamp shipments by lamp type, retail channel, and program period (2010-12 and 2013-14)**

| Lamp Type | Program Period | Retail Channel | | | | | | | | Total* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Discount | Drug | Grocery | Hardware | Home Improv | Ltg & Electronics | Mass Merch. | Wholesale Club | |
| All LED | 2010-12 | - | - | 270 | 21,480 | 16,289 | 864 | 1 | 70,356 | 109,260 |
| | 2013-14 | 3,351 | - | 12,374 | 108,370 | 569,579 | 5,655 | 17 | 1,527,305 | 2,226,651 |
| Avg/Yr | 2010-12 | - | - | 90 | 7,160 | 5,430 | 288 | < 1 | 23,452 | 36,420 |
| Avg/Yr | 2013-14 | 1,676 | - | 6,187 | 54,185 | 284,790 | 2,828 | 9 | 763,653 | 1,113,326 |
| **% Change in Annual Avg** | | **N/A** | **N/A** | **6774%** | **657%** | **5145%** | **882%** | **2450%** | **3156%** | **2957%** |
| LED A-lamp | 2010-12 | - | - | - | - | - | - | - | - | - |
| | 2013-14 | 2,538 | - | 6,786 | 59,164 | 388,653 | 2,160 | 15 | 214,985 | 674,301 |
| Avg/Yr | 2010-12 | - | - | - | - | - | - | - | - | - |
| Avg/Yr | 2013-14 | 1,269 | - | 3,393 | 29,582 | 194,327 | 1,080 | 8 | 107,493 | 337,151 |
| **% Change in Annual Avg** | | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |
| Specialty LED | 2010-12 | - | - | 270 | 21,480 | 16,289 | 864 | 1 | 70,356 | 109,260 |
| | 2013-14 | 813 | - | 5,588 | 49,206 | 180,926 | 3,495 | 2 | 1,312,320 | 1,552,350 |
| Avg/Yr | 2010-12 | - | - | 90 | 7,160 | 5,430 | 288 | < 1 | 23,452 | 36,420 |
| Avg/Yr | 2013-14 | 407 | - | 2,794 | 24,603 | 90,463 | 1,748 | 1 | 656,160 | 776,175 |
| **% Change in Annual Avg** | | **N/A** | **N/A** | **3004%** | **244%** | **1566%** | **507%** | **200%** | **2698%** | **2031%** |

* Total excludes all LED fixtures as well as LED lamps shipped to “unknown/other” channels.
Source: Program tracking data.

#### 4.1.2.3 Retail channel characteristics

During the supplier interviews conducted in 2015, DNV GL staff asked lamp manufacturers' representatives to characterize their sales of IOU-discounted lamps through the 2013-14 ULP in the different retail channels. We interviewed representatives of 18 manufacturing organizations including 16 who participated in 2013-14 and 2 former participants. These manufacturing representatives supplied more than 97% of total ULP-discounted CFLs and LED lamps during the 2013-14 period. We also interviewed 6 retail lighting buyers. We present results below by grouping retail channels that share common characteristics to highlight these similarities and minimize redundancy in the findings. In the following subsections we characterize three groups of retail channels: (1) discount, drug and grocery stores; (2) home improvement and hardware stores; and (3) mass merchandise stores, lighting and electronics stores, and wholesale clubs.

##### 4.1.2.3.1 Discount, drug, and grocery channels

The discount, drug, and grocery channels represented roughly 60% of all ULP-discounted CFLs and less than 1% of all ULP-discounted LED lamps in the 2013-14 program. Some representatives offered their thoughts on how to characterize these channels:

- **These channels are not traditional destinations for energy-efficient lamp purchases.** Lamp suppliers and retail buyers observed that shoppers in the discount, drug, and grocery channels—unlike in other retail channels such as hardware and home improvement—do not typically visit these stores for the purpose of buying replacement lamps. In the words of manufacturers' representatives:
    - "Lighting is not the only thing [discount, drug and grocery stores] are selling. They are selling thousands of different types of stuff."
    - "Customers in drug stores and discount stores are quite different from the customers in the big box [channels]. For big box customers, they always go there [for lighting], but not for drug stores and discount stores."
    - "For supermarket and discount stores, light bulbs are not a major category or a fast-moving product for them."

  Thus, consumers who purchase replacement lamps in these stores are often doing so as an impulse purchase—in other words, because they have spotted a bargain or because it is convenient for them to purchase replacement lamps while they are in the store shopping for their primary product offerings (e.g., food, medications, or personal care items), particularly if the lamps are discounted. Again in the words of manufacturers' representatives:
    - "If you needed two light bulbs, and are doing the grocery shopping, you just buy from that store. You don't want to make another trip to a particular hardware store or [mass merchandise or home improvement store] just to buy two bulbs. They just buy there because of the convenience."
    - "If [customers] need light bulbs, and they're discounted, they're more apt to just buy them at drug or grocery stores versus going to [home improvement chain stores]."

- “Especially [in] grocery, that customer is making an impulse buy—and if it's a higher price point, then the impulse won't be there. If it's a CFL not on promotion, they're not going to pick that up. There's no influence there to do it.”

- **These channels do not allocate a lot of shelf space to lamps.** Interviews with lighting suppliers in recent years suggest that because drug and grocery retailers often view lighting as an adjunct to their primary product offerings, they typically allocate a small portion of their retail shelf space to lighting. The suppliers and retail buyers that supplied the discount channel also reported that stores in this channel often do not stock replacement lamps year-round; instead, they sell them during seasonal or promotional periods that last four to six months. However, program incentives encourage these retailers to allocate additional shelf space or end-cap displays to replacement lamps.

- **California’s IOU programs have traditionally targeted the discount and grocery channels for reaching hard-to-reach customers.** Interviews with participating lighting suppliers in recent years suggest that the ULP has encouraged lamp allocations to discount stores and independent or small chain grocery stores that may cater to specific ethnic communities. These allocations, along with some allocations to rural grocery and hardware stores, were designed to extend the program’s access to so-called hard-to-reach customers.

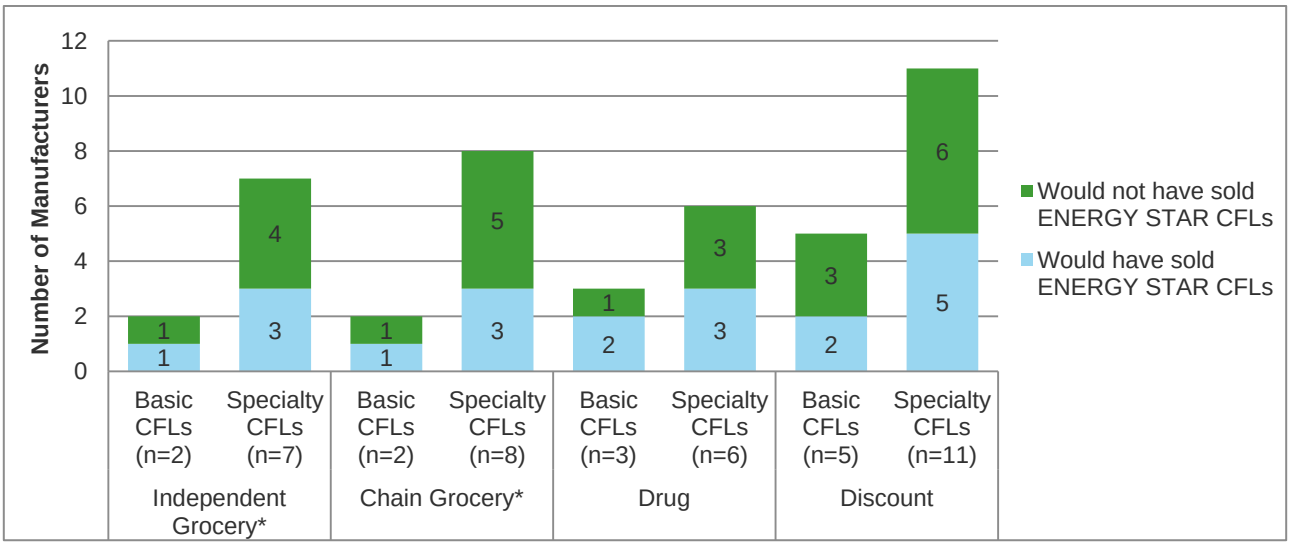
- **Many supplier representatives said they would not be selling ENERGY STAR CFLs through discount, drug, and/or grocery channels without the ULP.** Interviewers asked the participating lighting suppliers who sell ULP-discounted lamps in these channels whether they would have sold any ENERGY STAR CFLs—basic spiral CFLs or specialty CFLs—to discount, drug and/or grocery stores in the absence of the program. Figure 1 shows that about half of the relevant suppliers—and in some channels, more than half—said that they would not have sold any ENERGY STAR CFLs through these channels without the ULP.

In explaining their responses, a few lighting suppliers said that many grocery, drug and discount stores will not accept ULP-discounted lamps unless they are free of charge:

- “For discount, supermarket and pharmacies, they don't want to pay for [the lamps].”

- “If it’s really, really cheap for them, or even no cost, then they're willing to stack a whole pallet of light bulbs into a supermarket.”

**Figure 1: Participating manufacturer willingness to supply ENERGY STAR CFLs to the discount, drug, and grocery channels with and without the ULP by channel and CFL type, 2015 (supplier telephone interviews)**




* The chain grocery channel includes companies with 10 or more store locations participating in the ULP and the independent grocery channel includes all other grocery retailers.

A few discount store buyers reported that dollar stores, which comprise a large component of the discount channel, would not be able to sell ENERGY STAR CFLs without the ULP discounts. These retail buyers also said that any non-program bulbs in this channel (if available) are typically traditional incandescent lamps (if available) or EISA-compliant halogen lamps, and that discount stores will either carry ULP program or incandescent lamps, but typically not both. These retail lighting buyers commented:

- "If we didn't have an incentive, we wouldn't be carrying the [CFL], and our [CFL] sales would be zero. We really can't bring in regular priced bulbs, even on the closeout market or some off price—it just doesn't compare with the incentives and the pricing we have through this program."
- "Because of our $1 price point, we can't really sell anything that's not subsidized or that is newer technology [like LED lamps]. Everything [we sell] that is not subsidized, for all intents and purposes, is incandescent."
- "Certain dollar stores will carry program and non-program bulbs, but for the most part they either have [discounted lamps through] a program and they're not buying regular goods, or vice versa."

All three retail lighting buyers we interviewed revealed that their stores stop selling CFLs when their allocations of ULP-discounted lamps sell out. In contrast, several lighting supplier representatives said that some drug and grocery stores would continue to sell basic and specialty CFLs, even without ULP discounts. However, they noted likely changes such as reduced volume of lamp sales, particularly for specialty CFLs. In the words of manufacturers' representatives:

- "A lot of these discount and grocery stores are still selling CFLs and LED lamps when program allocations ran out—but very, very little. They were greatly affecting their cash flow [by buying non-program lamps], so they'd rather wait until the next year to get more program allocations rather than continue selling many lamps."

- “For a non-promotional [CFL], people are still buying it at supermarkets, just not as much. These stores are not going to stock a whole lot of light bulbs into a supermarket without the discounted product.”

Some manufacturers’ representatives suggested that even with program discounts, drug and grocery channels carry a more limited lamp selection than found in hardware, home improvement or mass merchandise channel:

- “The specialty sales are always kind of a [home improvement store] thing, more so than the general purpose [lighting] needs. There won't be too much distribution of reflectors and whatnot through the grocery channel.”
- “Grocery stores stock general purpose and maybe some specialty like candelabra or small kinds of stuff, but the bigger reflectors and such tend to be at the [home improvement] channel.”
- “[Drug stores] typically carry a few pieces of each item, and they only have maybe the bare spiral. They really haven't carried that much specialty in their stores.”

Figure 1 (above) shows that, in general, the percentage of supplier representatives who said that their specialty CFL sales would disappear without the ULP is greater than the percentage of suppliers who said that their basic CFL sales would disappear without the program. These suppliers provided two primary explanations:

1. **Specialty CFLs are generally more expensive than basic spiral CFLs.** Without program support, retailers’ wholesale costs for specialty CFLs are higher than for basic CFLs. As mentioned above, retailers in these channels will not pay much to stock replacement lamps.
2. **Specialty CFLs sell more slowly than basic CFLs.** This slower sell-through rate creates challenges for both retailers and the manufacturers that supply lamps to them. As noted, non-big box channels do not allocate a lot of retail space to lighting products in general and this premium on space means that retailers in these channels favor lighting products with quicker sell-through rates.

Since LED lamps are typically more expensive than CFLs, it is not surprising that lamp manufacturers also reported that they do not expect LED lamps to sell in many discount, drug and grocery channels, even with the ULP incentives. Instead, some suppliers reported strong sales of non-program LED lamps without ENERGY STAR certification in grocery and drug stores. According to one manufacturer’s representative:

- “I'm selling LEDs outside of the [program] marketplace that are not ENERGY STAR rated, and we're just blowing through them. They're very inexpensive. But it has nothing to do with this program.”

Among the three retail lighting buyers we interviewed (all in the discount channel), none sold any LED lamps at their California stores because the price is too high, even with existing ULP discounts. A few manufacturers’ representatives interviewed mentioned the difficulties of selling LED lamps at a price point that worked for discount stores in particular. According to one representative:

- “I have to make a little profit, and I don't have to make a lot. But I have to make something, so when I can't, [LED sales are] not in the cards.”

All three of the retail buyers from discount stores voiced strong support for increasing program incentives for LED lamps to help discount stores stock these lamps. These retail buyers mentioned that programs in other states have demonstrated their customers' strong interest in LEDs at a lower price point. They commented:

- "We're getting [LED lamps] in other utility-subsidized programs now and we know [they] sell very well for a buck. We're looking at how we can get LEDs for a dollar in California. That's really our focus right now."
- "We have had some LED products through an incentive program outside California and we've done very well with it. We don't stock LEDs for our California stores but it's something we're pursuing."

#### 4.1.2.3.2 Home improvement and hardware channels

The home improvement and hardware channels received approximately 23% of all CFLs and approximately 30% of all LED lamps shipped to retailers through the 2013-14 ULP. These channels differ markedly from the discount, drug and grocery channels in terms of how they stock and display lamps and how their consumers shop for lamps. Some of the characteristics of home improvement and hardware channels include:

- **These channels are destinations for energy-efficient lighting purchases.** Interviewees noted that consumers typically visit the home improvement and hardware channels because they want to purchase a particular type of lamp or because they have a home improvement project that might require a variety of lighting products.
    - One manufacturer's representative said that the home improvement channel is a lighting destination particularly for LED lamps because "customers are going to feel, and whether it's right or wrong, that they need to be in The Home Depot, or the Lowe's store, buying that [LED lamp] there to make sure they're getting their best deal."
    - Another mentioned that customers shop home improvement stores specifically for lamp replacement because "the customers going there, they have a thought: 'I have to replace a light bulb.'"
- **These channels allocate a lot of shelf space to lamps.** As discussed above, discount, drug, and grocery stores—because of space limitations and a desire to quickly sell through most of their products—prefer to limit their lighting displays to the most popular types of lamps. However, as destination stores for consumers who may be seeking specific lamp types, home improvement and hardware retailers tend to provide a fairly comprehensive range of lamps—even if this means stocking lamp types for which demand is minimal. One lighting manufacturer's representative suggested that hardware stores "always want to have a full line of products, from the lowest wattage to the highest wattage" because they serve as destinations for products that are difficult to find.
- **These channels sell energy-efficient lamps all year long.** Stores in the home improvement and hardware channels generally stock energy-efficient lamps year-round rather than during specific promotional periods. Stores participating in the ULP often have two categories of energy-efficient

lamps, including the promotional lamps that they sell at a discount through the program and the everyday lamps which usually have a higher price point than the promotional lamps.[70]

- **Different manufacturers may supply promotional lamps and everyday lamps via different distribution methods.** For example, the ULP-discounted promotional lamps are often drop-shipped to chain hardware stores directly from the manufacturer whereas the everyday lamps may originate from warehouses owned by the retailers. These types of retailers also typically insist that the promotional lamps and the everyday lamps have different package sizes and stock-keeping units (SKU)[71] to reduce confusion in tracking these lamps, since the everyday and promotional lamps have different price points and the promotional lamps are subject to ULP rules (for example, limitations on multi-pack sizes). In addition, many stores market the promotional and everyday lamps differently, with the promotional lamps usually receiving more prominent placement within the store (for example, on end-caps versus in the aisles) and often with more prominent signage.
- **Only a minority of suppliers in these channels said they would not be selling ENERGY STAR CFLs without the ULP.** In contrast to the discount, drug, and grocery channels (in which the majority of manufacturers stop selling CFLs when ULP discounts are not available), only three of the lamp manufacturers that serve the home improvement channel and three that serve the hardware channel said that would not have sold CFLs in these channels if the ULP discounts were not available. Figure 2 shows their responses. Manufacturers' representatives provided a number of reasons as to why they would continue to sell CFLs in the home improvement and hardware channels in the absence of the ULP discounts. Some of the reasons they mentioned include:
    - Since these are destination stores for lighting, these retailers can stock lamps at higher price points than may be typical in other retail channels.
    - There are fewer of these stores and greater distances between them than for many other retail store types. Combined with higher prices, the reduced options for alternate shopping destinations make shopper demand curves more inelastic because of the sunk costs of making the trip to such stores.
    - Customers who shop in these stores are generally less price-sensitive than customers who shop in the discount, drug, and grocery store channels.
    - According to manufacturers' representatives, lighting buyers for home improvement chains prefer retail markdowns instead of manufacturer buy-downs for their promotional lamps. This practice may narrow the price difference between the promotional and everyday lamps.
- **Less than one-third of suppliers in these channels said they would not be selling ENERGY STAR LED lamps without the ULP.** Figure 2 shows their responses.

[70] It is important to note that other retail channels besides hardware and home improvement also have both everyday and promotional lamps, although there is more variation within these other channels. For example, as discussed in the previous section, in the grocery channel the stores in the discount grocery subsector of this channel often sell energy-efficient bulbs only when they are ULP-discounted.

[71] A SKU is typically an alphanumeric code that identifies a particular retail product. Different products have different SKU that allow individualized tracking for inventory purposes.

**Figure 2: Participating manufacturer willingness to supply ENERGY STAR CFLs to the home improvement and hardware channels with and without the ULP by channel and CFL type, 2015 (supplier telephone interviews)**

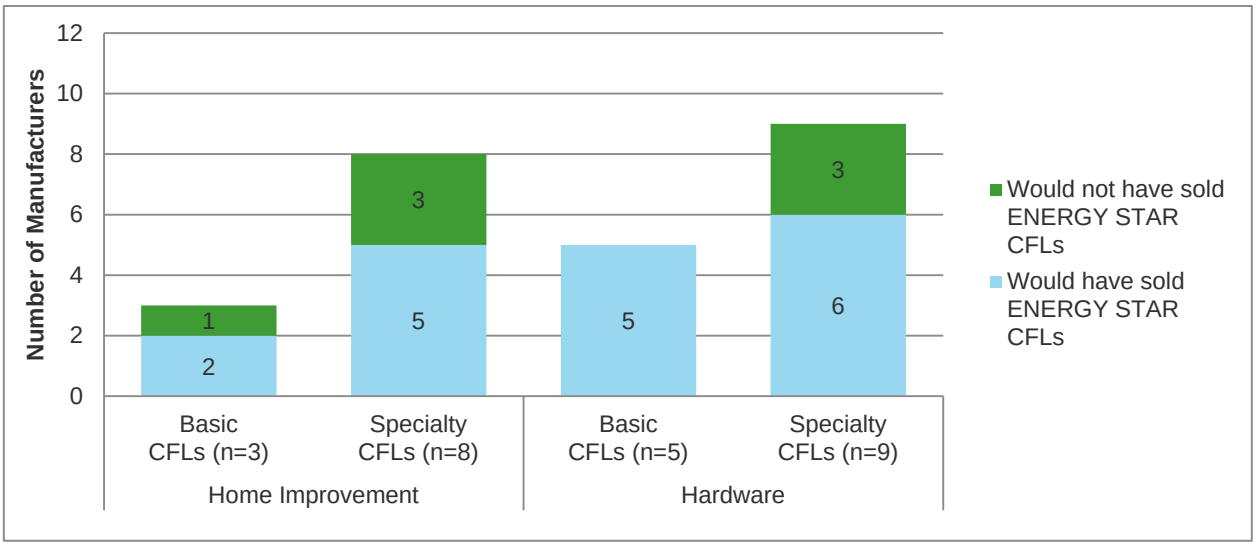
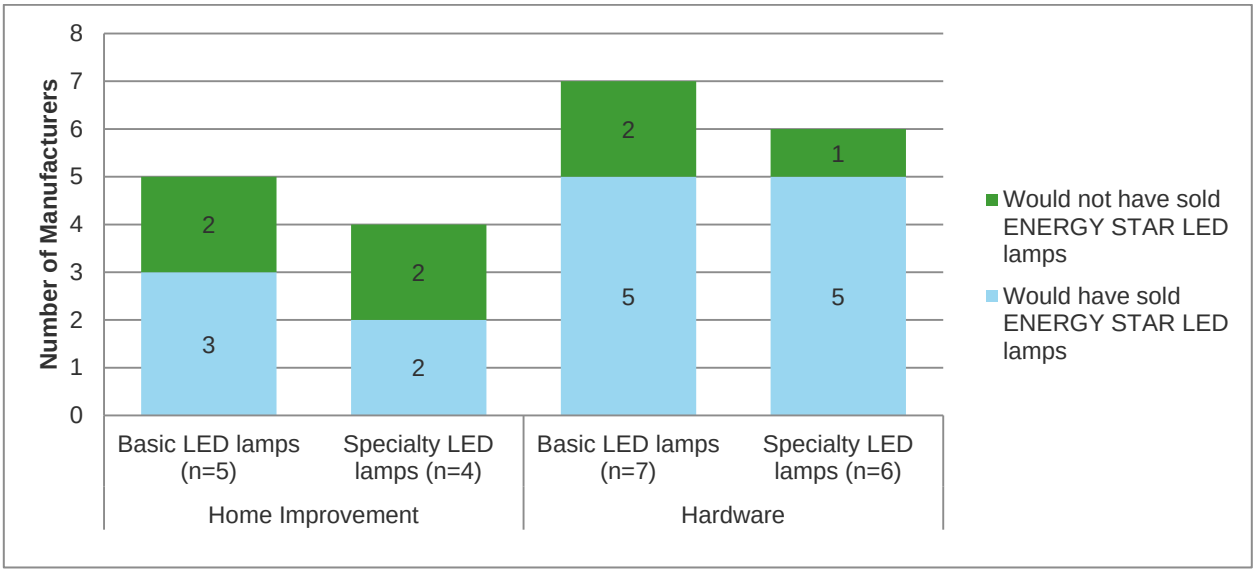



**Figure 3: Participating manufacturer willingness to supply ENERGY STAR CFLs to the home improvement and hardware channels with and without the ULP by channel and LED lamp type 2015 (supplier telephone interviews)**




While there are many similarities between the home improvement and hardware channels, there are also some key differences. First, stores in the hardware channel are, on average, much smaller than those in the home improvement channel. Second, stores in the hardware channel are often independently-owned while stores in the home improvement channel are part of large retail chains. Independent ownership gives the stores in the hardware channel more flexibility to make deals with lighting suppliers—for example, while many stores in the hardware channel typically purchase their everyday bulbs from their

affiliated brands (ACE, True Value, et al.), they may make their own deals with other manufacturers for promotional lamps to be sold with ULP discounts. In contrast, stores in the home improvement channel tend to purchase lamps from a set number of lighting manufacturers.

#### 4.1.2.3.3 Mass merchandise, wholesale club, and lighting and electronic channels

The other retail channels that participated in the 2013-14 ULP include mass merchandise stores, wholesale clubs, and lighting and electronics stores. These channels received 15% of all CFL and 66% of all LED lamp shipments through the 2013-14 ULP. Most participants in these channels are large chain retailers that share some of the characteristics of other channels with large chain stores such as the home improvement channel. For example, some of the lighting manufacturers stated that the three big box channels—mass merchandise stores, wholesale clubs, and home improvement stores—are similar in that many have made a strategic shift away from promoting lamp types that are different from those they sell on their shelves on an everyday basis. Such a strategic shift in lighting product procurement greatly limits the number of lighting manufacturers who can supply these retail chains. The smaller, more opportunistic lighting manufacturers, who made short-term promotional lighting sales to these large chains through the ULP in past program cycles, are no longer able to make such deals. The lighting manufacturers who can still supply these large retail chains are larger manufacturers who have the capacity to supply the "everyday" (non-ULP) lamps for large retailers. According to one manufacturer's representative:

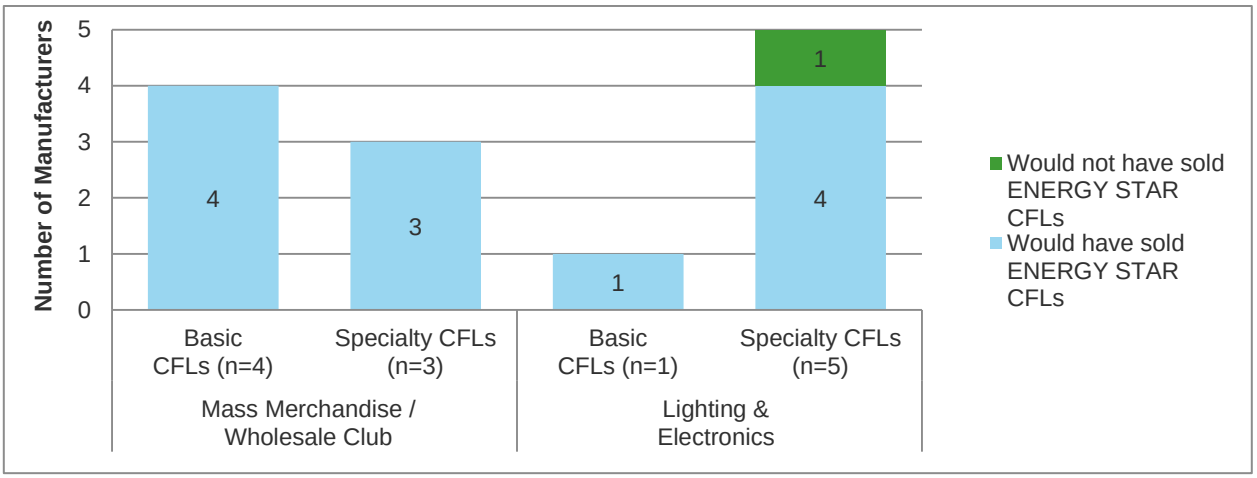
- "There are very, very few manufacturers that are selling to the big box stores, meaning the national brand and maybe FEIT Electric. The majority of the manufacturers are not selling to the big box stores. They're selling to the smaller chains."

In addition, only one manufacturer's representative said that his organization would not be selling ENERGY STAR specialty LED lamps in the mass merchandise or wholesale club channels without the ULP, but both LED lamp suppliers to lighting and electronics stores stated that they would not sell ENERGY STAR LED lamps in those stores without the ULP.

Figure 4 shows that very few manufacturers supplied these channels (6 for mass merchandise and wholesale clubs, and 5 for lighting and electronics stores). Only one of the five suppliers to lighting and electronics stores stated they would not have been able to sell any CFLs through these channels without the ULP. Similarly, none of the six manufacturers in the mass merchandise and wholesale club channels said that would not have been able to sell any CFLs through these channels without the ULP. Retailers in these channels were more likely than any other channel to continue selling lamps when program discounts ran out, primarily because many carry the same products during program and non-program periods.

- One manufacturer's representative noted, "For [the mass merchandise and wholesale club channels], we still would have sold lamps without program discounts because otherwise we wouldn't have had the items in the stores."
- A retail buyer for a wholesale club chain said, "We don't change our [product] mix pursuant to a rebate being available—it's the same item numbers every day of the week."

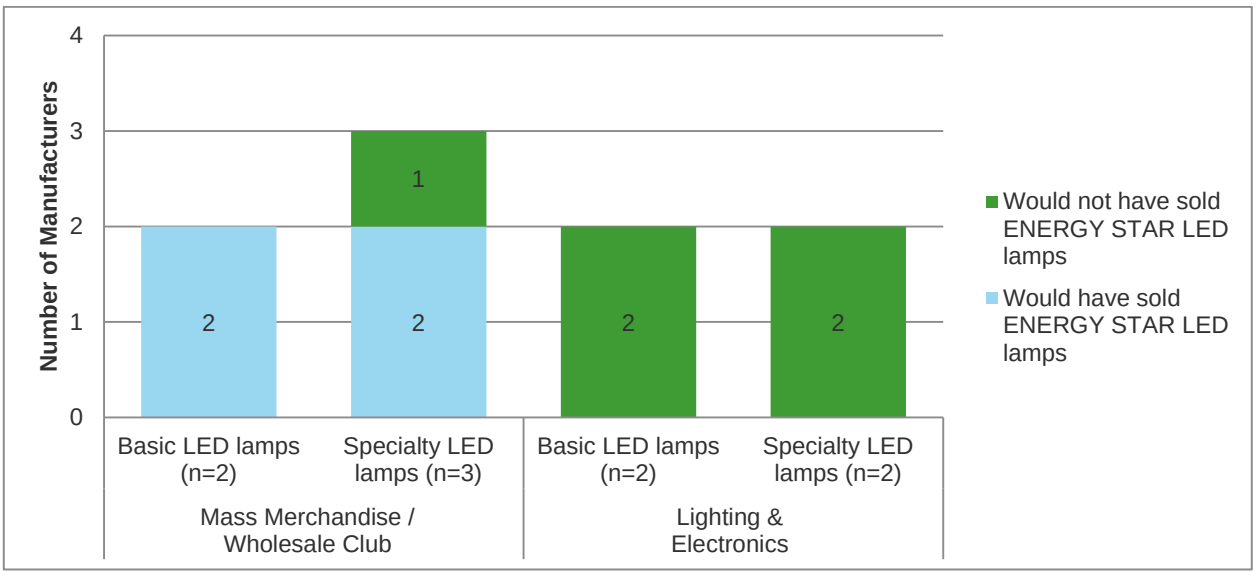
**Figure 4: Participating manufacturer willingness to supply ENERGY STAR CFLs to the mass merchandise, wholesale club, and lighting and electronics channels with and without the ULP by channel and CFL type, 2015 (supplier telephone interviews)**




Note: Mass merchandise and wholesale club channels combined to protect interview participant anonymity.

Another attribute that mass merchandise stores and wholesale club stores share with home improvement stores is that they typically stock LED lamps. Only one supplier said his organization would not be selling ENERGY STAR specialty LED lamps in the mass merchandise and wholesale club channels without the ULP, but both LED lamp suppliers to lighting and electronics stores stated that they would not sell ENERGY STAR LED lamps in those stores without the ULP (see Figure 5).

**Figure 5: Participating manufacturer willingness to supply ENERGY STAR LED lamps to the mass merchandise, wholesale club, and lighting and electronics channels with and without the ULP by channel and CFL type, 2015 (supplier telephone interviews)**



Several supplier representatives claimed that mass merchandise stores and wholesale clubs have procurement practices that limit the variety of lamps that they sell, particularly with an aim toward greater uniformity in the bulbs they sell.

- A retail lighting buyer for a mass merchandise chain commented, "We try to find the one item that's going to hit 80% of the total market needs, and that's really all that I have room for. I'd love to have another 15 LEDs or CFLs on our floor to try to round out the market to compete more, but we don't have the SKU luxury for that."
- One wholesale club chain introduced LED lamps that meet CEC specifications across all its stores nationwide to standardize its lighting product offerings. The store's retail buyer explained, "I want to be able to carry the one item that can go across the country and qualify for as many possible rebates to make this product affordable for my members."

Lighting manufacturers' representatives also noted some important differences between the home improvement channel and the mass merchandise and wholesale club channels. For example, the representatives did not consider stores in the mass merchandise and wholesale club channels as a destination for lighting purchases like home improvement stores, but rather grouped mass merchandisers and wholesale clubs with other channels in which consumers purchase lighting products on impulse or as convenience purchases (such as grocery stores). This similarity between mass merchandise stores, wholesale clubs, and the grocery channel may not be surprising given that many large mass merchandisers and wholesale clubs also sell grocery items.

### 4.1.3 Supplier perspectives on lamp efficacy regulations

We asked respondents about perceptions of the general effects of EISA, which incrementally took effect from 2012 through 2014, on California's replacement lamp market through mid-2015.[72] We also asked respondents for their perspective on the effects of Tier 2 specifications—which require 45 lumens per watt by 2020—on California's market for replacement lamps. Key findings include:

- Supplier representatives reported that the most notable effects of the legislation on the California market include the phase-out of traditional incandescent lamps (not surprisingly), increased manufacturing and/or sales of EISA-compliant halogen lamps, and increased sales of CFLs or energy-efficient lamps in general.
- Nearly half of manufacturers' representatives suggested that Tier 2 specifications, when implemented, would eliminate some lamp types including EISA-compliant halogen lamps (5 respondents) or CFLs (2 respondents) because they would no longer meet the required efficacy.

#### 4.1.3.1 General effects of EISA through mid-2015

Interviewers asked manufacturers' representatives whether they thought EISA regulations have impacted the residential lighting market in California. Among the 15 lighting manufacturers who responded to the question, more than three-fourths reported some effect (Figure 6):

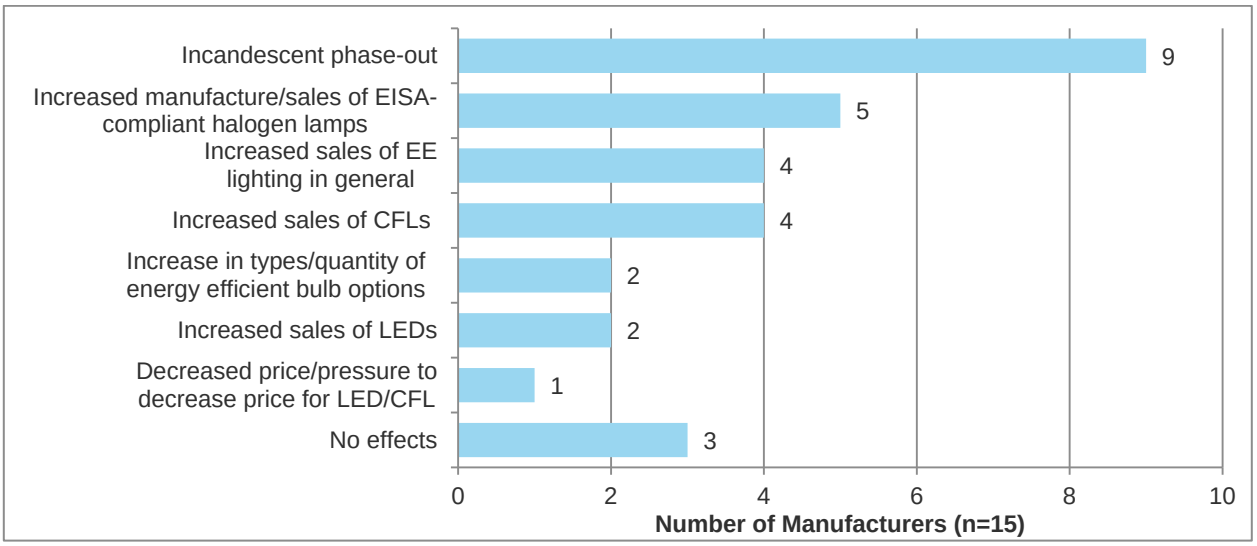
- Nearly two-thirds (9 manufacturers' representatives) mentioned the phase-out of traditional incandescent lamps.

[72] See section 3.1.1 for more background on EISA

- Another one-third said they saw an increase in consumers selecting EISA-compliant halogen lamps to replace the phased-out incandescent lamps (5 manufacturers' representatives).
- Additionally, four manufacturers' representatives mentioned an increase in energy-efficient lighting sales in general. One of these suppliers said that EISA regulations had "pushed [customers] to the next level of [lamp] efficiency" while another noted, "people had to, whether they like it or not, buy CFL or LED or halogen."
- Another four representatives reported increased sales of CFLs.
- Two mentioned increased LED lamp sales.

Other manufacturers' representatives reported an increase in the types/quantity of energy efficient lamp options (2 respondents) and pressure to decrease prices of CFL and LED lamps (1 respondent). Three suppliers reported no effects from the EISA legislation on the California market: two of these said that IOU incentive programs had encouraged many California consumers to switch from incandescent to more efficient lamps prior to the legislation's enactment, and the third provided no further explanation.

**Figure 6: Participating manufacturer perceptions of EISA's effects on California's residential replacement lamp market, 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.

### 4.1.3.2 General effects of EISA Tier 2

We asked suppliers whether they thought Tier 2 of EISA regulations, which will take effect in 2020, would impact the residential market for replacement lamps in California.[73] Of the 15 manufacturers' representatives who responded to the question, the vast majority thought Tier 2 would impact the California lighting market (13 respondents; see Figure 7).

[73] Tier 2 requires that general service lamps manufactured in 2020 or later have an efficiency of at least 45 lumens per watt.

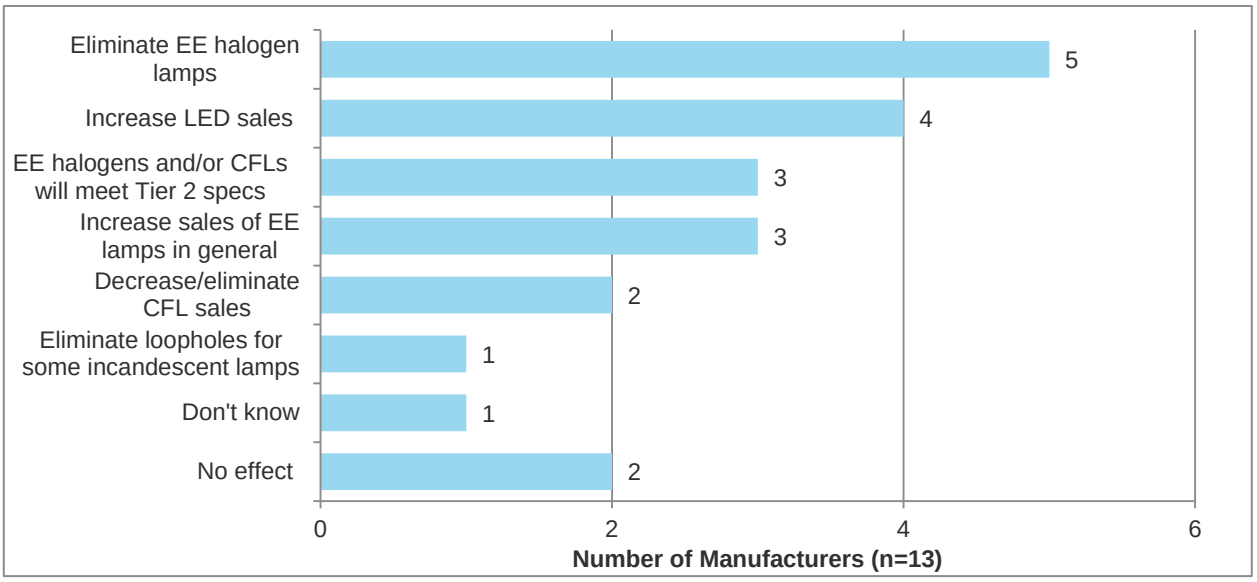
- One-third reported halogen lamps would fail to meet Tier 2 specifications and therefore would be eliminated from the California market (5 respondents).
- Another one-fourth of manufacturers' representatives suggested that LED lamp sales would increase and replace sales of less efficient lamps (4 respondents).
- Three representatives suggested that halogen lamps and/or CFLs would meet or exceed Tier 2 specifications of 45 lumens per watt by 2020. One of these said, "45 lumens is going to be hard to hit, but our engineers [are] already working to make changes to get there."
- An additional three representatives reported that the implementation of Tier 2 specifications would lead to an increase in sales of higher efficiency lamps in general.

By contrast, not all of the manufacturers' representatives we interviewed thought CFLs would retain their market position: two forecasted that CFL sales would greatly decrease and/or fail to meet Tier 2 specifications and would be phased out.

Other manufacturers' representatives asserted that Tier 2 would eliminate loopholes for some incandescent lamps (such as modified spectrum lamps) or didn't know whether the California market would be affected (2 respondents). Two manufacturers' representatives said they anticipated Tier 2 would have no effects because they predicted that the California market would already be transformed to higher lamp efficiency by then. These representatives commented:

- "I don't think it would change anything because once you start using CFLs or LEDs, it's hard for customers to go back to using a so-called high-efficiency, regular incandescent."
- "[Tier 2] will not create a big difference for the California lighting market. First, high-efficiency products fulfill what consumers want to replace the incandescent. Second, compact fluorescent lamps and LEDs will already [have penetrated] the markets by 2020."

**Figure 7. Manufacturer perceptions of EISA Tier 2 effects on California's market for residential replacement lamps, 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.

Similarly, we asked retail lighting buyers whether they thought Tier 2 of EISA regulations would impact California's residential replacement lamp market differently than in other markets in the country. Five of six retail buyers indicated they didn't know, and one questioned whether Tier 2 would take effect. This respondent (a retail buyer for a mass merchandise chain) observed, "It just depends on what California decides to do. As a nation, I don't think it will ever take effect."

### 4.1.4 Supplier perspectives on the CEC LED lamp specification

As described in Section 3.2.2 above, the CPUC required that LED lamp manufacturers meet the California Energy Commission's Quality standard for LED lamps (the CEC LED lamp specification) and that all LED lamps included in the ULP needed to meet the CEC specification starting in 2014. During the telephone interviews conducted in 2015, interviewers did not explicitly ask supplier representatives for their perspectives on the effects of the CEC specification on the residential replacement lamp market, but nearly all shared their unsolicited views. Because the interview guides were not designed to systematically explore the effects of the CEC specification, suppliers' opinions on its impacts on the California lighting market varied. Nevertheless, opinions coalesced around the difficulties in meeting the standard as well as perceived negative market effects, such as competition from less expensive non-ENERGY STAR LED lamps that do not meet the CEC specification. Key findings include:

- **Most lighting suppliers' representatives expressed negative reactions to the ULP requirements that LED lamps meet the CEC specification.** Suppliers reported negative market effects, particularly decreased program participation for LED lamps and difficulties competing against less expensive LED lamps that do not meet the specification.

- **However, a few manufacturers' representatives opined that the CEC specification represented a positive development**. These representatives suggested that the standard is pushing technological advancement and improving overall LED lamp performance.

#### 4.1.4.1 Detailed findings

According to a large majority of supplier representatives, the effects of the CEC specification for LED lamps were mostly negative. The most frequently mentioned effect among manufacturer representatives in the 2015 interviews was that the specification led to lower supplier participation in the ULP for LED lamps. Eight of the 18 manufacturer representatives interviewed said that their companies were not manufacturing LED lamps that met the CEC specification at the time of the interviews. Reasons for not producing LED lamps that met the specification varied, but typically centered around the technological challenges and costs of producing the higher quality lamps:

- One manufacturer's representative who reported discontinuing LED replacement lamps that met the CEC specification explained: "We're only offering fixtures only right now [through the ULP]. Everything has got to be CEC spec to be in the program, so we're a lesser player right now. We're trying to figure a way to get a better [CEC-spec LED] product to market but haven't yet."

According to many supplier representatives, the entry of low-cost, lower quality non-ENERGY STAR LED lamps into the California residential lighting market made it more difficult to sell LED lamps that met the CEC specification for LED lamps. Because of the lower price point of the non-ENERGY STAR LED lamps, the representatives claimed that their LED lamps that met the specification had difficulty competing against these lower quality LED lamps. According to these representatives, the LED lamps that met the specification were higher priced, on average, compared to the non-ENERGY STAR LED lamps, even when incentives were factored into the price. Below we provide a selection of the complaints lodged by the supplier representatives on this topic.

- According to a disgruntled manufacturer's representative, "We jumped through all the hoops and had a CEC product, but China imports have beaten us [on price] without an incentive."
- One manufacturer's representative reported developing an LED lamp that met the spec for a major home improvement store, but said that "it doesn't sell well" because "it's so high priced that even with the incentives, it doesn't move."
- According to another manufacturer's representative, "The CEC is almost creating a problem where the cheaper LEDs and non-ENERGY STAR LEDs come in, and consumers are more likely to buy those because of the difference in price point, especially at a big box store."

While it may be true that LED lamps that meet the CEC specification were at a higher price point that was too high for price-sensitive consumers (even with incentives), lower quality, non-Energy LED lamps would have been on California retail shelves regardless of whether the CEC specification requirement for program incentivized LED lamps existed. Furthermore, data from recent shelf surveys in California suggest that CEC specification lamps are becoming increasingly available and with the program's discounts, are on average less expensive than even non-ENERGY STAR qualifying lamps. These suggest different trends than supplier representatives said were occurring in California.

Table 13 below shows the share of ENERGY STAR and non-ENERGY STAR MSB LED A-lamps, share of ENERGY STAR MSB LED A-lamps that met and did not meet the CEC specification, and the price per lamp for ENERGY STAR MSB LED A-lamps that did and did not meet the CEC specification and the price per non-ENERGY STAR MSB A-lamp. As shown, the share of non-ENERGY STAR LED A-lamps stocked in California retail stores actually declined between 2014 and 2015 from 66 percent of LED A-lamps to 57 percent of LED A-lamps (though non-ENERGY STAR lamps still comprised a majority of LED A-lamps stocked on shelves in 2015). Regarding price, ENERGY STAR LED A-lamps that met the CEC specification had by far the lowest price per lamp on average compared to ENERGY STAR LED A-lamps that did not meet the CEC specification and to non-ENERGY STAR LED A-lamps. In 2014, ENERGY STAR LED A-lamps that met the CEC specification were $4.23 less per lamp than non-ENERGY STAR LED A-lamps (38% less expensive), and in 2015, ENERGY STAR LED A-lamps that met the CEC specification were $2.79 less per lamp than non-ENERGY STAR LED A-lamps (42% less expensive).

**Table 13: Percent of lamps and price per lamp of MSB LED A-lamps by ENERGY STAR and CEC specification qualification status, 2014 and 2015 (retail store shelf surveys)**

| Lamp Type | All Channels | | n | |
|---|---|---|---|---|
| | 2015 | 2014 | 2015 | 2014 |
| Percent of lamps | | | | |
| ES label | 43% | 34% | 55,854 | 16,540 |
| No ES label | 57% | 66% | 67,015 | 29,315 |
| Percent of lamps | | | | |
| ES label and meets CEC spec | 36% | 6% | 26,824 | 891 |
| ES label and does not meet CEC spec | 64% | 94% | 29,030 | 15,649 |
| Price per lamp | | | | |
| ES label and meets CEC spec | $3.89 | $6.84 | 26,824 | 891 |
| ES label and does not meet CEC spec | $8.32 | $10.73 | 29,030 | 15,615 |
| No ES label | $6.68 | $11.07 | 67,015 | 29,301 |

Some supplier representatives believed that the CEC specification has a positive influence, suggesting that there were some advantages to the CEC specification in terms of pushing technological advancement and improving lamp performance. Some of these market players anticipated that these benefits would eventually push other states to adopt similar specifications for LED lamps.

- One manufacturer's representative reported the company does not participate in the ULP because of the CEC specification but is working toward producing an LED lamp that meets the spec. He commented, "We weren't going to go to the additional expense of updating [our LED lamps] but now we're going toward the CEC spec … because we know eventually everywhere else is going to require it."
- Another manufacturer's representative said the specification has value—particularly with regard to driving technology advancement—but needs revision to accommodate the range of consumer preferences. This representative suggested that the CRI requirement in particular "should almost be like the gold standard for what we want the market to attain. So, there needs to be a step down, almost like a good, better, best [LED product]."

As part of the 2015 California Upstream Lighting Impact Evaluation, we will explore the impacts of the CEC LED lamp specification more deeply through a series of direct questions on the subject that are designed to elicit clearer and more nuanced responses.

### 4.1.5 Supplier perspectives on LED lamp quality

Interviewers asked all lamp supplier representatives whether they were aware of any issues with the quality or performance of LED lamps (including ENERGY STAR and non-ENERGY STAR LED lamps). Key findings include:

- About half of the manufacturers' representatives said they were aware of one or more issues with LED lamp quality or performance, primarily among non-ENERGY STAR lamps (9 respondents). They mentioned four types of quality issues: dimmability failure, lumen degradation, early lamp failure, and poor/unusual light quality. Nearly all attributed these quality issues to non-ENERGY STAR lamps produced with low quality components.
- Most suppliers said the primary reason for dimmability failure is that some LED lamps are incompatible with certain dimmer switches. In addition, many respondents noted an influx of manufacturers with limited experience in the lighting market and subsequent difficulty with technical aspects of lamp functionality like dimmability.
- Two retail buyers also identified one or more LED lamp issues as reported by the manufacturers' representatives (dimmability, early lamp failure, lumen degradation, and light quality) and echoed their conclusion that these issues exist primarily among non-ENERGY STAR lamps.

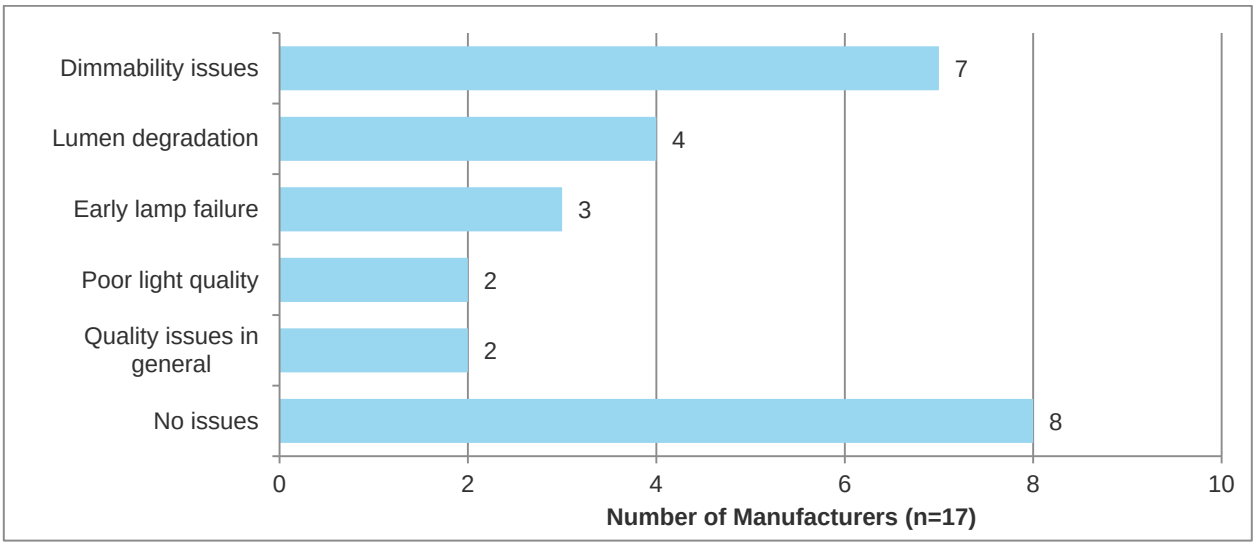
#### 4.1.5.1 Detailed findings

DNV GL interviewers asked suppliers whether they were aware of any issues with the quality or performance of LED lamps. Among the 17 manufacturers' representatives who responded to the question, roughly half said they were aware of one or more issues with LED lamp quality or performance (9 respondents; see Figure 8). As shown, suppliers primarily mentioned issues such as dimmability failure (7 respondents), lumen degradation (4 respondents), early lamp failure (3 respondents), poor/unusual light quality (2 respondents), and quality issues in general (2 respondents).

Nearly all respondents attributed quality issues to non-ENERGY STAR LED lamps produced with low quality components. These representatives noted that the non-ENERGY STAR lamps have functionality and expected lifespan far below LED lamps that meet ENERGY STAR requirements. Their comments include:

- "The problem is manufacturers are producing bulbs that are not omni-directional, are not dimmable, and don't meet the ENERGY STAR spec because they can make them much cheaper and don't have to wait for the testing. It's causing market confusion from a consumer perspective."
- "[There are] no issues with ENERGY STAR models but this non-CEC, non-ENERGY STAR stuff, good luck! With those things, you might get early failure, or you could get anything."
- "Without ENERGY STAR, it's buyer beware."

**Figure 8: Participating manufacturer perceptions of issues with LED lamp quality or performance (of those who perceived issues), 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.

As noted above, 7 manufacturers' representatives reported dimmability issues with some LED lamps. Unlike the other quality issues, supplier representatives reported this issue for both ENERGY STAR and non-ENERGY STAR lamps. Most suppliers said the primary reason for dimmability failure is LED lamp incompatibility with certain switch types. In addition, many respondents have noted an influx of manufacturers with limited experience in the lighting market, some of whom may struggle with technical aspects of lamp functionality.

- "There are so many newcomers in the market that haven't a clue how to actually dim with electronic [LEDs] that whenever you hear somebody having trouble with dimming electronic LED light bulb, probably you can trace it back to a manufacturer who hasn't been in business real long."
- "LEDs cannot work for every dimmer switch, for sure, especially those digital ones."
- One manufacturer explicitly called out potential incompatibility with dimmer switches and explained, "We state on our packaging to check our website to see what dimmers will match the bulbs that you're using."

Four respondents mentioned issues with lumen degradation or expected lumen output decline over the life of the LED lamp. While all LED lamps decline in lumen output over time, these manufacturers' representatives mentioned lumen output declines earlier or more intense than expected. Manufacturers' representatives said:

- "I'm absolutely certain that there's lumen degradation out there because you can drive an LED harder and get more out of it—it just won't do it for a real long time. So what's going to happen with some of the products a year or two into it?"
- "It doesn't happen for ENERGY STAR bulbs but if manufacturers are using a cheap chip, the heat factor is killing the lumens."

Three supplier representatives mentioned hearing about early lamp failure for LED lamps. Unlike incandescent lamps, which fail when the filament breaks, LED lamp failure often produces gradual degradation rather than catastrophic change. LED lamps also fail for more complex reasons, ranging from mechanical and electrical to material. In particular, the quality of material directly impact LED lamp performance and lifetime, and represents an area where some manufacturers seek to substantially reduce costs. Nearly all representatives mentioned that early failure was an issue for less expensive, non-ENERGY STAR LED lamps. According to one manufacturer's representative, early lamp failures may occur long after the sale but long before the lifespan indicated:

- "These lamps go out in the field and a year or two later they start getting early failures, but meanwhile they've all been sold long ago so they can't recall them."

Two manufacturers' representatives mentioned light quality issues (such as poor color or warmth). Similar to most of the other quality issues, representatives mentioned this applies primarily to LED lamps that do not meet ENERGY STAR specifications. These representatives' observations included:

- "The light that came out of it was very weird. It had a [blue] tint to it, and it was supposed to be soft white, or 2700K. There's going to be some [manufacturers] that don't care. They just want to put something else in the market."
- "Number one, the issue is going to be capacitor technology, which means that it's going to not be very pretty and kind of a dull LED light."

We also asked participating retail lighting buyers whether they were aware of any issues with the quality or performance of LED lamps. Four of six retail buyers indicated they were aware of one or more issues, and echoed similar comments made by the manufacturers' representatives about dimmability, early lamp failure, lumen degradation, and light quality as primarily existing among some non-ENERGY STAR lamps. Their comments include:

- "The lesser bulbs have all those problems like dimmability, uniform light coverage, pleasant light spectrum, and the program LED bulbs have zero problems."
- "I do know there are substandard LEDs out on the market, but none that we carry. But everybody has different dimmability standards."

#### 4.1.5.2 Supplier perspectives on the ULP

The supplier telephone interviews specifically addressed the ULP's influence on CFL and LED lamp sales, and several supplier representatives offered their perspectives on the program's general market influences as well. We also addressed recent changes in the ULP, the ULP's reduction in incentives for basic CFLs (see Table 10 and Table 11 above), and continuity of ULP incentives throughout the 2013-14 program. Finally, we asked supplier representatives to describe how they select products for inclusion in the ULP and the role of IOU staff in these decisions, and asked for their suggestions regarding the types of products they'd like to see included in the ULP.

Key findings include:

- The ULP has influenced the types of CFLs and LED lamps sold by some manufacturers. The program was also responsible for the presence of four manufacturers in California's market for residential replacement lamps.

- All of the manufacturers' representatives we interviewed reported that the ULP has affected the LED lamps they offered for sale in California during the 2013-14 period. Their responses all related to the CEC specification. Half reported that the program had influenced their decision to sell lamps that meet CEC specifications and another one-fourth mentioned the ULP had influenced the lamp shapes they offered.
- When asked about recent changes in the ULP and whether these had affected their participation, nearly all supplier representatives' reported some effects. The most frequently mentioned changes included difficulty meeting the CEC specifications for LED lamps (4 respondents), and changing product mix due to ULP incentive changes in basic and specialty CFLs (3 respondents). A handful mentioned challenges meeting the CEC specification or that they had changed product mix to align with the increased program focus on specialty CFLs, notably high-wattage and other types.
- Several representatives mentioned that the program had, in some instances (e.g., in a specific retail channel or during a specific timeframe), discontinued incentives for basic CFLs and suggested that doing so was premature since many of these customers would likely select EISA-compliant halogen lamps instead of these CFLs without discounts.
- Two-thirds of manufacturers' representatives reported that there were periods during which ULP discounts were not available from mid-2014 to mid-2015 (n=16). Nearly two-thirds stopped selling CFLs and/or LED lamps in California until discounts resumed and cited "missed opportunities" for selling CFLs. A handful of retail buyers offered the same perspective.
- When asked how they chose to sell specific lamps through the 2013-14 ULP, less than half of the manufacturers' representatives we interviewed said that they chose the lamps that the IOUs wanted them to sell. Equally as many mentioned that they chose the lamps that are their biggest sellers and/or that they chose products that the retailers normally stock. The vast majority of retail buyers interviewed said that the IOUs chose the lamps for them.
- Three-quarters of the manufacturers' representatives said that the IOUs encouraged them to sell one or more specific types of CFLs through the ULP (particularly specialty CFLs), while a smaller number mentioned that the IOUs encouraged them to sell specific LED lamp types.
- Only two of the lighting manufacturers' representatives we interviewed reported that they were completely satisfied with the range of lamps sold through the 2013-14 ULP (14 respondents). Nearly three-fourths suggested that the ULP should do more to promote LED lamps and three representatives mentioned that the program should promote all ENERGY STAR lamps and basic CFLs. Other responses were mixed, and few retail representatives expressed their perspectives on this issue. About half of the manufacturers' representatives suggested eliminating the requirement that LED lamps meet the CEC specification.

### 4.1.6 Overall market influences of the ULP

While the 2015 supplier interviews did *not* include general questions regarding the overall influences of the ULP, roughly half of the manufacturers' representatives volunteered perspectives regarding the program's influence on their activities.

- **Four manufacturers' representatives mentioned that the ULP influenced the types of CFL and LED lamps they sold in general.** Three of these mentioned they sold some lamp types, such as

high wattage CFLs, that they would not otherwise have sold. By contrast, two said they were not selling some LED lamp types due to the requirement that ULP-discounted LED lamps must meet the CEC specification. Others mentioned their willingness to produce whatever lamp types would be eligible for ULP incentives. Manufacturers' representatives noted:

  - "We probably would not be selling the CFL high wattage and the specialty stuff [without the program], but I think we'd still be selling the standard choices."
  - "We'll supply whatever lighting products the ULP provides incentives for."
  - "The IOUs want different models so we offer them many different varieties."

- **Four manufacturers' representatives attributed their California market presence to the IOU programs. These companies' business models focus solely on utility incentive programs.** As a result, these respondents reported no sales of CFLs or LED lamps during periods when ULP discounts were not available. One representative stated,
  - "Our business is different than everybody's—[we only] sell program bulbs."

Manufacturers' representatives also mentioned other influences of the ULP, including increasing sales overall for CFLs and LED lamps as a result of discounted lamp prices (2 respondents) and broadening the sales channels in which CFLs are sold (1 respondent).

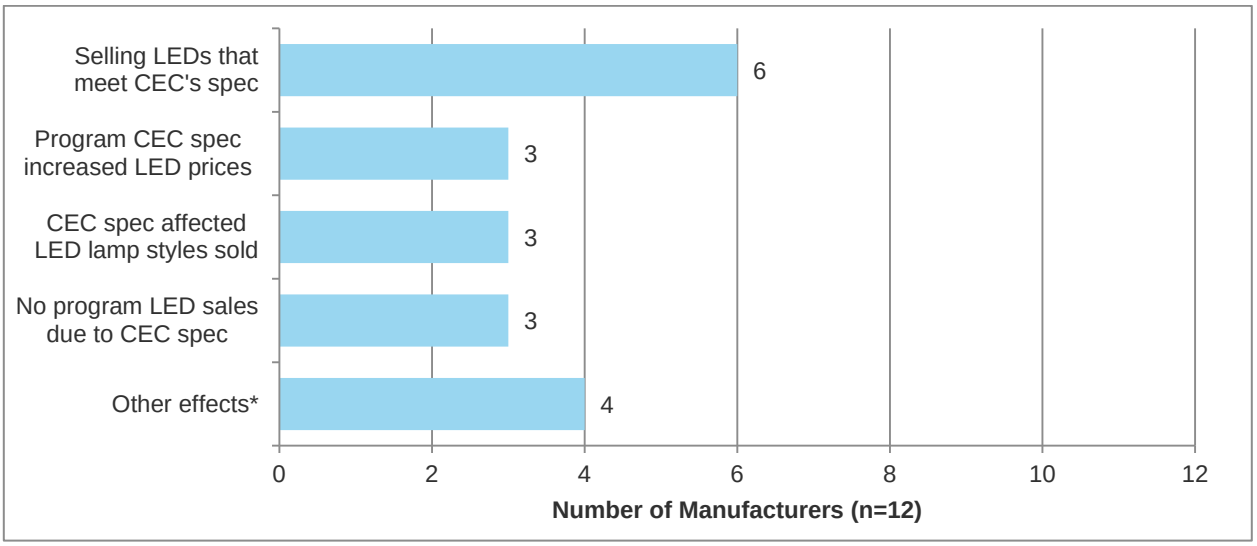
#### 4.1.6.1 Influences of the ULP on LED lamp sales

During the 2015 interviews, we asked suppliers whether the ULP had influenced LED lamp sales. Of the 12 who responded to the question, all reported that the ULP had some influence. When asked to elaborate on the program's influence, the vast majority mentioned some type of influence resulting from the CEC specification for LED lamps (Figure 9).

Half of the respondents reported selling LED lamps that meet the CEC specification. In addition, three respondents each mentioned the following influences related to the CEC specification: that the CEC specification caused an increase in LED lamp prices; and that they do not sell program LEDs due to difficulties meeting the CEC specification. Three additional respondents noted that the program had affected the shapes (or form factors) of LED lamps sold. Other effects mentioned by one manufacturer's representative each include not selling ULP-discounted LED lamps because it could adversely impact non-program sales; conducting LED promotions at different times than they normally would; not selling ULP-discounted LED lamps in 2014 due to CEC specification (but planning to sell ULP-discounted LED lamps in 2015); and that the program has raised LED quality standards by requiring CEC specification LEDs. One manufacturer's representative explained how the ULP program has raised the overall quality of LED lamps sold in the California market:

- "With the program, we have a direction: we need to make sure that we have a better product to qualify for rebates. California has been dictating the direction of the advancement of LED color."

**Figure 9: Participating manufacturer perceptions of ULP influences on LED lamp sales (among those who perceived an influence), 2015 (supplier telephone interviews)**

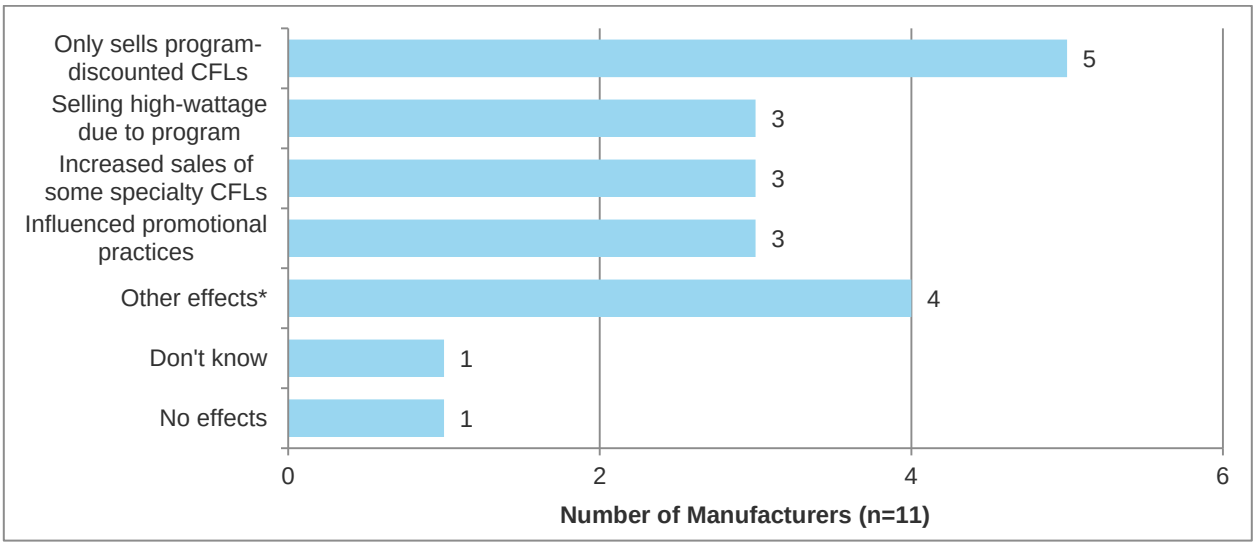



Note: Interview question allowed multiple responses.
*Other effects include: not selling program LEDs because it could adversely impact non-program sales; conducting LED promotions at different times than they normally would; not selling ULP-discounted LED lamps in 2014 due to CEC specification (but planning to sell ULP-discounted LED lamps in 2015); and that the program has raised LED quality standards by requiring LED lamps that meet the CEC specification.

### 4.1.6.2 Influences of the ULP on CFL sales

We also asked whether the ULP had influenced CFL sales and if so, how. Among 13 suppliers responding to the question, 11 indicated the program had some influence on CFL sales and promotions, one indicated no influence and one respondent was unsure. When asked about the type of influence, 11 suppliers reported a wide range of effects on CFL sales and promotion practices attributed to the program (Table 10). Suppliers most frequently reported selling only program-discounted CFLs (5 respondents). Other influences mentioned include selling some specialty lamp types only due to program incentives, such as high-wattage and 3-way lamps (3 respondents), and increased sales volume for particular lamp types (3 respondents). Additionally, three suppliers reported the ULP influenced their promotional practices such as using ULP-required point-of-sale marketing materials and changing their lamp promotion timing due to the ULP's influence.

**Figure 10. Participating manufacturer perceptions of ULP influences on CFL sales (among those who perceived an influence), 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.
*Other effects reported include: selling fewer lamp types, helping sales of specialty CFLs in general, increasing awareness of CFLs, and non-program sales increase.

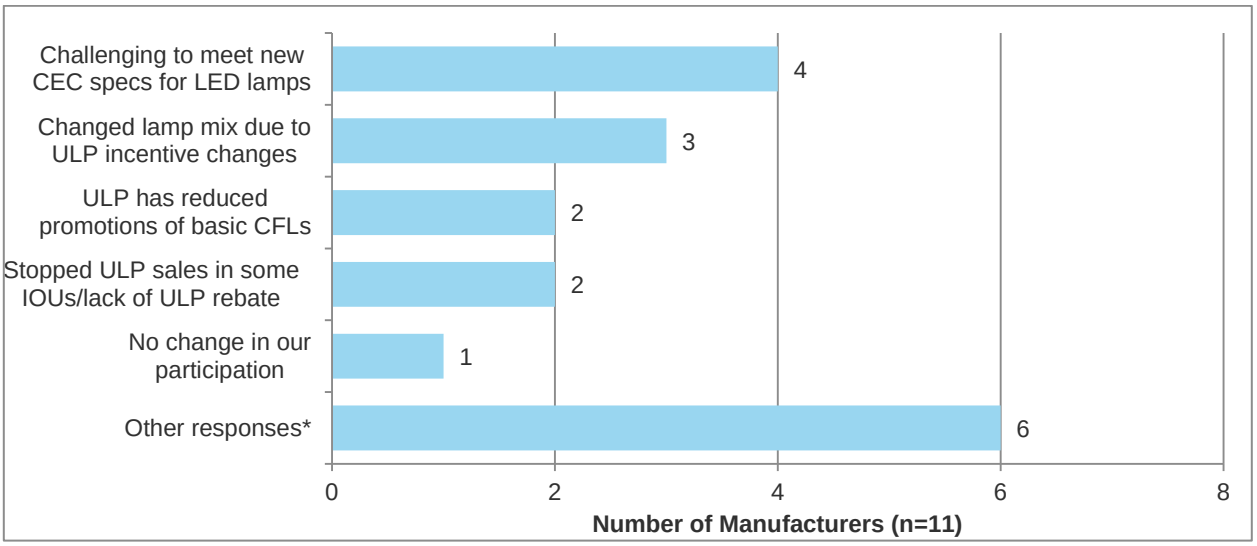
### 4.1.6.3 Recent changes in the ULP

The interviews addressed recent changes in the ULP in general. Many representatives commented on the program's reduction or elimination incentives for basic CFLs in particular. We describe the supplier representatives' perspectives on both of these topics below.

#### 4.1.6.3.1 General changes

Interviewers asked participating lighting suppliers some general questions regarding whether there had been any recent changes in ULP activities and whether the changes affected their participation in the program. Of the 12 manufacturers' representatives who responded to the question, 11 reported some change in the nature of the program between 2013 and 2014 and one indicated no change (Figure 11). These 11 suppliers reported a wide range of changes, including difficulty meeting the CEC specifications for LED lamps (4 respondents) and changing product mix due to ULP incentive changes in basic and specialty CFLs (3 respondents). Two respondents each mentioned the ULP's reduced support for basic CFLs and a lack of IOU rebates in some IOU territories. We discuss supplier perspectives on the challenges suppliers reported of complying with the CEC specifications in Section 4.1.4 above, and we discuss the reduction and/or discontinuation of basic CFL incentives in more detail below.

**Figure 11: Recent changes in the ULP according to participating manufacturers (among those who perceived changes), 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.
* "Other" responses included overall decrease in ULP lamp sales; ULP has increased promotion of specialty CFLs, reduction in lamp sales through some retail channels due to price competition, stopped selling ULP bulbs through IOU service territory due to change in program focus, added new CFLs or LEDs to our product line, and not selling LEDs through ULP due to new CEC specs.

During the 2015 telephone interviews, we did not explicitly ask supplier representatives for their perspectives regarding incentives for basic but three shared their unsolicited perspectives that the program had eliminated some subsidies for basic CFLs and that it was premature to do so—especially in hard-to-reach retail channels.[74] They based this assertion on the belief that shoppers in these channels are more price-sensitive than shoppers in other channels. Supplier representatives reported that many grocery and discount stores simply will not stock CFLs unless they can acquire them at a discount through the ULP (as described above in Section 4.1.2.3.1). In addition, one supplier mentioned that California faces more competition from EISA-compliant halogens than other states, such as Massachusetts, because it has mostly moved away from basic CFL rebates. In the words of manufacturers' representatives:

- "When you turn the CFL program off … CFL [sales] slide down fairly quickly. But the spike up isn't for LEDs, it's the halogen. And they rocket up. Without a program in place, in the majority of [cases], halogen is being sold in [place] of those CFLs."
- "CFLs [need to be] a player in pushing away the halogen sale."

### 4.1.6.4 Continuity of ULP discounts

During the 2015 telephone interviews, researchers asked the manufacturers' representatives whether they had encountered any periods during the 12 months prior to the interview when program-discounted

[74] At least one of the IOUs has continued to reserve very limited funding for basic spirals for hard-to-reach channels, such as dollar stores and rural stores, according to one manufacturer's representative.

CFL or LED lamps were not available. About two-thirds (11 respondents) of the 16 lighting manufacturers who responded to the question reported that there were periods when program-discounted lamps were not available over the course of the previous year, while five respondents said that they did not experience any interruption in program-discounted lamps. Two of the six retail lighting buyers also reported periods during which no program-discounted lamps were available.

Of the 11 lighting manufacturers' representatives who mentioned periods during which ULP incentives were not available, just under two-thirds reported that they stopped selling CFLs and/or LED lamps in California until IOU program discounts resumed (7 representatives). Four said that their companies continued to sell ENERGY STAR CFLs or LED lamps when program discounts were not available, but two of these reported a range of effects attributed to the absence of IOU incentives (including lower overall sales and a shift in the retail channels in which they were selling lamps, such as fewer or no sales at grocery stores and/or discount stores).

Suppliers presented a range of reasons for these periods when lamps were not available. These fell into three categories:

- **IOUs initiating programs as late as May or June** (mentioned by 3 representatives).
- **Allocations running out before year-end** (mentioned by 5 representatives). These representatives cited reasons for these stoppages including ULP funds running dry, certain lamps being especially popular, and shifts in program emphasis by some IOUs. According to the manufacturers' representatives, the consequences of these stoppages included missed opportunities for sales and disappointed retailers. A handful of retail buyers echoed this sentiment. Their comments include:
    - "We run out program allocation quickly. We have found ways to exhaust our utility offering and funding from virtually everybody we do business with," said a retail buyer for a wholesale club chain. "We don't down-spec our product when the rebates go away to try to hit a price point."
    - "I sell a very large amount of ENERGY STAR bulbs, but I sell less in your program [because allocation runs out]," said a retail buyer for a mass merchandise chain.
- IOUs ending programs early because the supplier had difficulty meeting the CEC specification (the latter mentioned only by 1 manufacturer's representative).

One additional representative did not know why allocations ran out.

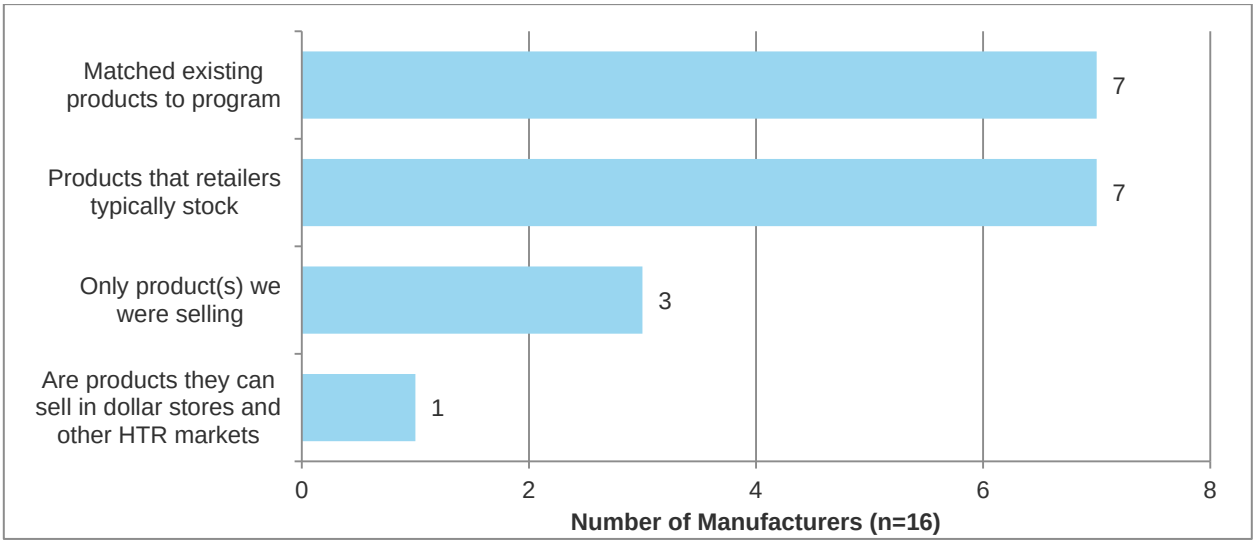
#### 4.1.6.5 How suppliers select products to include in the ULP

Although the ULP limited sales of certain lamp types by eliminating or reducing incentives for them (such as basic CFLs), the 2013-14 program continued to provide incentives for a wide variety of specialty lamps. Thus, lamp manufacturers still had some latitude in terms of which types of energy-efficient lamps they chose to sell through the program during the 2013-14 period.

After reviewing with the suppliers the types and quantities of lamps they sold through the ULP during the 2013-14 period, interviewers asked them to explain why they chose to sell those particular lamp types through the ULP. Of the 16 manufacturers' representatives who responded to the question, 7 mentioned that they chose the lamps that the IOUs wanted them to sell, and 7 mentioned that they matched their existing products to those receiving program incentives (Figure 12). In particular, these suppliers selected

products that are their biggest sellers and/or they chose the products that their retailers normally stocked. Three additional representatives said these were the only product(s) they were selling that qualified for ULP discounts, while one respondent reported selecting products that were attractive to dollar stores and other hard-to-reach channels.

**Figure 12: Participating manufacturer rationale for choosing which lamp types to sell through the ULP, 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.

Similarly, interviewers reviewed lamps and quantities sold through the ULP with six retail buyers and asked them to explain why they chose to sell those particular lamp types. The vast majority (5 respondents) said that the IOU chose the lamps for them while one respondent attributed their choice to consumer demand.

IOU program staff also played a role in determining which products to include in their incentive programs. Interviewers asked participating lamp suppliers whether IOU program staff encouraged them to sell any particular lamp types through the 2013-14 ULP. Among the 16 manufacturers' representatives who responded to the question, ten mentioned encouragement to sell at least one or more type of lamp technologies and shapes while another three indicated no IOU encouragement to sell any particular lamp types (Figure 13).[75] Among suppliers reporting some type of encouragement:

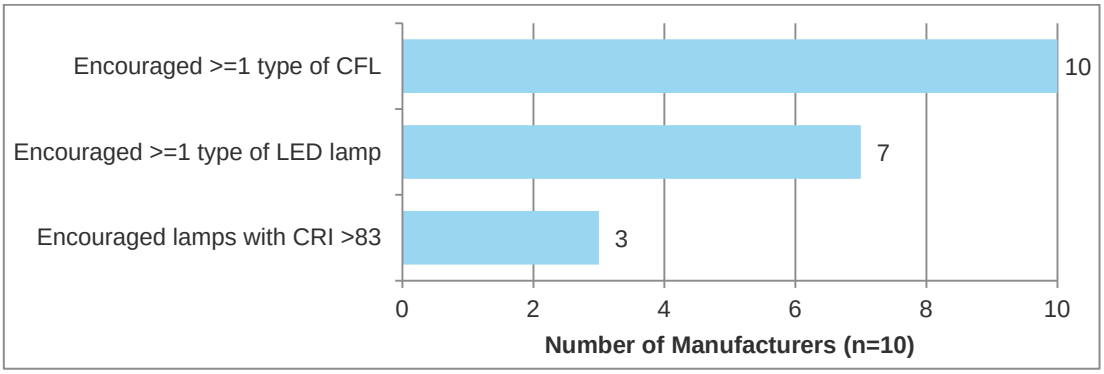
- Ten representatives stated that the IOUs encouraged them to sell one or more types of CFLs through the ULP. Of these:
    - Six mentioned that program staff had encouraged them to sell high-wattage CFLs (e.g., 32 watt lamps)
    - Three mentioned covered CFLs (A-lamps and/or globes)

[75] Note that some manufacturers' representatives mentioned more than one lamp technology and/or shape and that multiple responses were allowed

- Another three mentioned CFL reflectors
- Two mentioned spiral CFLs in grocery and discount channels
- One representative mentioned that the program encouraged them to sell specialty CFLs without specifying any particular types.

- Seven stated that the IOUs encouraged them to sell one or more types of LED lamps through the ULP. Of these:
  - Four manufacturers' representatives mentioned LED reflectors; and
  - Three mentioned LED A-lamps.
- Three mentioned that the ULP encouraged them to sell lamps with a minimum CRI of 83 through the ULP.

**Figure 13: Manufacturer perspectives on the types of lamps encouraged by the IOUs for inclusion in the 2013-14 ULP, 2015 (supplier telephone interviews)**

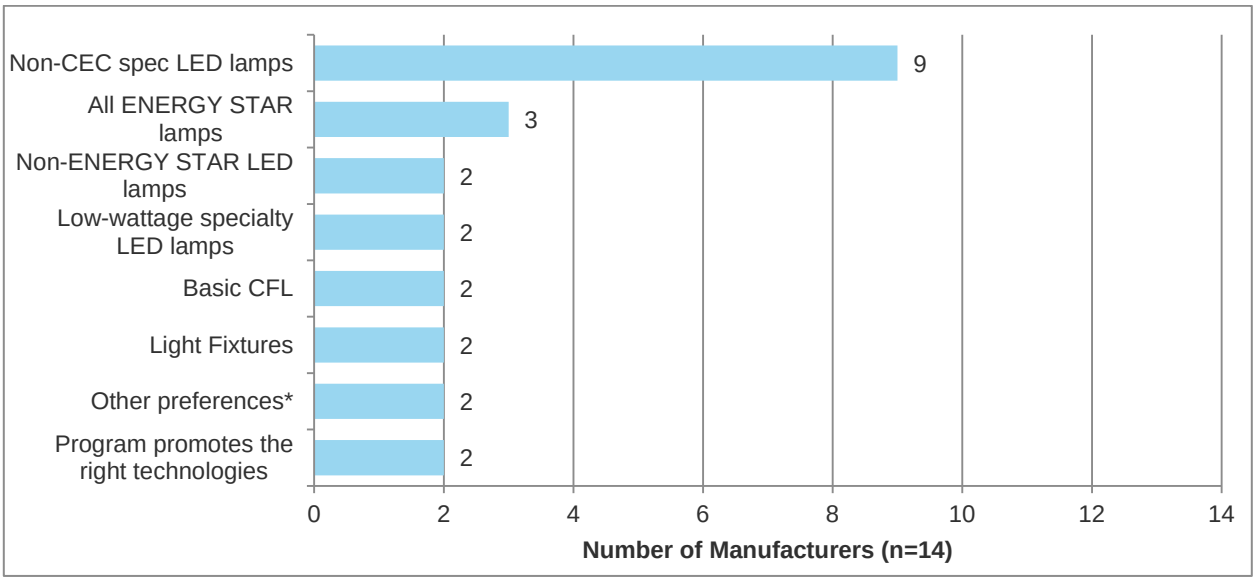



Note: Interview question allowed multiple responses.

#### 4.1.6.6 Manufacturer suggestions for products to include in the ULP

We asked manufacturer representatives whether they thought the ULP promoted the right kinds of lighting products. Fourteen manufacturer representatives responded to the question, and 12 reported that the ULP should promote one or more types of LED lamps or CFLs that were not discounted by the 2013-14 ULP (see Figure 14). When asked for examples, most suggested that the program should promote LED lamps that do not meet the CEC specification (9 representatives). Only two of the lighting manufacturer representatives said they were satisfied with the range of lighting products being promoted by the ULP and did not have suggestions for additional lamps being added to the program.

**Figure 14: Participating manufacturer perspectives regarding product types that the ULP should promote, 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.
* "Other preferences" included promotion of R-30 CFLs and less promotion of CFL A-lamps.

Of the six lighting buyers interviewed, four had opinions on whether the ULP should change the lighting products it promotes. These retail buyers suggested that the ULP should stop requiring that LED lamps meet the CEC specification (2 respondents) and place greater focus on low wattage LEDs such as chandeliers (1 respondent) and globes (1 respondent).

### 4.1.7 Supplier perspectives on future lamp sales

Interviewers asked lighting supplier representatives to describe their expectations for U.S. CFL sales from mid-2015 and beyond.

- Among the 12 manufacturers' representatives who responded to the question, slightly more than half expected CFL sales to decrease (7 representatives), three of whom forecasted that CFLs will no longer be available in most stores within a few years. Three expected no change in sales in the near future, and one respondent expected CFL sales to increase. Lastly, one representative reported being unsure of future CFL sales direction.
- Similar to manufacturers' representatives, the majority of retail lighting buyers who responded to the question reported that they expect CFL sales to decrease (4 out of 5 representatives), while the remainder expected sales to increase based on their expectation of continued availability of ULP discounts in the future.
- Nearly two-thirds of manufacturers' representatives expected LED lamp sales to increase (7 representatives), and many cited lower production costs and increased consumer acceptance as driving factors. Slightly more than one-third expected decreasing LED lamp sales through the ULP

program but large increases for non-program lamps due to the rise of non- ENERGY STAR LED lamps (4 respondents).

- Retail buyers expressed mixed perspectives on future LED lamp sales and the directionality of any anticipated changes in sales.

#### 4.1.7.1 Future CFL sales

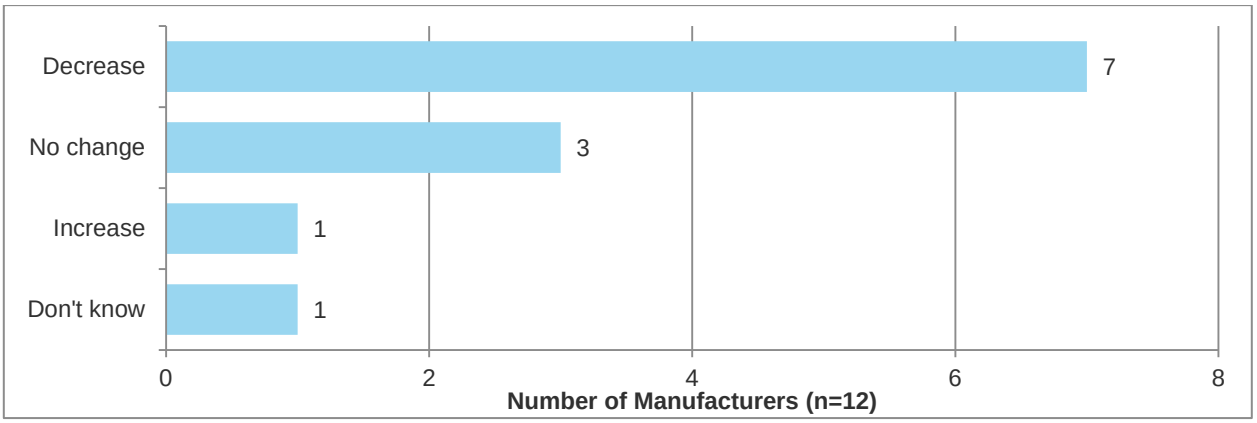
When asked to describe their expectations for future CFL sales in the U.S., most of the 12 representatives who responded to the question suggested that CFL sales would decrease in the latter half of 2015 and beyond (7 respondents; Figure 15). A smaller number reported that they expect CFL sales to remain flat (3 respondents). In more detail, the interview results showed:

- **Slightly more than half of manufacturers' representatives reported that they expect CFL sales to decrease in the future** (7 representatives). When asked to explain the rationale for their expectations, the most-cited reasons were competition from EISA-compliant halogen lamps, declining LED lamp prices, and the introduction of non-ENERGY STAR LED lamps that sell for one-third to one-half the price of those meeting the CEC specification. One respondent forecasted the erosion of ULP incentives for CFLs, thereby accelerating the decline in CFL sales. Three respondents suggested that, within a few years, CFLs will no longer be available in most stores:
    - "I see another halfway decent year of CFL sales in 2016, and then they're gone, and many folks are no longer in the CFL business. Retailers [are already] cutting back on the amount of space they give to CFLs."
    - "Whatever's there is only for a very short period of time, and then it's gone. And then those people will buy a non-energy saving model or a substandard LED bulb."
    - One respondent, whose company recently stopped selling CFLs to focus on LED lamps, said, "I don't envision ever getting back into CFLs. That ship has sailed."
- **Another one-fourth reported that they expect no change in CFL sales in the near future** due to continued program support and increased sales of program-discounted CFL high-wattage and reflectors (3 respondents). These manufacturers' representatives forecasted that the ULP would continue to provide discounts for specialty CFLs in the near future. Without this support, they suggested, CFL sales would decline. These manufacturers' representatives explained:
    - "CFLs will still sell [because] there are definitely people that are looking for them and will get them because they want to be energy efficient and whatnot. But you also have a large market that is voting with their wallet, and if they can save $1 on a four-pack, they will do it. So without a program in place that's going to help influence that, you'll see the majority of halogens being sold in for those CFLs."
    - "CFL sales are stable in California. We haven't experienced any decline in terms of numbers, and we're seeing more and more CFL reflectors and high wattage that have become popular."
- **Only one manufacturer's representative reported expecting U.S. CFL sales to increase** because of the rising popularity of CFL A-lamps and increased program support for specialty CFLs such as high wattage CFLs.

- **One representative was unsure what might happen with CFL sales**.

We also asked participating retail lighting buyers about their expectations for future CFL sales in the U.S. Four of five retail lighting buyers who responded expected some change in sales. Four lighting buyers reported that they expect CFL sales to decrease, and one (at a discount store chain) expected a sales increase sales through the discount channel based on continued program support for CFLs.

**Figure 15: Participating manufacturers' expectations regarding future CFL sales, 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.

### 4.1.7.2 Future LED lamp sales

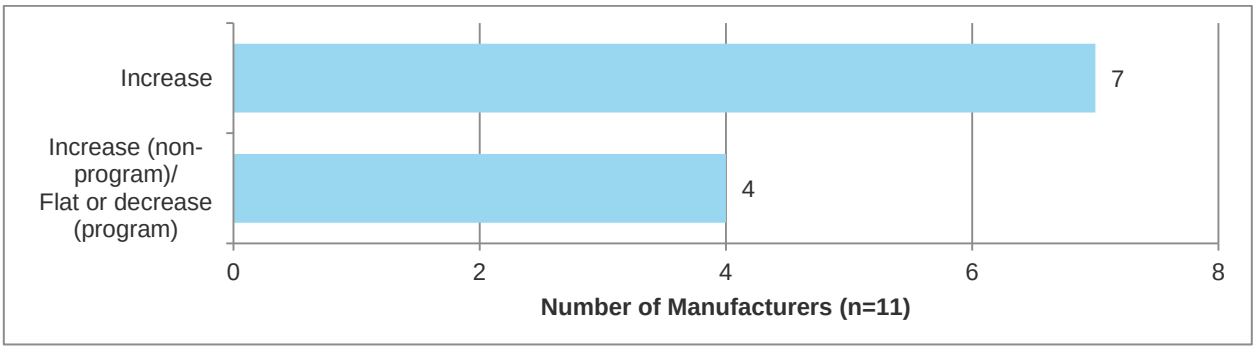
We asked suppliers to describe their expectations for future LED lamp sales in the U.S. from mid-2015 and beyond. Of the 11 representatives who responded to the question, most forecasted increased LED lamp sales in the latter half of 2015 and beyond (7 respondents; Figure 16). A smaller number expected decreased sales for LED lamps receiving ULP discounts but an increase in non-program LED lamps (4 respondents).

- **Nearly two-thirds of manufacturers' representatives reported they expected LED lamp sales to increase in the future** (7 representatives). These representatives mentioned that factors such as lower LED production costs and increased consumer acceptance would drive the increase. One representative forecasted an increase in the short-term but decreases in the longer term because of the possibility of that a new emerging lamp technology would detract from LED lamp sales. Their comments include:
    - "LED programs are going to be around for the next five years, and then there will be something different."
    - "[LED lamp sales] are definitely going to grow. They are going to catch on everywhere."
    - "LEDs are becoming more popular [and are] coming down in price. Sales and production will increase."

- **Slightly more than one-third of respondents forecasted flat or decreasing LED Lamp sales through the ULP but increasing sales for non-program lamps** (4 respondents). This expected increase in non-program LED lamp sales reflects continued acceptance for LED lamps that do not meet ENERGY STAR requirements and/or the CEC specification. Suppliers suggest that these LED lamps have flooded the market and cost less than program-discounted lamps (see Section 04.1.4 for more detail). One manufacturer's representative related that some retailers who sell program-discounted lamps have asked for larger rebates to help lagging sales of program LED lamps. These manufacturers' representatives commented:
    - "LEDs will do well [in California] but they will not be able to be counted through the program because they're not going to meet the CEC spec."
    - "CEC-spec LED bulbs face strong competition from cheaper, lower quality LEDs bulbs without ENERGY STAR certification."
    - "In-program [ULP] sales will decrease because of the influx of cheap, non-ENERGY STAR bubs."

We also asked participating retail lighting buyers about their expectations for U.S. LED sales in the future. All four retail lighting buyers who responded said that they expect increased sales. Several retail buyers related that LED lamp sales would be strong and continue to detract from CFL sales. One retail buyer at a mass merchandise chain commented on expectations for LED lamp sales in the future, saying "I don't see anything limiting their demand: it's on fire."

**Figure 16: Participating manufacturers' expectations regarding future LED lamp sales, 2015 (supplier telephone interviews)**




Note: Interview question allowed multiple responses.

## 4.2 Lamp availability

Below we present details regarding replacement lamp availability in California retail stores based on lamp stocking data. We collected the data using retail store shelf surveys in winter 2012-2013, summer 2013, winter 2014-15, and winter 2015-16.[76] Based on these data, there are two key indicators of lamp

[76] For ease of reference, the report refers to the winter 2012-2013, summer 2013, winter 2014-15, and winter 2015-16 shelf surveys as the 2012, 2013, 2014, and 2015 shelf surveys throughout Chapter 4.

availability: the percentage of stores that carry a particular lamp technology and/or shape, and the percentage of total lamps comprised by each lamp technology or shape. The sections below review these results. Each section (percentage of stores and percentage of lamps) compares lamp availability in the following order, by:

- Lamp technology
- Lamp technology and retail store category (big box versus non-big box)
- Lamp technology, retail store category, and lamp shape for typical replacement lamp types (A-lamp replacements, reflectors, and globes)
- Availability of IOU discount, lamp shape, and store category for MSB CFLs and LED lamps
- EISA lumen bin and store category for MSB incandescent and halogen A-lamps.

### 4.2.1 Percentage of stores

This section provides details regarding the percentage of California retail stores stocking each lamp technology and shape. Key findings include:

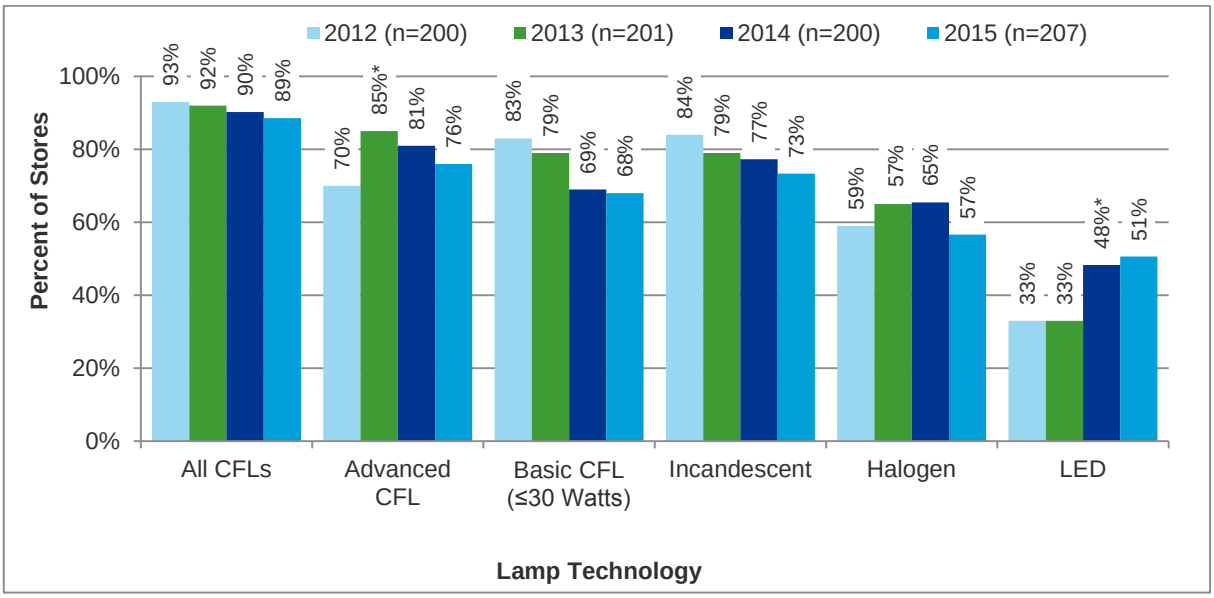
- Approximately nine out of ten California retail stores that sold residential replacement lamps in 2012, 2013, 2014, and 2015 sold CFLs. Approximately 7 out of 10 stores sold incandescent lamps and approximately 6 out of 10 stores sold halogen lamps in each year. Only one-third of stores stocked LED lamps in 2012 and 2013, but in 2014 and 2015 approximately half of stores stocked LED lamps, which was a statistically significant change.
    - At least 9 out of 10 big box stores stocked each lamp technology in 2014 and 2015; nearly all big box stores sold LED lamps in 2015.
    - Nearly 9 out of 10 non-big box stores stocked CFLs in 2014 and 2015, but only half of non-big box stores stocked halogen lamps and fewer than half of non-big box stores stocked LED lamps in 2015.
- Across all MSB A-lamp replacement technologies (which include spiral CFLs as well as CFL, LED, halogen, and incandescent A-lamps), a higher percentage of big box stores stocked each replacement technology compared to non-big box stores with the exception of CFL A-lamps.
    - The percentage of big box stores stocking CFL A-lamps decreased significantly between 2014 and 2015 from nearly 9 out of 10 stores to less than 3 out of 10 stores. Approximately 4 out of 10 non-big box stores stocked CFL A-lamps in 2015.
- Within the MSB reflector lamp category, a higher percentage of big box stores stocked LED, incandescent, and halogen lamps than non-big box stores in 2014 and 2015. In contrast, a higher percentage of non-big box stores stocked CFL reflector lamps than big box stores in 2015.
    - There was a significant decrease in the percentage of big box stores stocking CFL reflector lamps between 2014 and 2015 (from more than 9 out of 10 stores to approximately 6 out of 10 stores). Results suggest an overall decline in stocking of CFLs (of all form factors) in big box stores between 2014 and 2015.

- A considerably higher percentage of big box stores stocked MSB halogen and LED globe lamps in 2014 and 2015 than non-big box stores.
    - As with other CFL shapes in big box stores, there was a significant decrease in the percentage of big box stores stocking CFL globes from 2014 to 2015 (from roughly three-quarters of stores to less than one-fourth of stores).
    - There was a significant increase in the percentage of non-big box stores stocking MSB LED globes from 2014 to 2015 (from less than 5% of stores to nearly 15% of stores).
- A significantly higher percentage of non-big box stores stocked IOU-discounted CFL spirals and CFL reflectors than big box stores in 2014 and 2015.
    - In big box stores, the percentages of stores that stocked IOU-discounted CFL spirals, A-lamps, reflectors, and globes were substantially smaller than the percentages of stores that stocked the same CFL shapes without identifiable IOU discounts in both 2014 and 2015.
- There were minimal differences between big box and non-big box stores in terms of the percentage of stores that stocked IOU-discounted MSB LED A-lamps, reflector lamps, or globe lamps in 2014 and 2015.
    - The percentage of non-big box stores stocking LED globe lamps without IOU discounts increased five-fold between 2014 and 2015.
- In 2014 and 2015, more than 9 out of 10 big box stores that stocked replacement lamps for residential use stocked EISA-compliant halogen lamps and the same proportion of big box stores stocked EISA-non-compliant halogen or incandescent lamps. In non-big box stores, approximately half of stores stocked EISA-compliant halogen lamps and EISA-non-compliant halogen lamps.

#### 4.2.1.1 By technology

Figure 17 shows the percentage of stores across all retail channels that stocked a range of lamp technologies in 2012, 2013, 2014, and 2015, including any CFLs, advanced (or “specialty”) versus basic CFLs specifically, incandescent lamps, halogen lamps, and LED lamps. The percentage of stores that stocked LED lamps increased significantly from one-third of stores in 2012 and 2013 to approximately half of stores in 2014 and 2015. There were no significant changes between years in the percentage of stores stocking CFLs, halogen lamps, or incandescent lamps; between 89% and 93% of stores stocked CFLs, between 73% and 84% of stores stocked incandescent lamps, and between 57% and 65% of stores stocked halogen lamps in 2012, 2013, 2014, and 2015. The percentage of stores that stocked advanced CFLs increased significantly between 2012 and 2013 from 70% of stores to 85% of stores. See Table 36 in Appendix C for additional detail on the percent of stores carrying CEC and Non-CEC specification LED lamps.

**Figure 17: Percentage of stores carrying lamps by technology, 2012–2015 (retail store shelf surveys)**

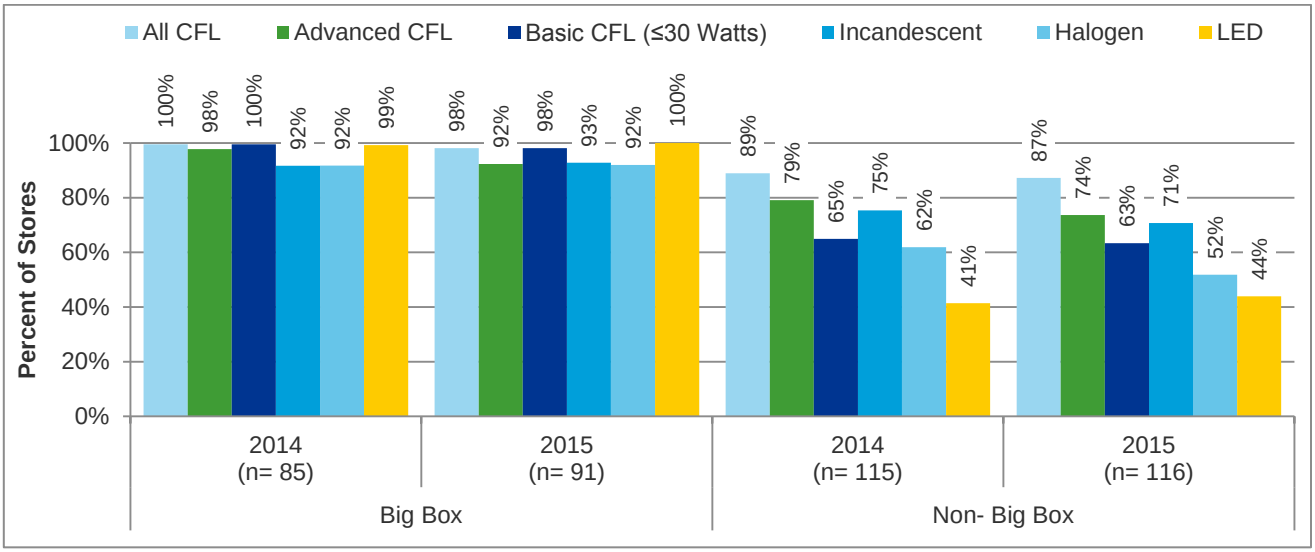



* Difference from prior study period is statistically significant at the 95% level of confidence.

### 4.2.1.2 By technology and store category

Figure 18 shows the percentage of big box and non-big box stores that carried different lamp technologies in 2014 and 2015. As shown, a higher percentage of big box stores stocked each lamp technology in both shelf survey phases compared to the percentage of non-big box stores stocking each lamp technology. All big box stores carried LED lamps in 2015 and more than 90% carried CFLs, incandescent, and halogen lamps in 2014 and 2015. Nearly 90% of non-big box stores carried CFLs in 2014 and 2015, but less than half carried LED lamps in both years (between 41% and 44% of non-big box stores). During the 2013 shelf surveys, only one-quarter of non-big box stores stocked LED lamps.

**Figure 18: Percent of stores carrying lamps by technology and store category, 2014 and 2015 (retail store shelf surveys)**




* Difference from prior study period is statistically significant at the 95% level of confidence.

### 4.2.1.3 By replacement lamp category and store category

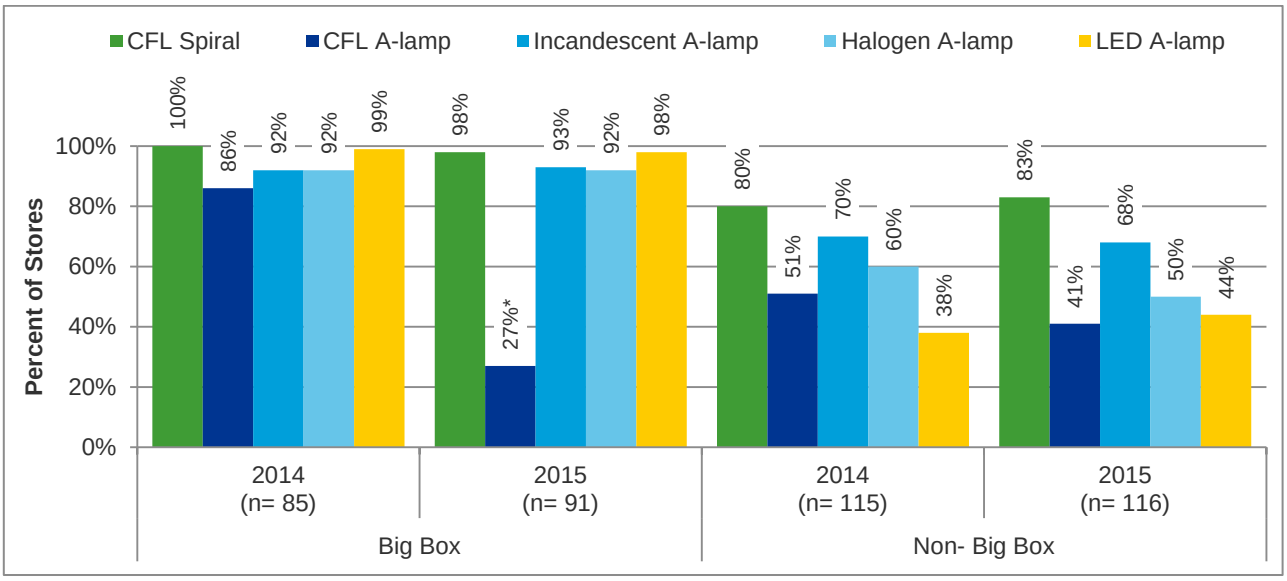
This section compares lamp availability by technology, store category, and year for typical replacement lamp types in the A-lamps replacement category (which includes basic spiral CFLs, CFL A-lamps, LED A-lamps, traditional incandescent A-lamps, and EISA-compliant halogen A-lamps) and for lamps of different technologies in the reflector and globe lamp categories.

#### 4.2.1.3.1 MSB A-lamp replacements

Figure 19 shows the percentage of big box and non-big box stores carrying A-lamp replacements including spiral CFLs as well as CFL, incandescent, halogen, and LED A-lamps by technology. As shown, a larger percentage of big box stores carried each A-lamp replacement technology in each year versus non-big box stores, except for CFL A-lamps. Within the big box category, approximately 9 out of 10 stores (or more) stocked each A-lamp replacement technology in 2015, except for CFL A-lamps, which saw a significant decrease from 86% in 2014 to 27% in 2015.

Within non-big box stores, a greater percentage of stores stocked spiral CFLs and/or incandescent A-lamps than the other A-lamp replacement technology. Approximately 8 out of 10 non-big box stores stocked spiral CFLs and 7 out of 10 stores stocked incandescent A-lamps in 2014 and 2015. Less than half of non-big box stores stocked LED A-lamps in 2014 and 2015.

**Figure 19: Percent of stores carrying A-lamp replacements by technology and store category, 2014 and 2015 (retail store shelf surveys)**

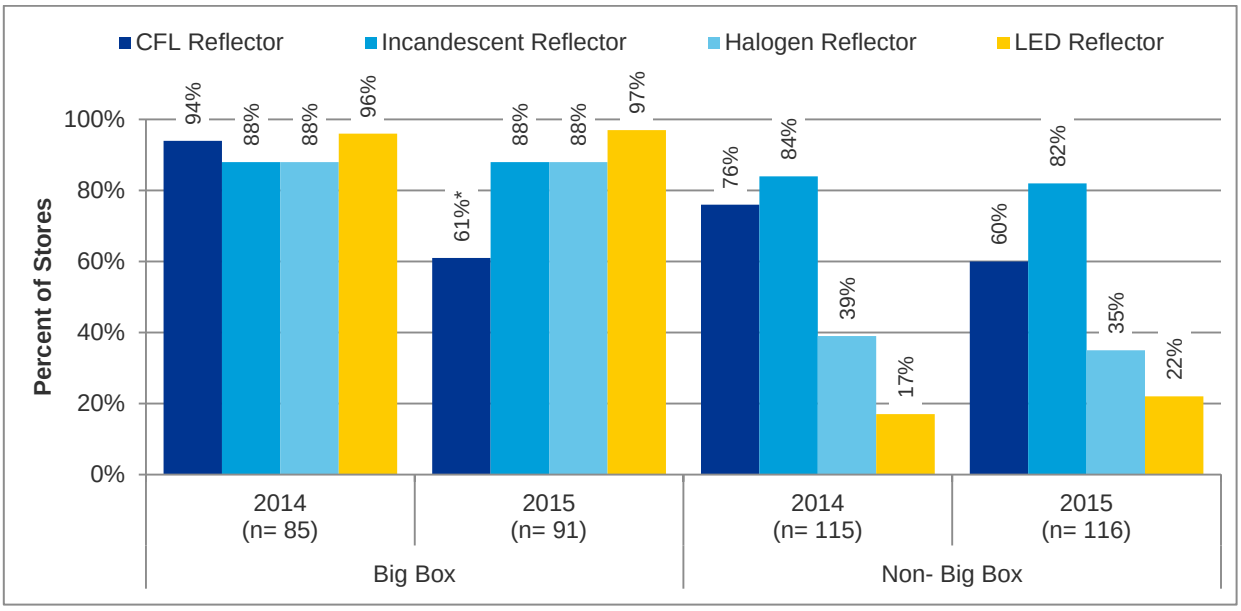



* Difference from prior study period is statistically significant at the 95% level of confidence.

### 4.2.1.3.2 MSB reflector lamps

Figure 20 shows the percentage of big box and non-big box stores carrying MSB reflector lamps by technology. As shown, the percentage of big box stores carrying CFL reflector lamps decreased significantly between years (from 94% of stores in 2014 to 61% of stores in 2015), which was the only significant change in this store category between years. Approximately 9 out of 10 big box stores carried incandescent and halogen reflector lamps in 2014 and 2015. Nearly all big box stores carried LED reflector lamps in 2014 and 2015. Within the non-big box category, there were no significant changes in the percentage of stores stocking each reflector lamp technology. Between 80 and 85% of non-big box stores carried incandescent reflector lamps and between 60 and 76% carried CFL reflector lamps in 2014 and 2015. Between 17% and 22% of non-big box stores stocked LED reflector lamps in 2014 and 2015.

**Figure 20: Percent of stores carrying MSB reflector lamps by technology and store category, 2014 and 2015 (retail store shelf surveys)**

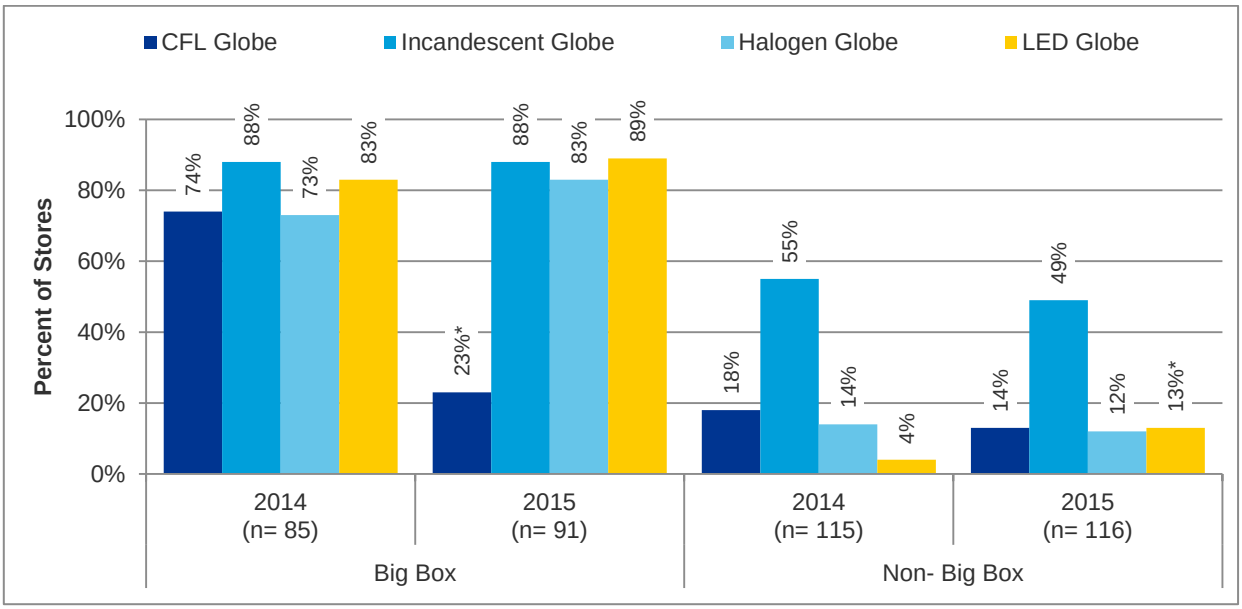



* Difference from prior study period is statistically significant at the 95% level of confidence.

### 4.2.1.3.3 MSB globe lamps

Figure 21 shows the percentage of big box and non-big box stores carrying MSB globe lamps by technology in 2014 and 2015. As shown, a much higher percentage of big box stores stocked halogen and LED globes in 2014 and 2015 compared to non-big box stores. There was a significant decrease in the percentage of big box stores that stocked CFL globes between 2014 and 2015 (from 74% to 23% of stores), which was the only statistically significant change between years in this store category. Nearly 9 out of 10 big box stores carried incandescent and LED globes in 2014 and 2015. Among non-big box stores, the percentage of stores stocking LED globes significantly increased between 2014 and 2015 (from 4% to 13% of stores). Approximately 5 out of 10 non-big box stores carried incandescent globes in 2014 and 2015, while less than 2 out of 10 non-big box stores stocked halogen and CFL globes in both years.

**Figure 21: Percent of stores carrying MSB globe lamps by technology and store category, 2014 and 2015 (retail store shelf surveys)**




* Difference from prior study period is statistically significant at the 95% level of confidence.

### 4.2.1.4 By availability of IOU discount and store category

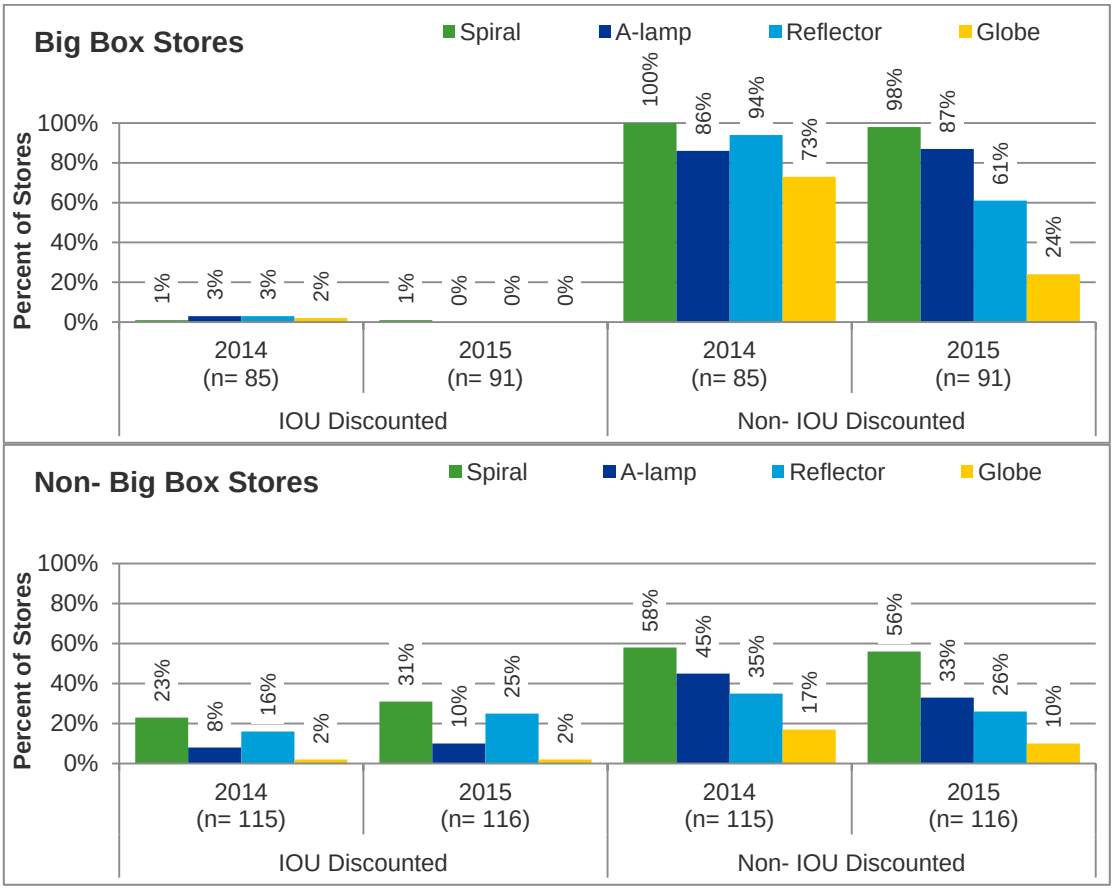
In 2014 and 2015, between 30 and 38% of all stores stocked at least one IOU-discounted lamp (CFLs and/or LED lamps). When we examine these results by store category, a smaller percentage of big box stores stocked IOU-discounted lamps than non-big box stores: between 13 and 16% of big box stores carried IOU-discounted lamps in 2014 and 2015 compared to between 32 and 41% of non-big box stores in both years.

Figure 22 shows the percentage of stores carrying MSB CFLs with and without IOU discounts by lamp shape (spiral, A-lamp, reflector, and globe) by store category. Results suggest that:

- A significantly higher percentage of non-big box stores stocked CFL spirals and reflectors with IOU discounts than big box stores. This may be explained in part by utility programs shifting incentives away from CFLs and towards LED lamps. Another contributing factor could be poor labeling of IOU-discounted CFLs in big box stores; shelf survey field researchers reporting difficulty identifying IOU-discounted lamps in big box stores during the 2014 and 2015 shelf surveys and reported similar difficulties during shelf surveys conducted in 2012 and 2013.
- In the big box category, the percentages of stores that stocked IOU-discounted CFL spirals, A-lamps, reflectors, and globes were substantially smaller than the percentages of stores that stocked the same CFL shape without an identifiable IOU discount in both 2014 and 2015. In non-big box stores, a greater percentage of stores stocked CFL spirals, A-lamps, reflectors, and globes without IOU discounts versus with IOU discounts for each of those CFL shapes in each year, but the gap between the two was far smaller for non-big box stores than for big box stores.

The percentage of big box stores stocking reflector and globe CFLs without IOU discounts was significantly smaller in 2015 than in 2014; these were the only significant changes between years in either store category.

**Figure 22: Percent of stores MSB CFLs with and without IOU discounts by store category and lamp shape, 2014 and 2015 (retail store shelf surveys)**



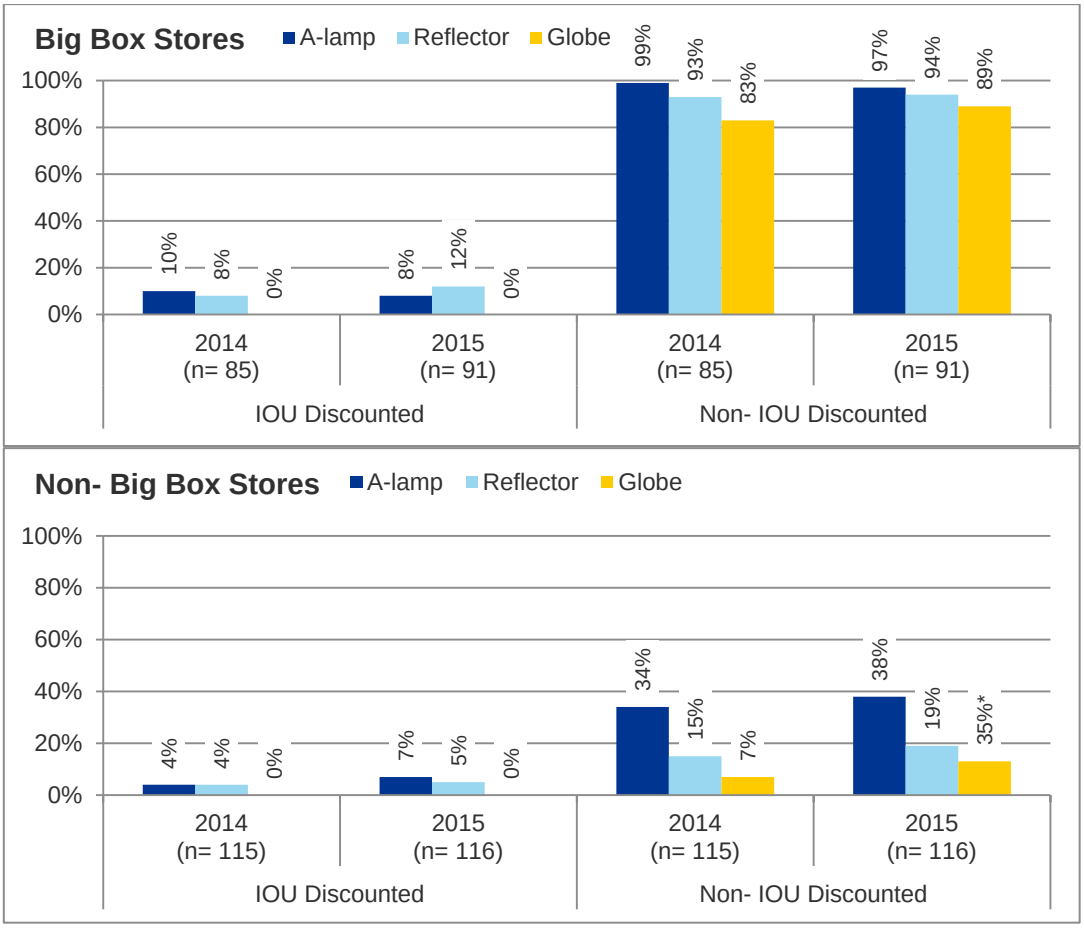

* Difference from prior study period is statistically significant at the 95% level of confidence.

Figure 23 shows the percentage of stores carrying MSB LED lamps with and without IOU discounts by lamp shape (A-lamp, reflector, and globe) by store category. Results suggest that:

- A higher percentage of big box stores stocked MSB LED lamps without IOU discounts than non-big box stores; more than 90% of big box stores stocked A-LED lamps and reflectors without IOU discounts in 2014 and 2015.
- There were no significant differences in the percentage of big box stores and non-big box stores stocking IOU-discounted MSB LED lamps in 2014 or 2015.
- The percentage of non-big box stores stocking LED globe lamps without IOU discounts increased five-fold between 2014 and 2015; this was the only significant change in either store category between

years and is expected given the decrease in IOU incentive allocations to globe lamps between the 2013-14 and 2015 program periods.

**Figure 23: Percent of stores carrying MSB LED lamps with and without IOU discounts by store category and lamp shape, 2014 and 2015 (retail store shelf surveys)**




* Difference from prior study period is statistically significant at the 95% level of confidence.

### 4.2.1.5 By EISA compliance and store category

Field researchers collected data on the light output (measured in lumens) for all lamp models in California retail stores during the 2014 and 2015 shelf surveys whenever this information was available. We then categorized all incandescent and halogen lamp models for which light output was available into the same lumen bins defined by EISA and AB 1109.[77] All together, these data allowed analysts to categorize lamp models as "compliant" with each stage of EISA (i.e., the lamp model met the maximum wattage requirements specified by EISA for each lumen bin) or non-compliant (i.e., the lamp model had higher wattage than required by EISA within its lumen bin). Figure 24 shows the percentage of big box and non-

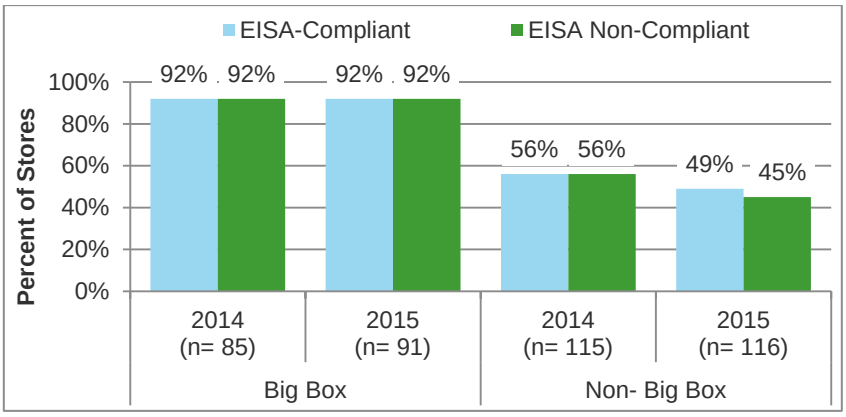
[77] The relevant bins include 1490-2600 lumens (lamps with high light output), 1050-1489 lumens (medium-high light output), 750-1049 lumens (medium-low), and 310-749 lumens (low light output); see Section 3.1 above for more details on EISA, AB 1109, and the relevant lumen bins.

big box stores that carried EISA-compliant and non-compliant incandescent and halogen lamps[78] during 2014 and 2015.

As shown, more than 9 out of 10 big box stores stocked EISA-compliant lamps in 2014 and 2015. The same percentage of big box stores also stocked EISA-non-compliant lamps in both years. The percentage of non-big box stores that stocked EISA-complaint and EISA-non-compliant was significantly lower in both 2014 and 2015 when compared to big box stores; approximately half on non-big box stores stocked EISA-compliant and EISA-non-compliant lamps in both years.

Because EISA and AB 1109 gradually phased out inefficient lamps over time according to lumen bins, results are more meaningful when examined by the percentage of halogen lamps that comply with EISA standards compared with the percentage of halogen and incandescent lamps that do not comply with EISA standards. The discussion regarding the percentage of lamps that are EISA-compliant and EISA-non-compliant in Section 4.2.2.8 below has further details on this topic.

**Figure 24: Percent of stores carrying EISA-compliant and non-compliant incandescent and halogen lamps by store category, 2014 and 2015 (retail store shelf surveys)**




* Difference from prior study period is statistically significant at the 95% level of confidence.

## 4.2.2 Percentage of lamps

The percentage of total lamps observed in retail stores is another indicator of the relative availability of different lamp technologies. Below we repeat the series analyses shown in Section 4.2.1 based on the percentage of lamps available in California retail stores. Key findings include:

- The share of total lamp stock in California retail stores comprised by incandescent lamps declined significantly between 2012, 2013, 2014, and 2015, while the share comprised by LED lamp share increased significantly between 2013, 2014, and 2015. The increase in LED lamp share was largely driven by big box stores; LED lamps in big box stores comprised approximately a quarter of total lamp stock in 2015.

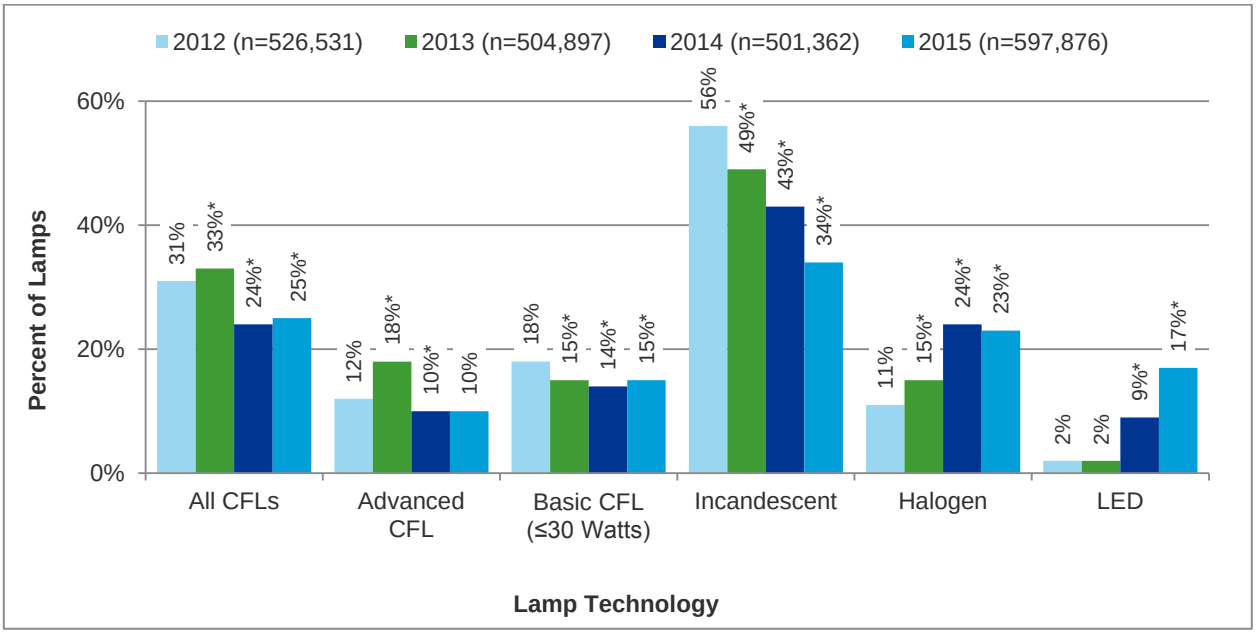
78 As of July 2016, there are no incandescent lamps available in retail stores that comply with EISA standards. Some halogen lamps comply with EISA standards and some do not. Thus, all lamps shown in figures and tables in this chapter that comply with EISA standards are halogen lamps, and those lamps that do not comply with EISA standards are a mix of incandescent and halogen lamps.

- Among MSB A-lamp replacements, halogen A-lamps comprised the largest share of lamp stock in big box in 2014 and 2015, but lost share to LED A-lamps between years. Spiral CFLs comprised the largest share of A-lamp replacement lamp stock in non-big box stores in 2014 and 2015.
    - There was a 33-percent drop in the share of MSB A-lamp replacement stock comprised by incandescent lamps in big box stores between 2014 and 2015.
    - The share of MSB A-lamp replacements comprised by LED A-lamps nearly doubled in big box stores between 2014 and 2015 and the share comprised by LED A-lamps nearly tripled in non-big box stores between years.
- The share of MSB halogen and LED reflectors among all MSB reflector lamps increased significantly in big box stores between 2014 and 2015, largely at the expense of incandescent reflectors and CFL reflectors.
- Among MSB globe lamps, the share of MSB CFL globes declined significantly in big box stores between 2014 and 2015, while the share of globe lamps comprised by LED in big box stores increased significantly between years. In non-big box stores the share of globe lamps comprised by LED lamps and CFLs increased significantly from 2014 to 2015 at the expense of incandescent globes.
- Out of all MSB CFLs stocked by California retailers, 19% were IOU-discounted in 2014 and 37% were IOU-discounted in 2015. Nearly 100% of MSB CFLs in big box stores were not IOU-discounted in 2014 and 2015. In non-big box stores, more than one-third of MSB CFLs were IOU-discounted in 2014 and more than two-thirds were IOU discounted in 2014.
    - There was a significant increase in the percentage of MSB spiral CFLs that were IOU-discounted in non-big box stores between 2014 and 2015, while there was a significant decrease in the percentage of MSB reflector CFLs that were IOU-discounted in non-big box stores between years.
- The share of MSB incandescent and halogen A-lamps comprised by EISA-compliant lamps increased significantly in big box and non-big box stores between 2014 and 2015. In 2015, more than 90% of incandescent and halogen lamps regulated by EISA were EISA-compliant in big box stores and nearly 80% were EISA-compliant in non-big box stores.

#### 4.2.2.1 By technology

Figure 25 shows the percentage of lamps stocked by technology across all California retail stores that sold replacement lamps to consumers in 2012, 2013, 2014, and 2015. In all four years, incandescent lamps comprised the largest share of total lamp stock, followed by CFLs, halogen lamps, and then LED lamps. The share of incandescent lamps decreased significantly from more than half of lamps in 2012 to approximately one-third of lamps in 2015. In the same timeframe, the share of lamp stock comprised by LED lamps increased dramatically from 2% in 2012 to 17% in 2015 (a significant increase year over year). These results likely reflect increased consumer demand for LED A-lamps (see Section 4.1.7.2 for lamp supplier perspectives on this topic and 5.1 for LED lamp purchase rates from our consumer surveys). The share of lamps comprised by CFLs declined from approximately one-third of lamps in 2013 to approximately one-quarter of lamps in 2014 and 2015, and the share comprised by halogen lamps increased from 11% of lamps in 2012 to nearly one-quarter of lamps in 2014 and 2015.

**Figure 25: Percent of lamps stocked by technology, 2012–2015 (retail store shelf surveys)**

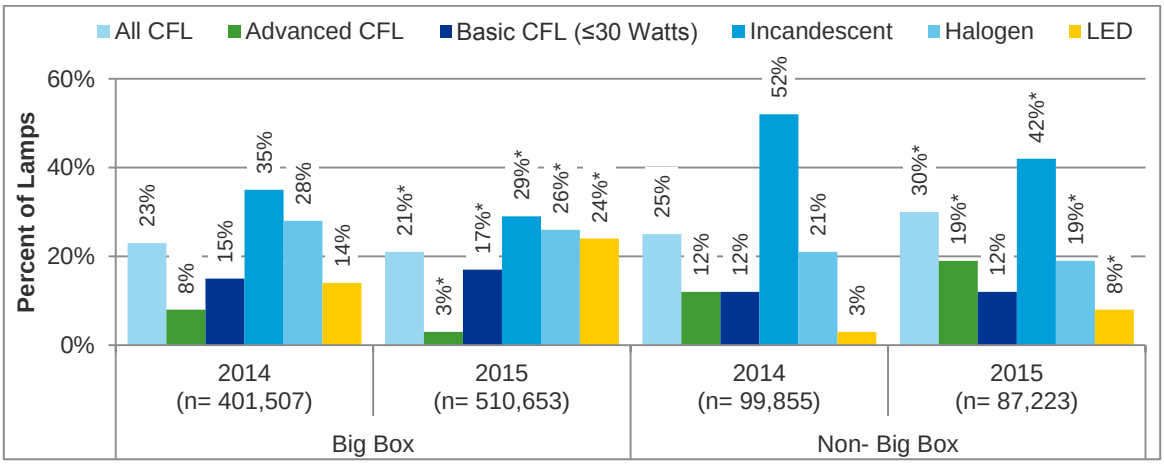



* Difference from prior study period is statistically significant at the 95% level of confidence.
Note: Results may not total 100% because of rounding. Also, note that "All CFLs" includes "Advanced CFL" and "Basic CFL (≤30 Watts)."

### 4.2.2.2 By technology and store category

Figure 26 adds the dimension of store category to the technology-level results shown above. These results provide further details regarding the decline in share of lamp stock comprised by incandescent lamps and increase in share comprised by LED A-lamps between 2014 and 2015. In both years, incandescent lamps comprised the largest share of total lamp stock in big box and non-big box stores. However, the share of incandescent lamps declined from 35% of lamps to 29% in big box stores between years and from 52% of lamps to 42% of lamps in non-big box stores between years (both were significant decreases). The share of LED A-lamps stocked in big box stores increased significantly from 14% in 2014 to 24% in 2015 (an increase of 71%), and the share of lamps comprised by LED A-lamps in non-big box stores nearly tripled from 2014 to 2015 (from 3% to 8%). In big box stores, share of lamps comprised by CFLs declined from 23% in 2014 to 21% in 2015. The opposite trend occurred in terms of the share of lamps comprised by CFLs in non-big box stores, which saw increase from 25% of lamp stock in 2014 to 30% in 2015.

**Figure 26: Percent of lamps stocked by technology and store category, 2014 and 2015 (retail store shelf surveys)**




* Difference from prior study period is statistically significant at the 95% level of confidence.
Note: Results may not total 100% because of rounding.

### 4.2.2.3 By replacement lamp category and store category

This section compares lamp availability in terms of the percentage of total lamps by technology, store category, and year for typical MSB replacement lamp types (A-lamps and spirals, reflectors, and globes). Taken together, MSB CFL, incandescent, halogen, and LED A-lamps in these shapes comprised 70% of all lamps stocked across all lamp technologies, base types, and shapes in California retail stores that stocked replacement lamps in 2014 and that percentage climbed to 74% in 2015. Note that Table 55 through Table 70 in Appendix C provide detail on MSB CFLs and LED A-lamps by lumen bin, lamp shape, and year.

#### 4.2.2.3.1 MSB A-lamp replacements

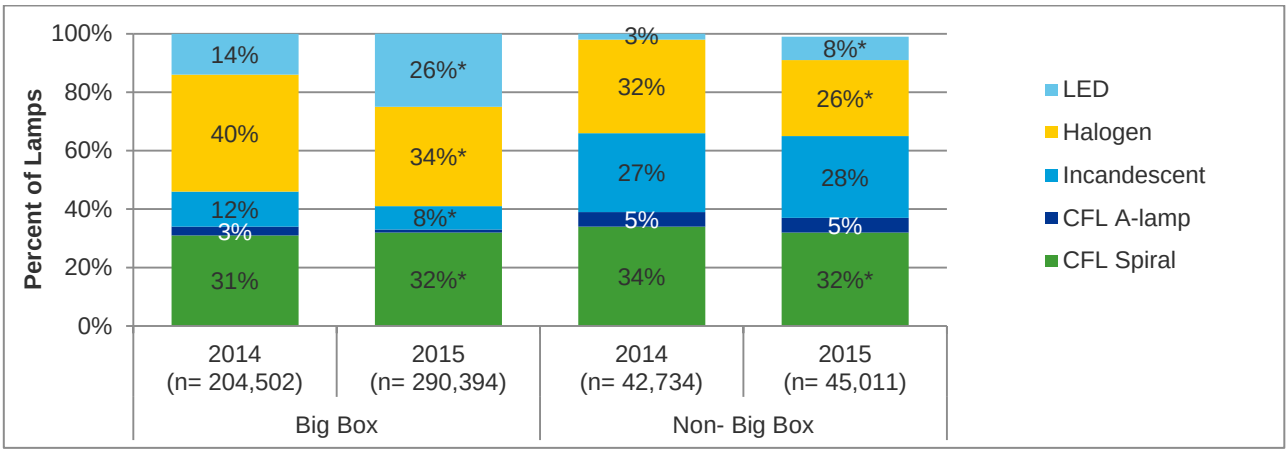
MSB CFL, incandescent, halogen, and LED A-lamp replacements—that is, spiral-style CFLs as well as CFL, incandescent, halogen, and LED A-lamps—comprised more than half of lamp stock across California retail stores in 2014 and 2015 (52% and 56%, respectively). Figure 27 shows the proportion of MSB A-lamp replacements by technology and store category in 2014 and 2015. In big box stores, halogen A-lamps comprised the largest share of MSB A-lamp replacement lamps in 2014 and 2015 (40% and 34% respectively), while in non-big box stores spiral CFLs comprised the largest share (34% and 32%) in both years. In big box stores, the greatest shift between years for A-lamp replacements was in the share of LED A-lamps (which increased from 14% to 26% of MSB A-lamp replacements) largely at the expense of incandescent lamps (which declined from 12% to 8% of total MSB A-lamp replacements) and halogen lamps (which declined from 40% to 34%). Nationally, the National Electrical Manufacturers Association (NEMA) reported an uptick in LED A-lamp shipments between 2014 and 2015 along with a decline in shipments of incandescent and CFL A-lamps.[79]

[79] NEMA, 2016.

In non-big box stores, halogen A-lamps decreased from 32% of A-lamp replacements stocked in this store category in 2014 to 26% in 2015. LED A-lamp stock nearly tripled in non-big box stores between 2014 and 2015 (an increase from 3% to 8%).

Interestingly, with regard to ENERGY STAR versus non- ENERGY STAR LED lamps, 34% of all MSB LED A-lamps stocked in California retail stores in 2014 qualified for ENERGY STAR and 43% qualified in 2015 (n=45,855 and 122,869, respectively). While these results suggest an increase in the share of LED A-lamps that meet ENERGY STAR, the share of MSB LED A-lamps that meet ENERGY STAR requirements was low in 2014 and 2015 relative to MSB CFL A-lamps (65% of which met ENERGY STAR in 2014 and 82% in 2015; n=6,835 and 5,208, respectively).

**Figure 27: Percent of MSB lamps stocked in the A-lamp replacement category by technology and store category, 2014 and 2015 (retail store shelf surveys)**

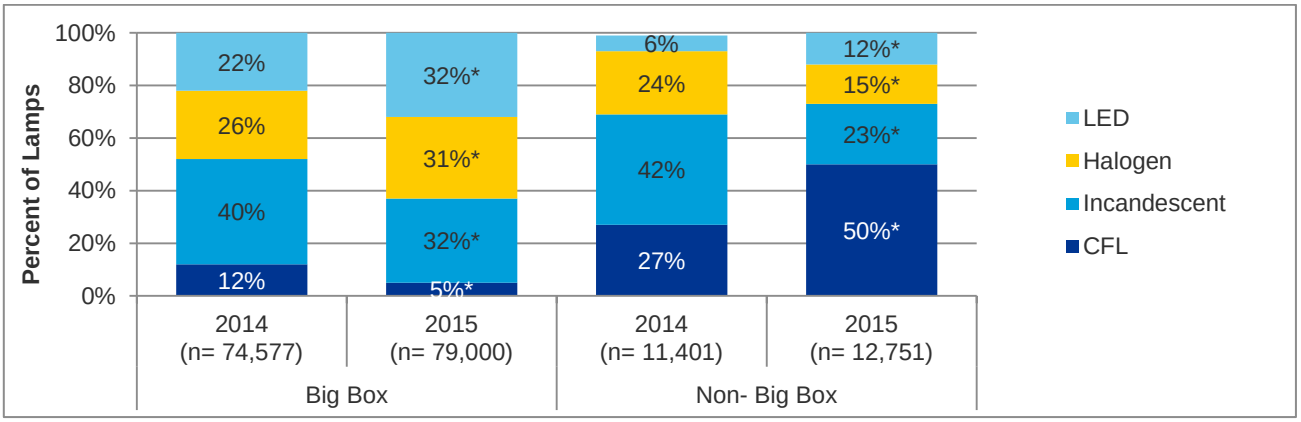



* Difference from prior study period is statistically significant at the 95% level of confidence.
Note: Results may not total 100% because of rounding.

### 4.2.2.3.2 MSB reflector lamps

MSB CFL, incandescent, halogen, and LED reflector lamps comprised 12% of all lamps stocked in California retail stores in 2014 and 13% in 2015. Figure 28 shows the proportion of MSB reflector lamps stocked by technology and store category in 2014 and 2015. Incandescent reflector lamps comprised the largest share of reflector lamps stocked in big box stores in 2014 (40%), but LED reflector lamps equaled incandescent lamps with the largest share in 2015 big box stores at 32% apiece; LED MSB reflector lamps showed the greatest increase in lamp share in big box stores, rising from 22% in 2014 to 32% in 2015 (an increase of 45%). While the share of LED reflector lamps increased in big box and non-big box stores between years and the share of incandescent reflector lamps declined between years, the trend in the share of CFL reflector lamps and halogen reflector went in opposing directions across store categories between 2014 and 2015. The share of CFL reflector lamps declined in big box stores between years from 12% to 5% of MSB reflector lamps, but increased in non-big box stores from 27% to 50% between years, while the share of halogen reflector lamps increased in big box stores from 26% to 31% between years and decreased in non-big box stores from 24% to 15%.

**Figure 28: Percent of MSB reflector lamps stocked by technology and store category, 2014 and 2015 (retail store shelf surveys)**



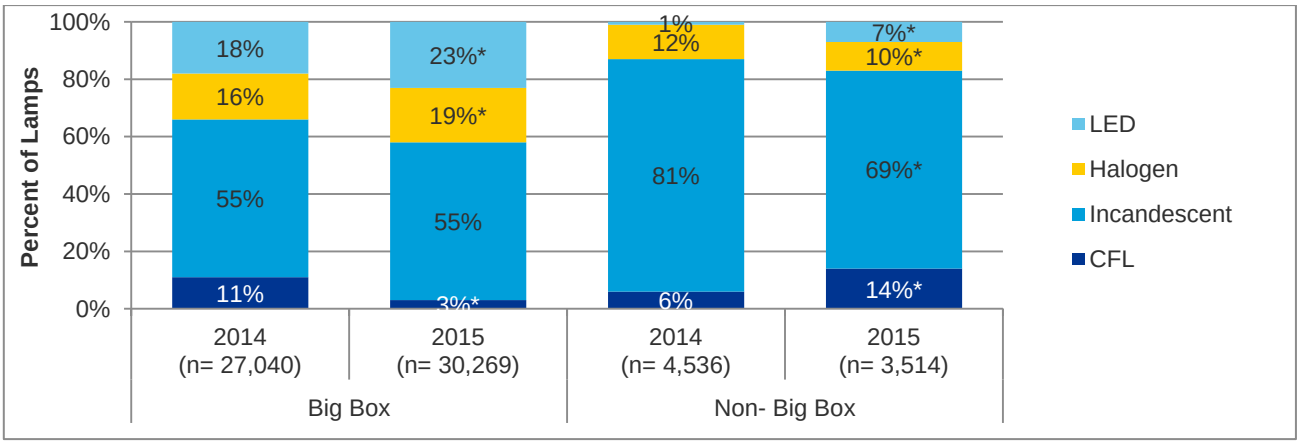

* Difference from prior study period is statistically significant at the 95% level of confidence.
Note: Results may not total 100% because of rounding.

### 4.2.2.3.3 MSB globe lamps

MSB CFL, incandescent, halogen, and LED globe lamps comprised 6% of all lamps stocked in California retail stores in 2014 and 5% in 2015. Figure 29 shows the proportion of MSB globe lamps stocked by technology and store category in 2014 and 2015. Incandescent lamps comprised the vast majority of MSB globe lamps stocked in big box and non-big box stores in both periods. In big box stores, there was a significant shift in total MSB globe lamp stock away from CFLs and toward LED lamps and halogen lamps.

Interestingly, the share of stock comprised by CFLs in non-big box stores more than doubled (an increase from 6% in 2014 to 14% in 2015), while the lamp share of incandescent lamps decreased from 81% in 2014 to 69% in 2015 (a decrease of 15%). The lamp share of LED lamps increased from 1% in 2014 to 7% in 2015 in non-big box stores.

**Figure 29: Percent of MSB globe lamps stocked by technology and store category, 2014 and 2015 (retail store shelf surveys)**




* Difference from prior study period is statistically significant at the 95% level of confidence.
Note: Results may not total 100% because of rounding.

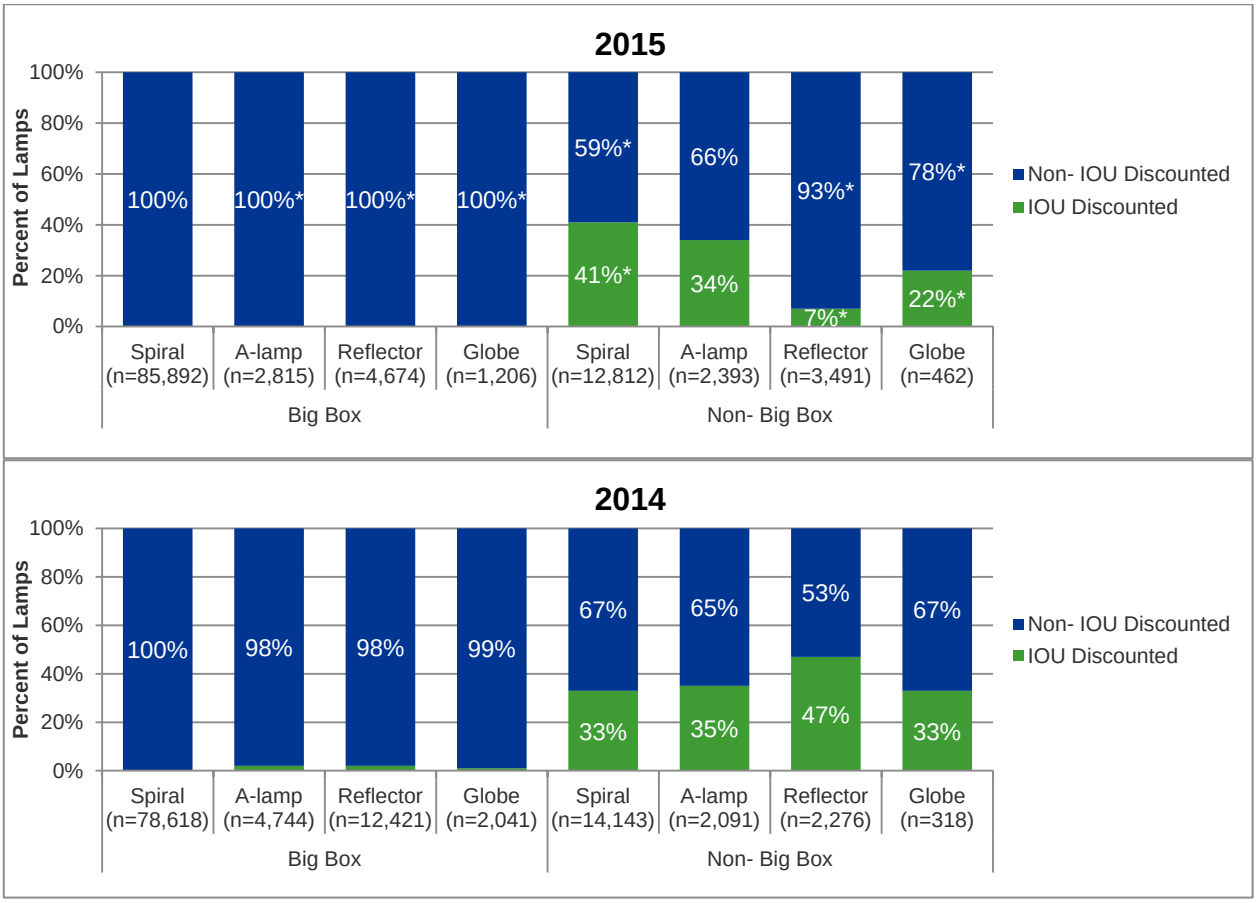
### 4.2.2.4 By availability of IOU discount and store category

Of all MSB CFLs stocked in California retail stores in 2014, shelf survey results suggest that nearly one-fifth these lamps were IOU-discounted (19%). In 2015, the share of IOU-discounted MSB CFLs nearly doubled to 37% of lamps. Roughly two-thirds of MSB CFLs stocked in non-big box stores in 2015 were IOU-discounted (68%), compared to 35% in 2014. In big box stores, less than one-half of one% of MSB CFLs were IOU-discounted in 2014 and 2015.

When examined further by lamp shape (Figure 30), results suggest that nearly all MSB spiral, A-lamp, reflector and globe CFLs in big box stores were not discounted by the California IOUs in 2014 and 2015. In non-big box stores, non-IOU discounted CFLs comprised the majority of CFLs stocked in MSB spiral, A-lamp, reflector and globe shapes in 2014 and 2015.

In non-big box stores, the share of MSB CFLs comprised by IOU-discounted lamps decreased significantly for reflectors (from 47% to 7%) and globes (from 33% in 2014 to 22% in 2015), but increased for spiral lamps (from 33% of all spirals with IOU discounts in 2014 to 41% in 2015).

**Figure 30: Percent of MSB CFLs with and without IOU discounts stocked by lamp shape and store category, 2014 and 2015 (retail store shelf surveys)**



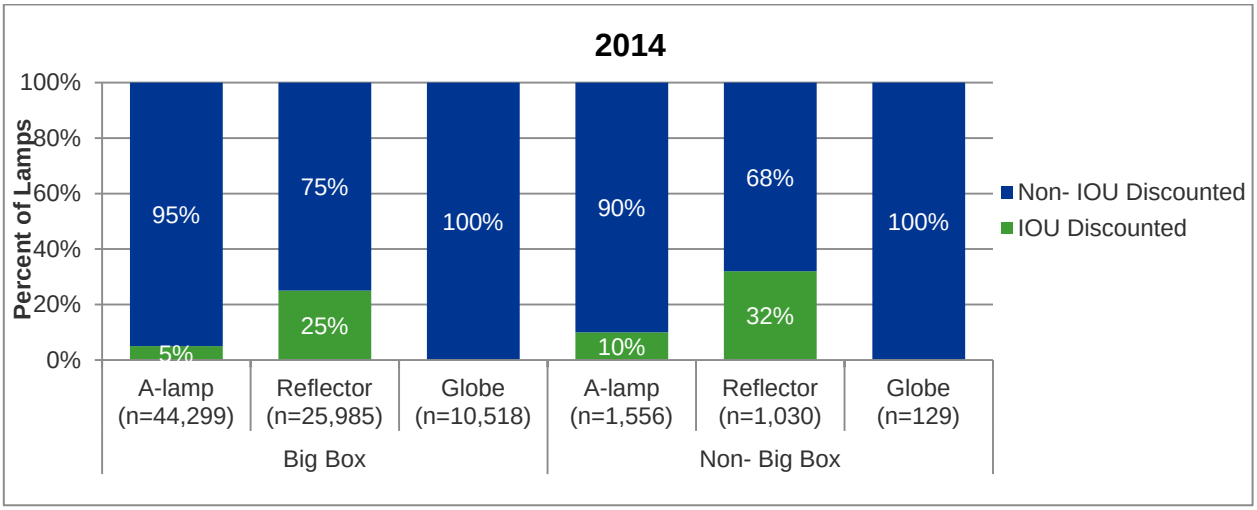

* Difference from prior study period is statistically significant at the 95% level of confidence.
Note: Results may not total 100% because of rounding.

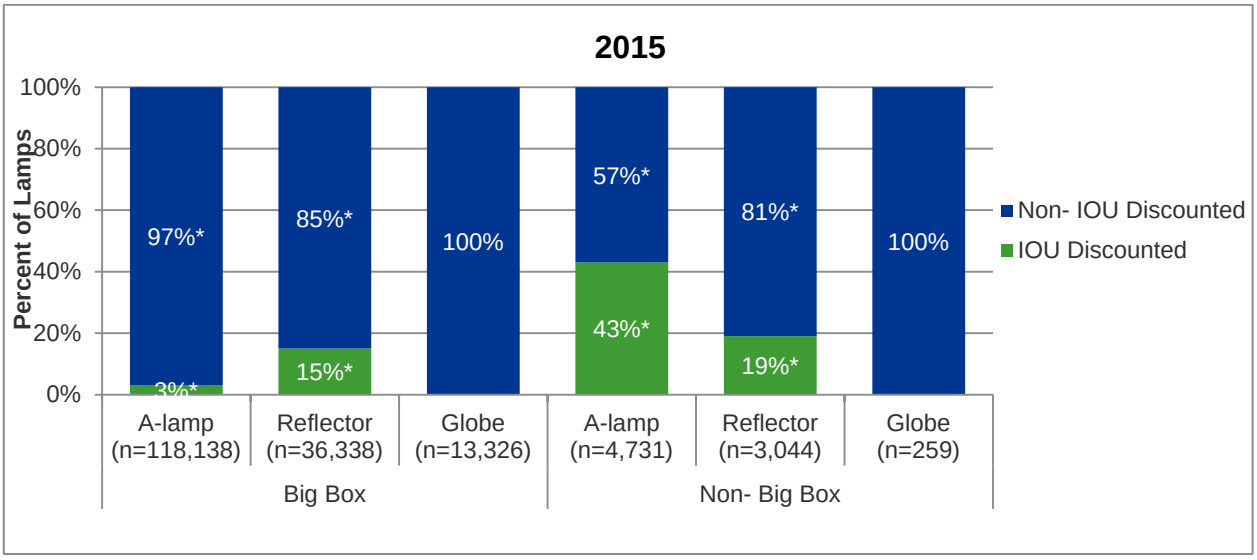
Of all MSB LED lamps stocked in California retail stores, shelf survey results suggest that 11% of these lamps were IOU-discounted in both 2014 and 2015. Overall, these results suggest that a smaller share of lamps were discounted by the program in 2015 than in 2014 (although it is important to remember that the lamp stock inventory data represent snapshots in time – i.e., it is possible that there were more or fewer IOU-discounted lamps stocked at different times of the year). One-third of MSB LED lamps stocked in non-big box stores in 2015 were IOU-discounted (33%), compared to only 14% in 2014. In big box stores, the percentage of MSB CFLs that were IOU-discounted doubled from 5% in 2014 to 10% in 2015.

As shown in Figure 31, the share of MSB LED lamp stock comprised by IOU-discounted lamps decreased significantly for reflectors from 25% in 2014 to 15% in 2015 and for A-lamps from 5% in 2014 to 3% in 2015 in big box stores. There were no IOU-discounted LED globes in 2014 or 2015.

In non-big box stores, the share of MSB LED lamp stock comprised by IOU-discounted A-lamps increased significantly between years (from 10% to 43%), while the share comprised by IOU-discounted reflector lamps decreased (from 32% to 19%) between years. As was the case in big box stores, there were no IOU-discounted LED globes in either year.

**Figure 31: Percent of MSB LED lamps stocked with and without IOU discounts by lamp shape and store category, 2014 and 2015 (retail store shelf surveys)**



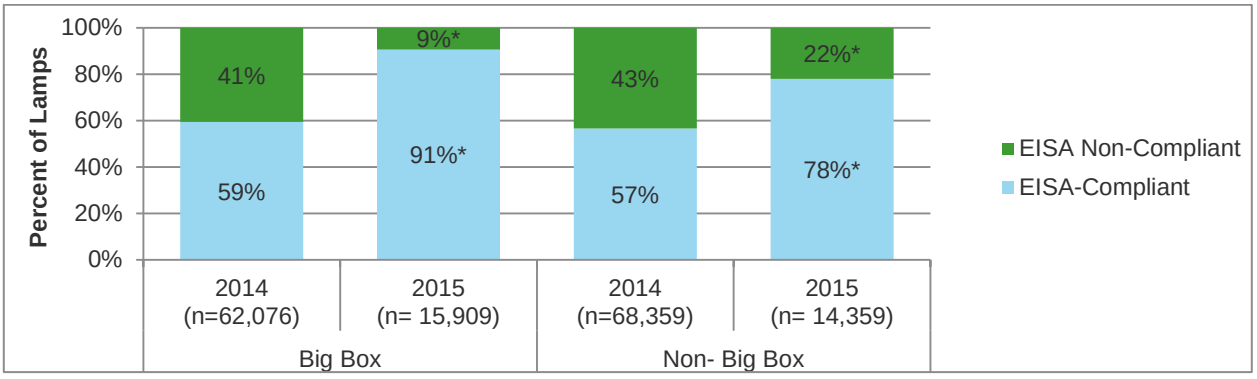



* Difference from prior study period is statistically significant at the 95% level of confidence.
Note: Results may not total 100% because of rounding.

### 4.2.2.5 By EISA compliance and store category

Figure 32 shows the proportion of incandescent and halogen lamp stock comprised by EISA-compliant and EISA non-compliant lamps by store category in 2014 and 2015. The share of EISA-compliant A-lamps in big box stores increased from nearly 60% of lamps in 2014 to more than 90% of lamps in 2015 (a significant increase). Non-big box stores also experienced an increase in the share of EISA-compliant lamps stocked between years (from 57% in 2014 to 78% in 2015). When examined in more detail (by lumen bin), results suggest that the share of EISA-compliant versus non-compliant lamps is growing over time in all lumen bins. For further details, please refer to Table 47 through Table 54 in Appendix C.

**Figure 32: Percent of EISA-compliant and non-compliant incandescent and halogen lamps stocked by store category, 2014 and 2015 (retail store shelf surveys)**




* Difference from prior study period is statistically significant at the 95% level of confidence.
Note: Results may not total 100% because of rounding.

## 4.3 Lamp diversity

This section examines lamp diversity in terms of the average number of lamp models available per store by lamp technology and lamp shape following the same pattern used above for lamp availability (i.e. by technology, by technology and store category, and so on). Key findings include:

- Across all California retail stores, incandescent lamps had the highest average number of lamp models per store in 2012, 2013, 2014, and 2015; however, the average number of incandescent lamp models per store declined steadily between 2012 and 2015 (from approximately 34 per store to 26 per store). In 2015, LED lamps surpassed CFLs in terms of the average number of lamp models per store (more than 16 lamp models per store). The average number of CFL models per store declined from approximately 19 per store in 2012 to 12 per store in 2015.
- California big box stores had approximately 4 to 5 times the lamp diversity (in terms of the average number of lamp models per store) for CFLs, halogen lamps, and incandescent lamps compared non-big box stores in both 2014 and 2015. In 2015, big box stores the average number of LED lamp models per store was more than 10 times higher compared to non-big box stores.
- There were more than 80 LED and incandescent lamp models per big box store in 2015. The average number of LED lamps models per big box store increased more than 60% between 2014 and 2015.
- The decline in the average number of CFL models per store between 2014 and 2015 (across all stores) was primarily driven by a steep decline in the average number of advanced CFLs in big box stores between years (from approximately 31 per big box store in 2014 to 17 per big box store in 2015).
- In non-big box stores, the average number of LED lamp models per store more than doubled between 2014 and 2015 (from approximately 3 per store to nearly 8 per store)
- Among MSB A-lamp replacement technologies, LED A-lamps had the highest average number of models per big box store in 2015 at more than 33 per store. The average number of CFL A-lamp models per big box store declined dramatically from more than 6 per store in 2014 to less than 1 per store in 2015. The average number of spiral CFL models declined by only 2 models per big box store between years (21 per store in 2014 and 19 per store in 2015). In non-big box stores, the average number of LED lamp models per store more than doubled to between 3 and 4 models per store in 2015.
- There were fewer MSB reflector lamp models available per store in 2014 and 2015 than MSB A-lamp replacements. In big box stores, incandescent reflector lamps had the greatest model number diversity in 2014 (14.2 models per store), but LED reflectors supplanted incandescent reflectors with the highest average number of lamp models per store in 2015 (18.5 models per store). The average number of CFL reflector lamp models per big box store declined by 50% between years to less than 3 models per big box store. In non-big box stores, there were more incandescent reflector models per store than for other reflector lamp technologies in 2014 and 2015. Between years, only the average number of LED reflector lamp models increased.
- Incandescent lamps had the highest average number of MSB globe lamp models per store in both big box and non-big box stores in 2014 and 2015. The average number of CFL globe models per big box

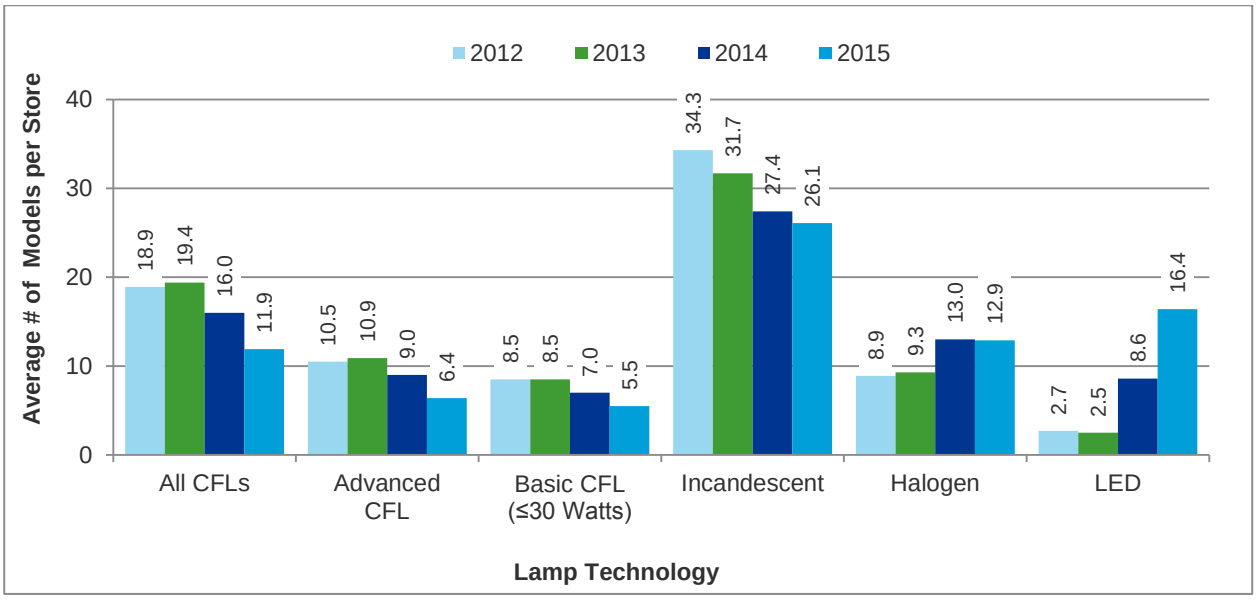
store declined more than 80% to less than 1 lamp model per store between years. The average number of LED globe lamp models per big box store increased to nearly 7 models per store in 2015.

- There was an average of less than 1 IOU-discounted MSB spiral, A-lamp, reflector, and globe CFL models per store in both big box and non-big-box stores in 2014 and 2015. There was also less than 1 IOU-discounted MSB LED lamp, reflector, and globe models per store in both store categories in 2014 and 2015.
- Diversity among EISA-compliant halogen lamp models increased between 2014 and 2015 in both store categories, while diversity of EISA-non-compliant halogen and incandescent lamp models decreased in both store categories between years.

### 4.3.1 By technology

Figure 33 shows the average number of lamp models per technology across all California retail stores that sold replacement lamps to consumers in 2012, 2013, 2014, and 2015. LED lamps experienced the largest change in the average number of models stocked per store during this period with an increase from less than 3 lamp models per store in 2012 and 2013 to more than 16 models per store in 2015. The largest decline in the average number of models stocked per store was found among CFLs, which decreased by 7.5 models per store between 2013 and 2015 (from 19.4 per store to 11.9 per store—a 39% decline). The average number of incandescent lamp models per store declined by 8.2 models per store between 2012 and 2015 (a 39% decline), but remained the lamp technology with the highest average number of lamp models available per store in 2015.

**Figure 33: Average number of lamp models per store by technology, 2012–2015 (retail store shelf surveys)**



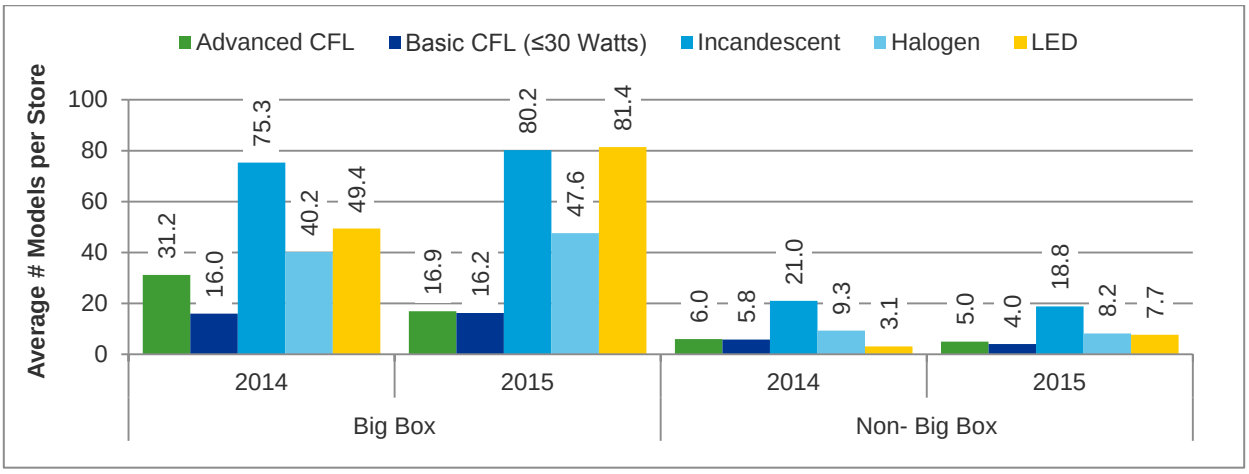

See Table 71 in Appendix C for the number of lamp models by technology and year.

## 4.3.2 By technology and store category

When further examined by retail store category, the data suggest an average of more than 200 lamp models per big box store in 2014 and 2015, and an average of more than 40 lamp models per non-big box store in both years.

Figure 34 shows that the average number of LED lamp models per big box store nearly doubled between 2014 and 2015 (from 49 to 81 per store). In 2015, the average number of LED lamp models per big box store and incandescent lamp models per store were approximately the same. The average number of CFL models per store declined by more than 14 lamp models per big box store between 2014 and 2015; this decline was driven by a decline in the average number of advanced CFL models per big box store between years. The most notable change in the average number of lamp models in non-big box stores was among LED lamps, which more than doubled from approximately 3 models per store in 2014 to nearly 8 models per store in 2015.

**Figure 34: Average number of lamp models per store by technology and store category, 2014 and 2015 (retail store shelf surveys)**




See Table 72 in Appendix C for the number of lamp models by technology, store category, and year.

## 4.3.3 By replacement lamp category and store category

This section compares lamp diversity by technology, store category, and year for typical MSB replacement lamp types (A-lamps and spirals, reflectors, and globes).

### 4.3.3.1 MSB A-lamp replacements

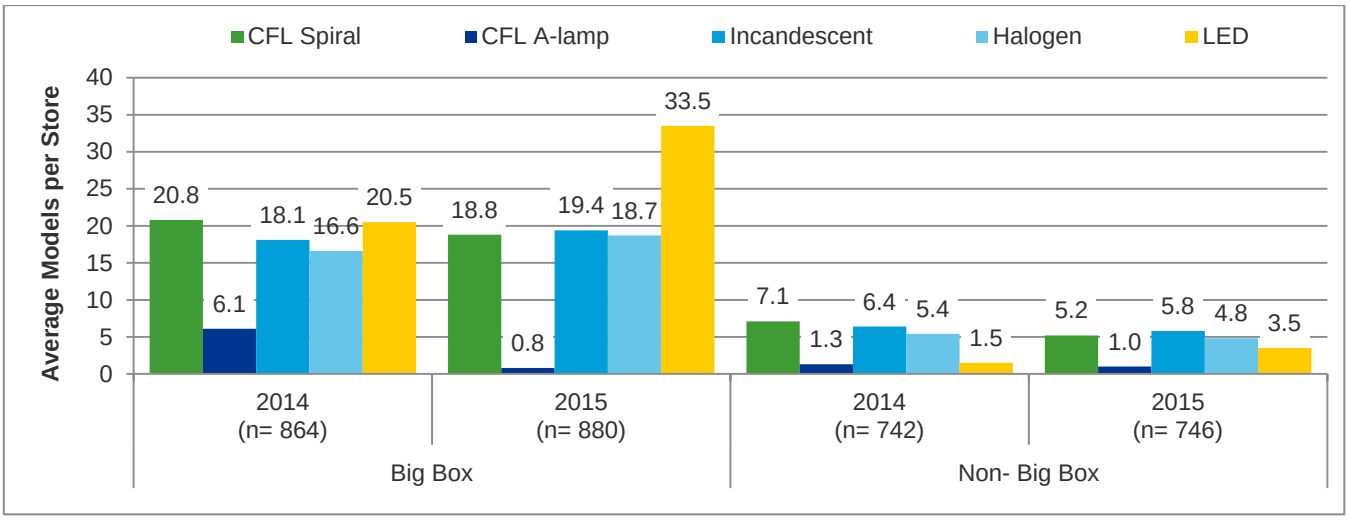
Figure 35 shows the average number of MSB spiral and A-lamp models per store by store category in 2014 and 2015. In both store categories, only the average number of models per store for LED and halogen lamps increased between years, while the average number of CFL spirals and A-lamps and incandescent A-lamps declined from 2014 to 2015.

In big box stores, there were the same number of spiral CFL models per store, on average, as LED lamp models in 2014 (approximately 21 each). Between 2014 and 2015, the average number of spiral CFL models per big box store decreased slightly between years (from approximately 21 per store to 19 per store), while the average number of LED A-lamp models increased by more than 60% from 20.5 per big

box store in 2014 to 33.5 per big box store in 2015. The average number of CFL A-lamp models in big box stores declined dramatically between years (from 6.1 in 2014 to 0.8 in 2015).

In non-big box stores, there were more CFL spiral models than LED A-lamp models per store in 2014 (7.1 compared to 1.5), but this gap narrowed in 2015 (5.2 CFL spiral models per store compared to 3.5 LED A-lamp models per store, on average). The average number of incandescent and halogen A-lamp models both decreased by approximately half of a model number between years.

**Figure 35: Average number of MSB A-lamp and spiral CFL models per store by technology and store category, 2014 and 2015 (retail store shelf surveys)**



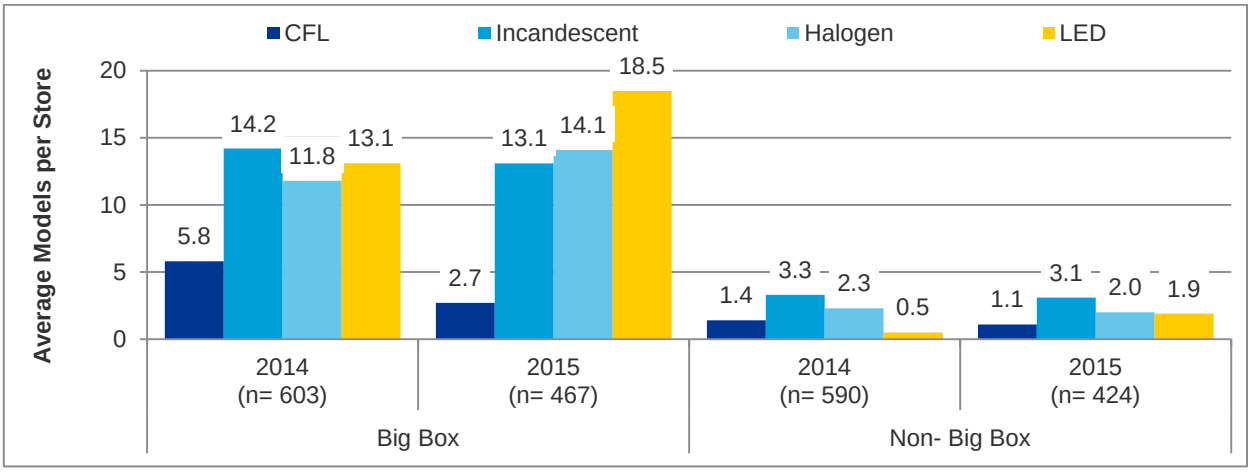

See Table 73 in Appendix C for the number of MSB A-lamp and MSB spiral CFL models by technology, store category, and year.

### 4.3.3.2 MSB reflector lamps

Figure 36 shows the average number of MSB reflector models per lamp technology by store category and in 2014 and 2015. In big box stores, incandescent reflector lamps had the greatest model number diversity in 2014 (14.2 models per store), but LED reflector lamps supplanted incandescent lamps with the highest average number of lamp models per store in 2015 (18.5 models per store) with a 41% increase in the average number of LED lamp models per big box store between years. The average number of CFL reflector lamp models per big box store declined by more than 50% between years (dropping from 5.8 to 2.7 models per store).

In non-big box stores, there were more incandescent reflector models per store than for other reflector lamp technologies in 2014 and 2015 (with an average of more than 3 incandescent reflector models per store). Between years, only the average number of LED reflector lamp models increased, while the average number of CFL, halogen, and incandescent lamp models decreased. The average number of LED reflector models per non-big box store nearly quadrupled from 0.5 per store in 2014 to 1.9 per store in 2015.

**Figure 36: Average number of MSB reflector models per store by technology and store category, 2014 and 2015 (retail store shelf surveys)**



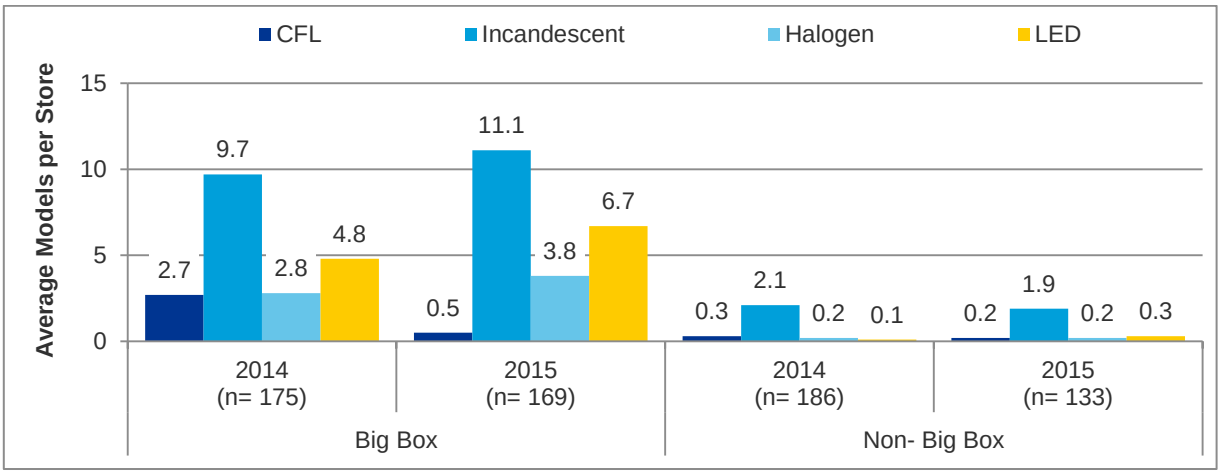

See Table 74 in Appendix C for the number of MSB reflector lamp models by technology, store category, and year.

### 4.3.3.3 MSB globe lamps

Figure 37 shows the average number of MSB globe models per store by store category and lamp technology in 2014 and 2015. Incandescent lamps showed the greatest model number diversity among globe lamps in 2014 and 2015 in both store categories. The greatest increase in the average number of globe lamp models per big box store between years was a 40% increase in the average number of LED globe lamp models per store, which increased by an average of 2 models per store between years (from 5 to 7). The average number of CFL globe lamp models per big box store declined by over 80% between years (from 2.7 to 0.5 per store).

In non-big box stores, there was an average of less than 1 CFL, LED, and halogen globe models per store in 2014 and 2015, while there were approximately 2 incandescent globe models per non-big box store in both years.

**Figure 37: Average number of MSB globe models per store by technology and store category, 2014 and 2015 (retail store shelf surveys)**



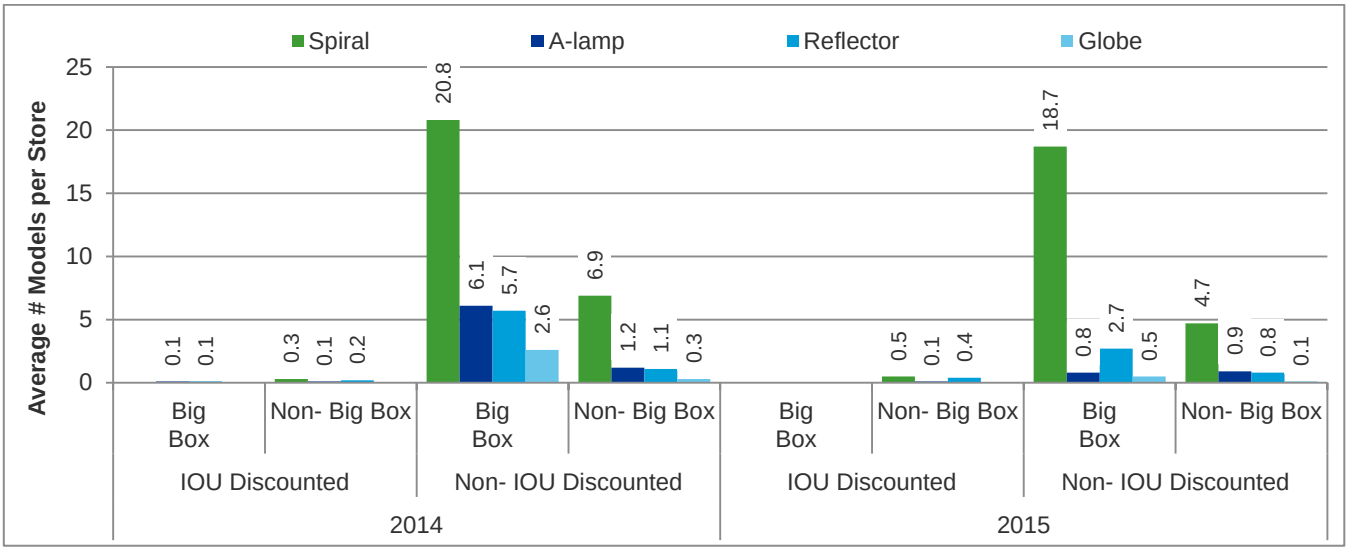

See Table 75 in Appendix C for the number of MSB globe lamp models by technology, store category, and year.

### 4.3.4 By availability of IOU discount and store category

Figure 38 shows the average number of MSB CFL models per store with and without IOU discounts[80] by lamp shape and store category in 2014 and 2015. There was little model number diversity among IOU-discounted MSB spiral, A-lamp, reflector, and globe CFLs in big box and non-big box stores in 2014 and 2015 (each lamp shape had less than one model number per store in both store categories in both years). It is difficult to determine whether the low diversity among IOU-discounted lamps (particularly in big box stores) is a reflection of poor labeling of IOU-discounted lamps or a more accurate representation of IOU-discounted lamp diversity in California retail stores that sold replacement lamps to consumers in 2014 and 2015.

80 Note that the same CFL model could have been sold with and without the IOU discount in the same retail channel, so some models are counted both with and without IOU discounts.

**Figure 38: Average number of MSB CFL models per store with and without IOU discounts by lamp shape and store category, 2014 and 2015 (retail store shelf surveys)**

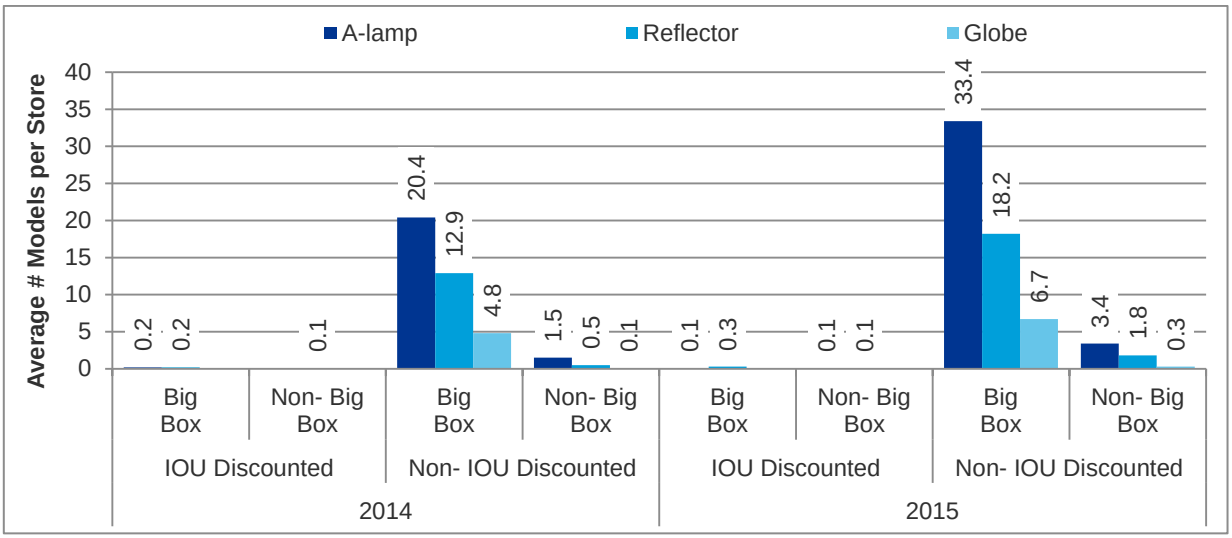



See Table 77 in Appendix C for the number of CFL models by lamp shape, store category, and year.

Figure 39 shows the average number of MSB LED models per store with and without IOU discounts by lamp shape and store category in 2014 and 2015. As was the case for CFLs, there was little model number diversity among IOU-discounted MSB A-lamp, reflector, and globe LED lamps in big box and non-big box stores in 2014 and 2015 (each lamp shape had less than one model number per store in both store categories in both years). This may be a reflection of poor labeling of IOU-discounted LED lamps.

For details on the number of MSB CFL and LED lamp models per store by lumen bin and lamp shape, please see Table 79 through Table 86 in Appendix C.

**Figure 39: Average number of MSB LED models per store with and without IOU discounts by lamp shape and store category, 2014 and 2015 (retail store shelf surveys)**




See Table 47 in Appendix C for the number of LED Lamp models by lamp shape, store category, and year.

### 4.3.5 By EISA compliance and store category

Table 14 shows the average number of EISA-compliant and EISA-non-compliant incandescent and halogen lamp models per store by store category in 2014 and 2015. On average, there were more EISA-compliant lamp models per big box store (11.7) than EISA non-compliant lamp models (9.0) in 2014. In 2015 the gap in average model number per big box store widened between EISA-compliant and EISA-non-compliant lamps (17.5 EISA-compliant models per store compared to 6.8 EISA-non-compliant models per store). Similarly, there were more EISA compliant lamp models than EISA non-compliant models per non-big box store in both 2014 and 2015, and the average number of EISA-compliant lamp models per store increased between years.

For details on the number of EISA-compliant and non-compliant incandescent and halogen lamp models per store by lumen bin (high, medium high, medium low, and low), please see Table 47 through Table 54 in Appendix C. For details on the number of MSB CFL and LED lamp models per store by lumen bin and lamp shape, please see Table 79 through Table 86 in Appendix C.

**Table 14: Average number of EISA-compliant and non-compliant incandescent and halogen lamp models per store by store category, 2014 and 2015 (retail store Shelf Surveys)**

| Year | Store Category | Average # Models per Store | |
|---|---|---|---|
| | | EISA-Compliant | EISA Non-Compliant |
| 2014 | Big Box | 11.7 | 9 |
| | Non-Big Box | 4.1 | 2.4 |
| 2015 | Big Box | 17.5 | 6.8 |
| | Non-Big Box | 4.5 | 1.2 |

See Table 87 in Appendix C for the number of EISA-compliant and non-compliant lamp models by technology, store category, and year.

## 4.4 Lamp pricing

This section examines lamp pricing in terms of the average price per lamp by lamp technology and lamp shape and presents results in the same order in which Sections 4.2.1 and 4.2.2 present results for lamp availability and Section 4.3 presents results for lamp diversity. Unless otherwise stated, prices represent the final purchase price after any discounts (IOU discounts and/or others). Key findings include:

- Average lamp prices decreased between 2014 and 2015 across all stores for all lamp technologies except incandescent lamps.
- LED lamp prices declined by nearly 50% between 2012 and 2015 from an average of more than $16.50 per lamp to just over $8.50 per lamp.
- LED lamp prices averaged approximately $8.50 per lamp in 2015, but were at least three times more expensive per lamp compared to other technologies. Halogen lamps were approximately $0.25 more expensive, on average, in 2015 than CFLs, averaging nearly $2.90 per lamp, and incandescent lamps averaged just over $2.00 per lamp in 2015.

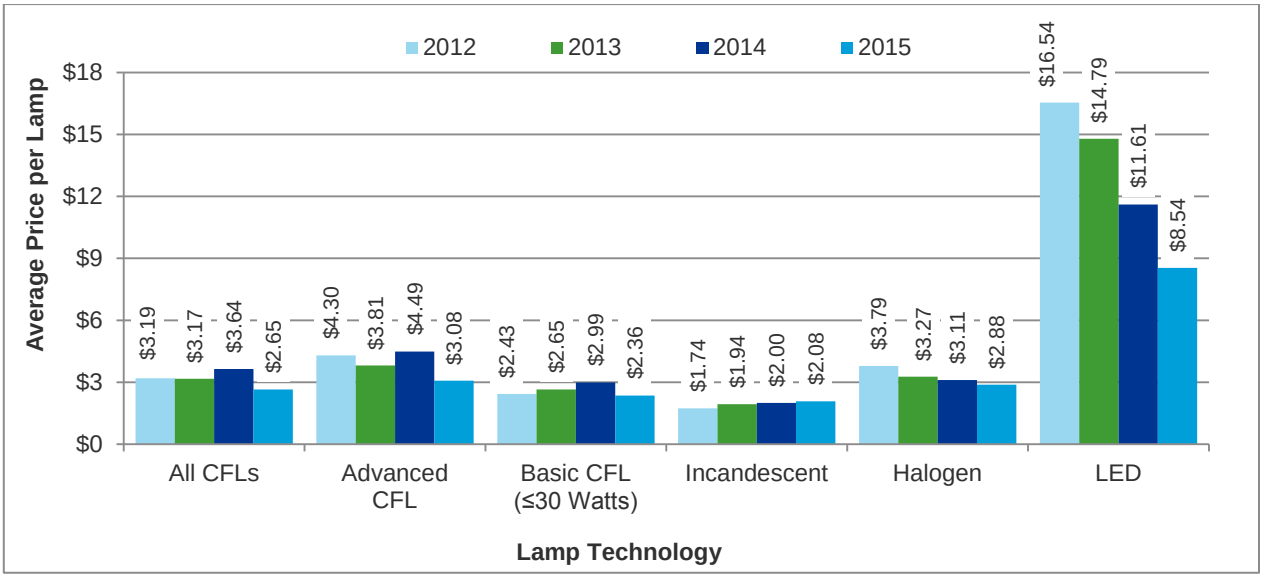
- The average price per lamp for CFLs and LED lamps declined by more than 25% between 2014 and 2015. The average price per LED lamp decreased from more than $11.50 per lamp in 2014 roughly $8.50 per lamp in 2015. CFLs decreased from more than $3.60 per lamp in 2014 to roughly $2.60 per lamp in 2015. The average price for advanced CFLs declined by more than 30% between years. Increased consumer demand for LED lamps was likely a key factor in the declining price for those lamps.
- LED lamps remained the most expensive lamp technology, in terms of the average price per lamp, in both big box and non-big box stores, while incandescent lamps were the least expensive lamp technology in both store categories in 2015.
- Average prices for MSB A-lamp replacements decreased for all technologies in non-big box stores between 2014 and 2015, and decreased for all technologies in big box stores between years, except for incandescent A-lamps (which increased slightly). LED A-lamp prices decreased by nearly $4.50 per lamp in big box stores between years (more than a 40% decline), and decreased by more than $3.50 per lamp in non-big box stores between years(nearly a 30% decline).
- With the exception of LED lamps, MSB reflector lamp prices ranged from approximately $4 to $7 in big box stores in 2015 and from $2 to $9 per lamp in non-big box stores. The average LED reflector lamp price was more than $12 per lamp in big box stores and more than $17 per lamp in non-big box stores in 2015. The average price for LED reflectors decreased in big box stores, but increased in non-big box stores between years, while the average price for CFL reflectors increased in big box stores, but decreased in non-big box stores between years.
- MSB LED globe prices decreased by more than 5% between years in both big box and non-big box stores. LED globes average less than $9 per lamp in big box stores in 2015 and approximately $14 per lamp in non-big box stores. CFL globes declined from nearly $5 per lamp in 2014 in non-big box stores to less than $2 per lamp in 2015 in non-big box stores.
- For lamps in the A-lamp replacement category, the lowest-cost A-lamp replacement option in both 2014 and 2015 was the traditional incandescent A-lamp, followed by the EISA-compliant halogen lamp. When IOU discounts were available, however, the lowest-cost option shifted to CFLs (basic spirals in 2014 and A-lamps in 2015). In 2015, program-discounted CFLs were roughly half the cost of incandescent A-lamps or EISA-compliant halogen A-lamps. Without program discounts, relatively inefficient lamps become the lowest-cost option for consumers.
- In 2015, IOU-discounted MSB CFLs were approximately $1 to $2 less per lamp than MSB CFLs without IOU discounts in big box stores. In non-big box stores, IOU-discounted MSB CFLs averaged $3.50 to approximately $9 less per lamp than MSB CFLs without IOU discounts in 2015.
- Across both store categories, IOU-discounted lamp prices were substantially lower for MSB LED lamps than MSB LED lamps without IOU discounts. In 2015, IOU-discounted MSB LED lamps were between $2 and $5 less per lamp than LED lamps without IOU discounts in big box stores and between $8 and $16 less per lamp in non-big box stores.
- The average price for EISA-compliant lamps was approximately $1 less per lamp in big box stores compared to non-big box stores in 2014 and 2015. In 2015, EISA-compliant lamps were approximately $1.50 per lamp in big box stores and $2.50 per lamp in non-big box stores.

### 4.4.1 By technology

Figure 40 shows the average price per lamp by lamp technology in 2012, 2013, 2014, and 2015. The average price per lamp for CFLs, LED lamps, and halogen lamps declined between 2012 and 2015, while average lamp prices for incandescent lamps increased between 2012 and 2015.

LED lamps had the highest average price during all four years at more than $16.54 per lamp in 2012, $14.79 in 2013, $11.61 in 2014, and $8.54 per lamp in 2015. The average price per LED lamp decreased year over year, and by nearly 50% between 2012 and 2015. Halogens were the next most expensive lamp technology after LED lamps in each year (except in 2014), and experienced a steady decline in average price from $3.79 per lamp in 2012 to $2.88 per lamp in 2015 (a 24% decline). CFLs were more than $3.00 per lamp, on average, in 2012, 2013, and 2014, but declined by 28% from $3.64 in 2014 to an average price of $2.65 per lamp in 2015. Although basic spiral MSB CFLs were about $1.00 per lamp more expensive than incandescent lamps in 2014, the average price of a basic CFL dropped by more than 60 cents to close the gap between the two technologies in 2015. The average price for halogen lamps also declined by nearly $0.25 between years, but translates into only a 7% decline from 2014 to 2015.

**Figure 40: Average price per lamp by lamp technology, 2012–2015 (retail store shelf surveys)**



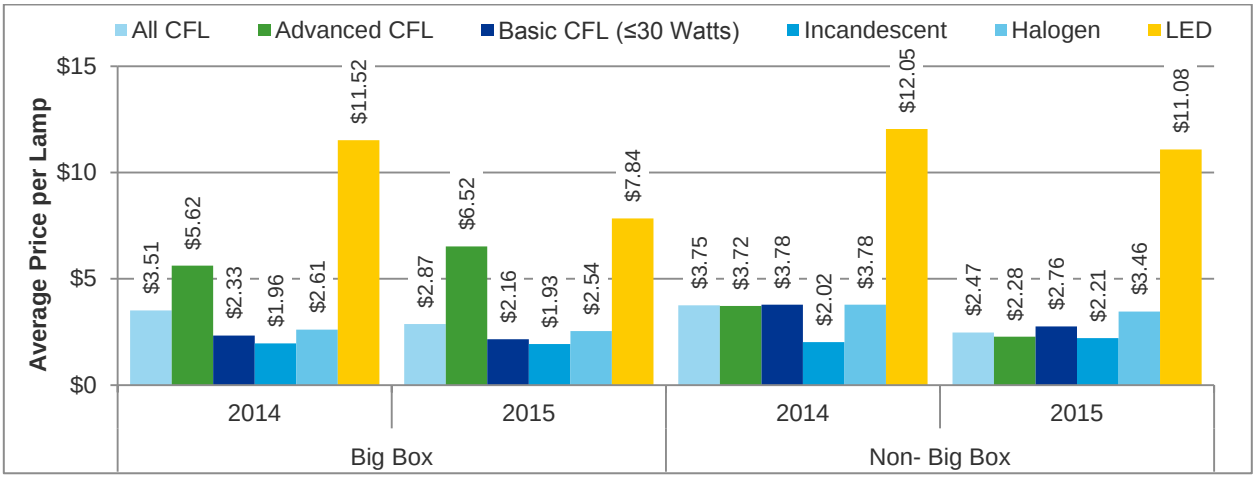

See Table 88 in Appendix C for the number of lamps by technology and year.
Note: "All CFLs" includes both "Advanced CFL" and "Basic CFL (≤30 Watts)."

### 4.4.2 By technology and store category

Figure 41 shows the average lamp price by lamp technology and store category in 2014 and 2015. In 2015, LED lamps remained the most expensive lamp technology in terms of the average price per lamp in big box and non-big box stores, while incandescent lamps were the least expensive lamp technology in both store categories in 2015. The most notable changes between 2014 and 2015 were decreases in the average price for LED lamps and CFLs. LED lamps decreased by an average of $3.68 per lamp in big box stores (a 32% decline) and by $0.97 per lamp in non-big box stores (an 8% decline). The average price per CFL decreased by $0.64 per lamp in big box stores between years (an 18% decline), and in non-big-

box stores, the decline in the average price per CFL was more than $1.25 per lamp between years (a 34% decline). Also noteworthy was the change in incandescent lamp pricing; in big box stores, the average price of incandescent lamps remained nearly the same between years at less than $2.00 per lamp, but in non-big box stores, the price per incandescent lamp actually increased by $0.19 between years (an increase of 10%).

**Figure 41: Average price per lamp by lamp technology and store category, 2014 and 2015 (retail store shelf surveys)**




See in Table 88 in Appendix C for the number of lamps by technology, store category, and year.
Note: "All CFLs" includes both "Advanced CFL" and "Basic CFL (≤30 Watts)."

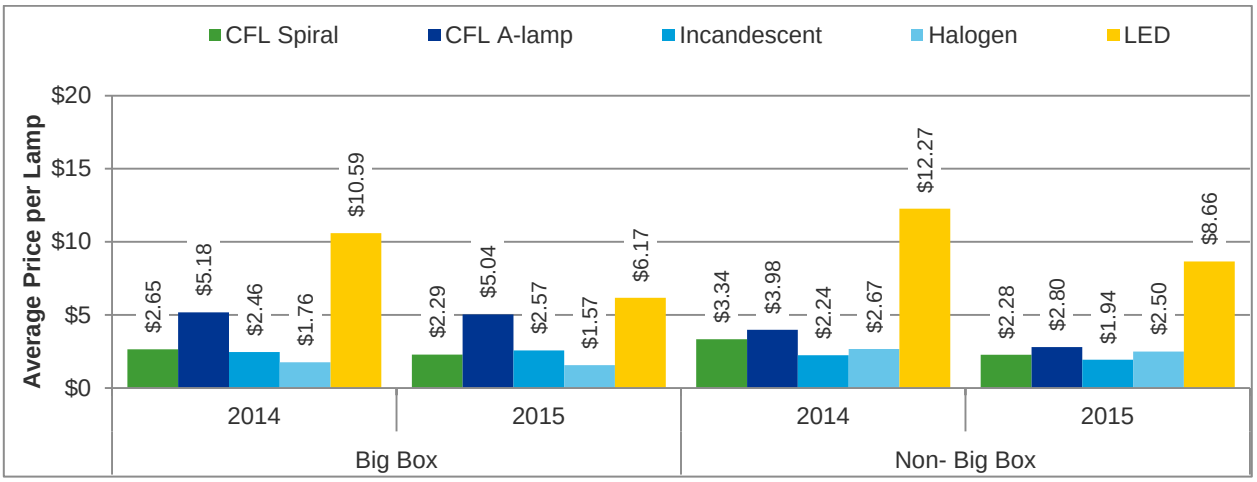
## 4.4.3 By replacement lamp category and store category

This section compares lamp pricing by technology, store category, and year for typical MSB replacement lamp types (A-lamps and spirals, reflectors, and globes).

### 4.4.3.1 MSB A-lamp replacements

Figure 42 shows the average MSB spiral and A-lamp price by lamp technology and store category in 2014 and 2015. The average price for LED A-lamps dropped by $4.42 per lamp in big box stores (a 41% decline) and decreased by $3.61 per lamp in non-big box stores (a 29% decline). The average price of spiral CFLs declined by more than 30% in non-big box stores with a decrease of $1.06 per lamp between years, while the average price for spiral CFLs decreased by $0.36 per lamp in big box stores during the same period (a 14% decline). The price of incandescent A-lamps went up by $0.11 per lamp in big box stores between 2014 and 2015 (4% increase), but fell by $0.30 per lamp in non-big box stores (13% decrease). The price of halogen A-lamps decreased by less than $0.20 per lamp between years in both store categories.

**Figure 42: Average price per MSB A-lamps and MSB spiral CFLs by lamp technology and store category, 2014 and 2015 (retail store shelf surveys)**

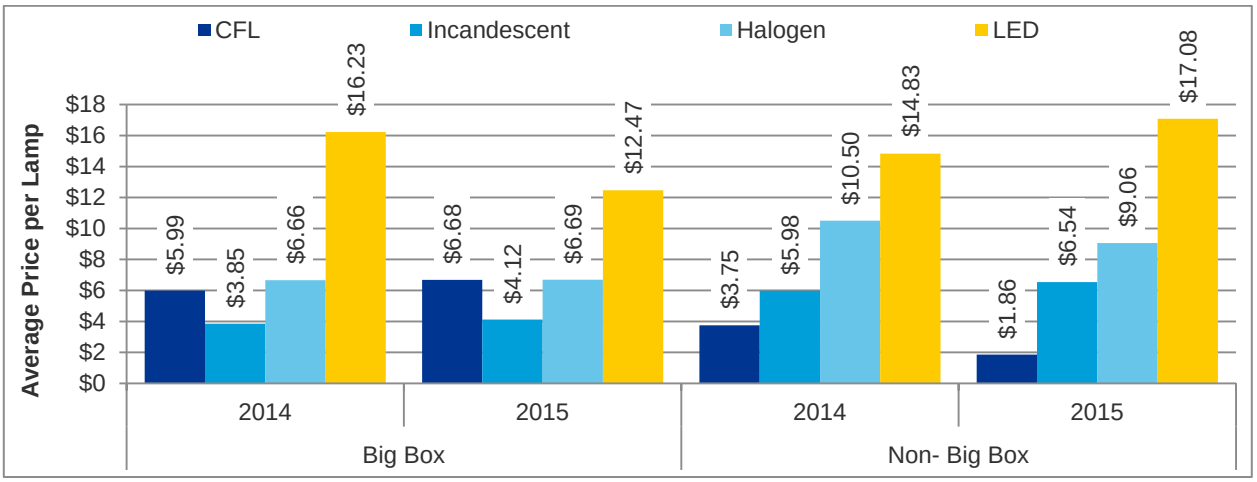



See Table 89 in Appendix C for the number of MSB A-lamp and MSB spiral CFLs by technology, store category, and year.

### 4.4.3.2 MSB reflector Lamps

Figure 43 shows the average MSB reflector lamp price by lamp technology and store category in 2014 and 2015. The trends in price changes between years were less consistent for reflector lamps than they were for MSB A-lamps and spirals, which generally showed decreases in the average price per lamp for each lamp technology and in each store category between years. The average price for CFL reflectors in non-big box stores cost half as much per lamp in 2015 compared to 2014 with a decrease of $1.89 per lamp between years, but increased by $0.69 per lamp in big box stores between years (a 12% increase). The price of LED reflector lamps dropped by $3.76 per lamp in big box stores from 2014 to 2015 (a 23% decline), but increased by $2.25 per lamp in non-big box stores between years (a 15% increase). The price for halogen reflector lamp decreased in non-big box stores by $1.44 per lamp between 2014 and 2015 (a 13% decline), but remained essentially the same price per lamp in big box stores in both years. The price of incandescent reflector lamps increased by less than 10% in both big box and non-big box stores between years.

**Figure 43: Average price per MSB reflector lamp by lamp technology and store category, 2014 and 2015 (retail store shelf surveys)**

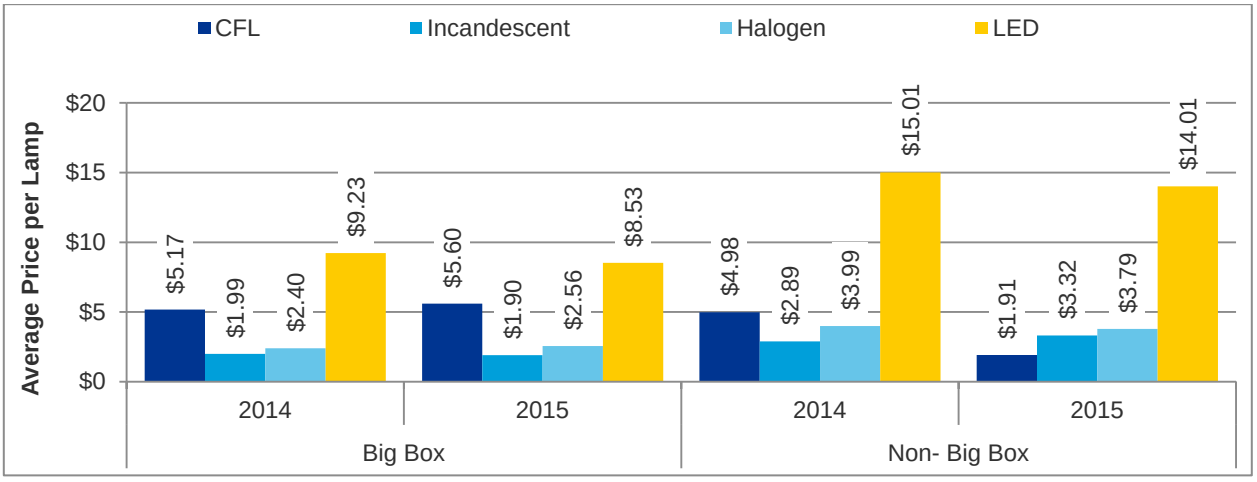



See Table 90 in Appendix C for the number of MSB reflector lamps by technology, store category, and year.

### 4.4.3.3 MSB globe lamps

Figure 44 shows the average MSB globe lamp price by lamp technology and store category in 2014 and 2015. The average price per globe CFL decreased significantly in non-big box stores by more than $3.00 per lamp between 2014 and 2015 (a 62% decline), while the price for CFL globes increased by $0.43 per lamp in big box stores from between years (an 8% increase). LED globe lamps decreased by $0.70 in big box stores between years (an 8% decline), and dropped by $1.00 per lamp in non-big box stores between years (a 7% decline). The only other notable change for MSB globe prices was a 15% increase in the average price of incandescent globe lamps in non-big box stores between 2014 and 2015 (an increase of $0.43 per lamp).

**Figure 44: Average price per MSB globe lamp by lamp technology and store category, 2014 and 2015 (retail store shelf surveys)**




See Table 91 in Appendix C for the number of MSB reflector lamps by technology, store category, and year.

### 4.4.4 By availability of IOU discount

For lamps in the A-lamp replacement category, Table 15 shows the average price per lamp across all California retail stores in 2014 and 2015.[81] For CFLs and LED lamps, the table includes the average prices with and without the IOUs' upstream lighting program discounts. Without IOU discounts, the lowest-cost option in both years was the traditional incandescent A-lamp, followed by the EISA-compliant halogen lamp. During both 2014 and 2015, when IOU discounts were available, the lowest-cost option shifted to CFLs (basic spirals in 2014 and A-lamps in 2015). In 2015, program-discounted CFLs were roughly half the cost of incandescent A-lamps or EISA-compliant halogen A-lamps. These results suggest that without program discounts, relatively inefficient lamps become the lowest-cost option for consumers. Also worthy of note is that in 2015, with IOU discounts, the average cost of an IOU-discounted LED A-lamp was within two dollars of the cost of traditional incandescent and EISA-compliant A-lamps.

**Table 15. Average price per general purpose lamp with and without IOU discounts across all retail channels by lamp technology and lamp style, 2014 and 2015**

| Lamp Type | 2014 | | 2015 | |
|---|---|---|---|---|
| | With IOU Discount | Without IOU Discount | With IOU Discount | Without IOU Discount |
| CFL spiral ≤ 30 W | $0.59 | $3.27 | $0.83 | $2.82 |
| CFL A-lamp ≤30 W | $0.93 | $5.45 | $0.72 | $6.34 |
| Traditional incandescent A-lamp ≤100 W | - | $1.90 | - | $1.63 |
| EISA-compliant halogen A-lamp ≤72W | - | $2.14 | - | $1.92 |
| LED A-lamp (all wattages) | $6.92 | $11.16 | $3.65 | $7.10 |

### 4.4.5 By availability of IOU discount and store category

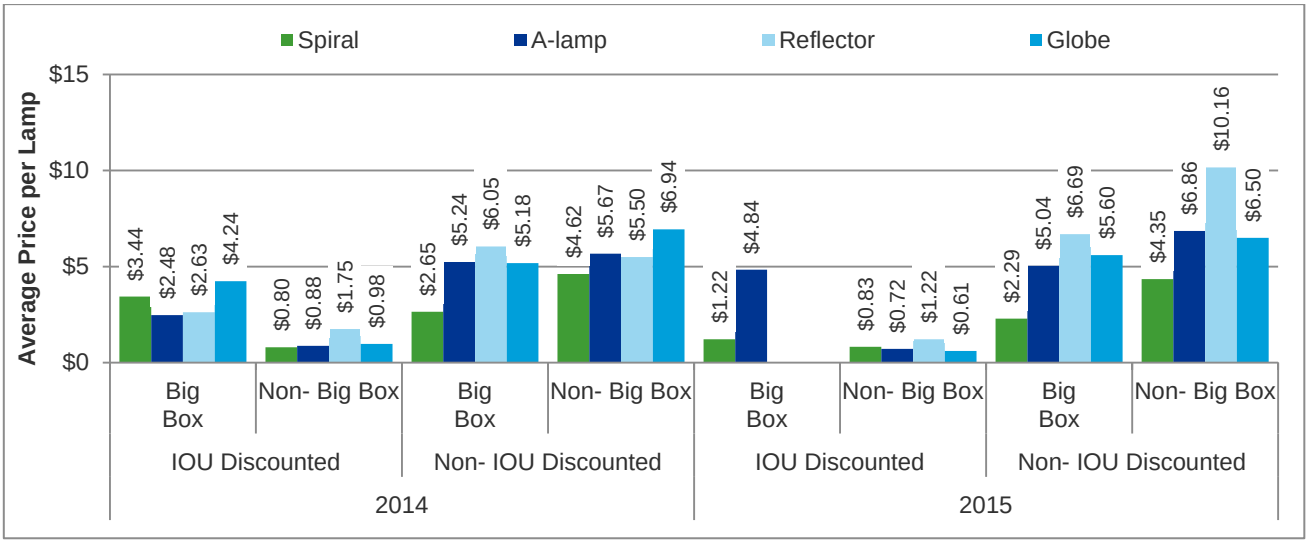
Figure 45 shows the average price per lamp for MSB CFLs with and without IOU discounts by lamp shape and store category in 2014 and 2015. In both years, IOU-discounted lamps were less expensive than those without IOU discounts for the common MSB lamp shapes in both store categories, except for spiral CFLs in 2014.

In 2015, the difference in average price between spiral CFLs with and without IOU discounts was greater in non-big box stores compared to big box stores ($3.52 less expensive per lamp in non-big box stores compared to $1.07 less expensive per lamp in big box stores). In 2014, the difference in average price between IOU-discounted and non-discounted spiral CFLs was also greater in non-big box stores ($3.82 less expensive), but in big box stores the average price per IOU-discounted spiral CFLs was $0.79 *more* than for spirals without IOU discounts). The reason for the higher average price for IOU-discounted spiral CFLs in big box stores in 2014 is likely due to the limited number of spiral CFLs that were IOU-discounted in that year and the fact that some of these lamps models were 3-way spiral CFLs (which tend to be more expensive). Reflector CFLs generally had the greatest gap in the average price between IOU-discounted and lamps without IOU discounts in both store categories and in both years compared to the difference in

[81] Note that the table shows lamps equivalent to 100 W traditional incandescent lamps or lower (i.e., it does not include high-wattage lamps).

average price between lamps with and without IOU discounts for other CFL shapes.

**Figure 45: Average price per MSB CFL with and without IOU discounts by lamp shape and store category, 2014 and 2015 (retail store shelf surveys)**




See Table 92 in Appendix C for the number of IOU-discounted and non-discounted MSB CFLs by lamp shape, store category, and year.

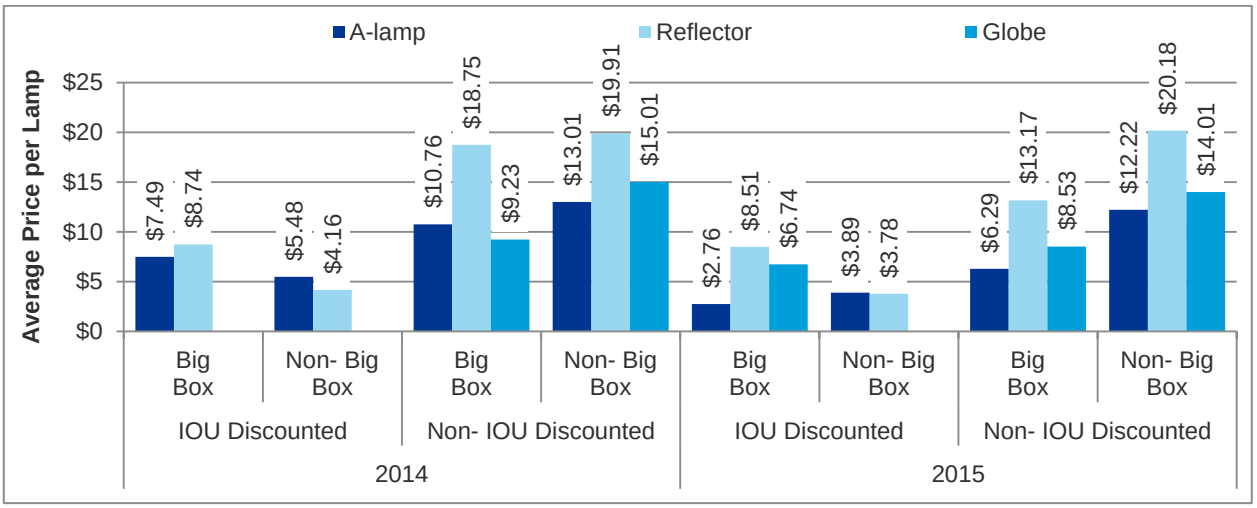
Figure 45 shows the average price per MSB LED lamps with and without IOU discounts by lamp shape and store category in 2014 and 2015. In both years, IOU-discounted lamps were less expensive than non-IOU discounted lamps in both store categories. Among LED lamps without IOU discounts, prices were highest for reflector lamps in both years in both store categories, and lowest for LED A-lamps (except for 2014 in big box stores in which LED globes had the lowest average price per lamp without IOU discounts).

In big box stores, the average price per IOU-discounted LED A-lamp was $3.27 less expensive than those without IOU discounts in 2014, while the gap in average price between LED A-lamps with and without IOU discounts widened to $3.53 in 2015. Interestingly, the average price per IOU-discounted LED reflector lamp in big box stores was $10.01 less expensive than LED reflector lamps without IOU discounts in 2014, but the gap between the average price for LED reflector lamps with and without IOU discounts narrowed to $4.66 in 2015.

In non-big box stores, the difference between the average price for IOU-discounted LED lamps and non-IOU discounted LED lamps was more pronounced than the difference found in big box stores. The average price per lamp for IOU-discounted LED A-lamps was $7.53 less expensive than LED A-lamps without IOU discounts in 2014 and $8.33 less expensive in 2015. Similarly, the average price per lamp for IOU-discounted LED reflectors in non-big box stores was $15.75 less expensive than LED reflectors without IOU discounts in 2014 and $16.40 less expensive in 2015.

For details on the average price of MSB CFLs and LED lamps by lumen bin and lamp shape, please see Table 98 through Table 105 in Appendix C.

**Figure 46: Average price per MSB LED lamp with and without IOU discounts by lamp shape and store category, 2014 and 2015 (retail store shelf surveys)**




See Table 93 in Appendix C for the number of IOU-discounted and non-discounted MSB LED lamps by lamp shape, store category, and year.

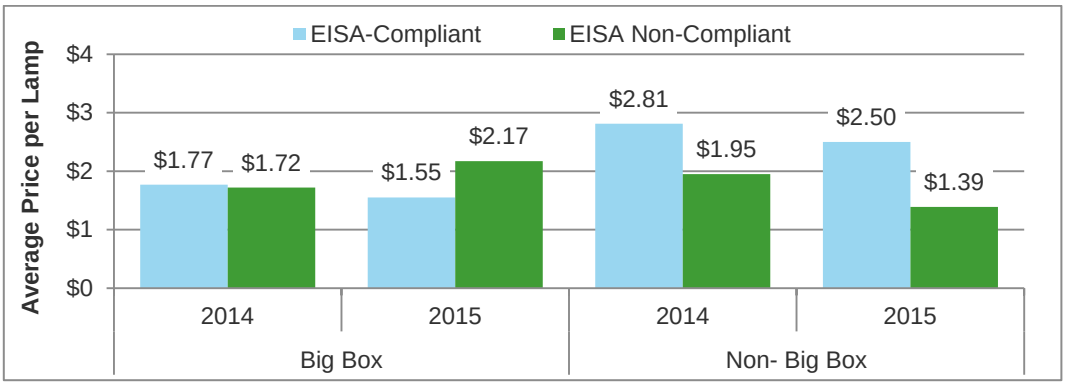
## 4.4.6 By EISA compliance and store category

Figure 47 shows the average price per EISA-compliant and EISA-non-compliant incandescent and halogen lamp by store category in 2014 and 2015. The average price for EISA-compliant lamps was approximately $1.00 less per lamp in big box stores compared to non-big box stores in both years. EISA-non-compliant lamps, on the other hand, were $0.78 more expensive per lamp in big box stores compared to non-big box stores.

Regarding price trends between years, the average price for EISA-compliant lamps declined more than 10% between years in both big box and non-big box stores. For EISA-non-compliant lamps, the average price rose by more than 25% per lamp in big box stores, but declined nearly 30% in non-big box stores between years.

For details on the average price of EISA-compliant and non-compliant incandescent and halogen lamps by lumen bin (high, medium high, medium low, and low lumens), please see Table 93 through Table 97 in Appendix C.

**Figure 47: Average price per EISA-compliant and EISA non-compliant incandescent / halogen lamp, 2014 and 2015 (retail store shelf surveys)**




See Table 109 in Appendix C for the number of EISA-compliant and non-compliant lamps by store category and year.

# 5. MARKET DEMAND

This chapter of the report summarizes the demand-side of California's residential market for replacement lamps, including consumer awareness of various lamp technologies and details regarding lamp purchases and consumers' purchasing decisions. The chapter also reviews consumer familiarity with EISA. Finally, the chapter discusses lamp disposition in the households of PG&E, SCE, and SDG&E residential electric customers.

## 5.1 Lamp awareness and purchases

Section 5.1 reviews awareness of various lamp technologies among PG&E, SCE, and SDG&E residential electric customers over time. Key findings include:

- CFL awareness remained steady at approximately 85% of the population in 2013 and 2015 after declining significantly between 2012 and 2013. Eighty-five percent of the population also reported awareness of LED lamps in 2015, while awareness of energy-efficient (EISA-compliant) incandescent lamps remained lower, at roughly three out of five consumers.
- During the 2015 survey, more than 60% of consumers reported having purchased CFLs, compared to roughly 30% for LED lamps and less than 20% for energy-efficient incandescent lamps.
- Recent lamp purchases were largely concentrated in home improvement stores, with roughly three-quarters of CFL, LED lamp, and energy-efficient incandescent lamp purchasers reporting having purchased lamps in this channel between January 2013 and summer 2015.
- Six percent of the population reported having purchased lamps online between January 2013 and summer 2015.

### 5.1.1 CFLs

The 2015 PG&E, SCE, and SDG&E residential electric customer telephone surveys included questions to address general awareness of CFLs. We started with an unprompted question to gauge awareness of different energy-efficient lamp types ("Can you start by telling me what kinds of energy-efficient light bulbs you've heard of?"). For respondents who did not mention CFLs, we followed with a prompted awareness question: "Compact fluorescent light bulbs – also known as CFLs – come in many shapes and sizes. The most common type of CFL is made with a glass tube bent into a spiral and fits in a regular light bulb socket. Have you ever heard of them?"

The 2012 and 2013 consumer telephone surveys addressed awareness of CFLs in a similar manner. Data are also available from previous evaluation reports regarding awareness rates among residential customers. While the phrasing of survey questions is not entirely consistent from year to year, each survey phase addressed general awareness of CFLs. Figure 48 shows significant increases in awareness of CFLs between 2001 and 2003 and again between 2003 and 2006. The awareness rate held steady through 2012 before declining by a significant margin from 96% of the respondent population in 2012 to 87% in 2013.[82] The awareness rate held steady between 2013 and 2015.

[82] Unless otherwise stated, we report statistical significance at the 90 percent level of confidence throughout this section of the report.

As explained in the previous market update report,[83] there are several theories regarding declining CFL awareness. These include the following:

- As newer energy-efficient lamp technologies compete for wallet-share, they also compete for mind-share. As a result, CFLs may no longer be top-of-mind for some consumers, which could result in declining awareness of CFLs.
- Related to the point above, the expanding range of lamp technologies may be causing confusion among purchasers, particularly given that many CFL shapes resemble incandescent lamps (i.e., with the spiral shape "hidden" inside a reflector or globe cover). This confusion could also result in declining awareness for CFLs.
- The heightened market attention to CFLs in previous years—such as Wal-Mart's goal of selling 100 million CFLs in 2007[84] and the California IOUs' providing incentives for nearly 100 million CFLs during the 2006-08 program cycle[85]— has waned, which could contribute to declining awareness of CFLs.
- As the range of lamp options expands, there is less retail shelf space available for each lamp technology. This decline in visibility of CFLs at the retail level (concurrent with increased visibility of LED lamps and EISA-compliant halogen lamps) may also be contributing to declining awareness.

While the explanation for the trend is unclear, recent studies in other regions of the U.S. have shown similar declines – for example, CFL awareness declined from 98% of the residential population in the Pacific Northwest (Idaho, Montana, Oregon, and Washington) in 2012 to 90% in 2013, a statistically significant change.[86] Awareness dropped (again significantly) between 2013 and 2014 (to 86%) but held steady through 2015 at 83%.[87] Similarly, the percentage of the Massachusetts general population who reported awareness of CFLs declined significantly between 2010 and 2012 (from 94% to 87%)[88] and then held steady through 2014 (at 88%).[89]

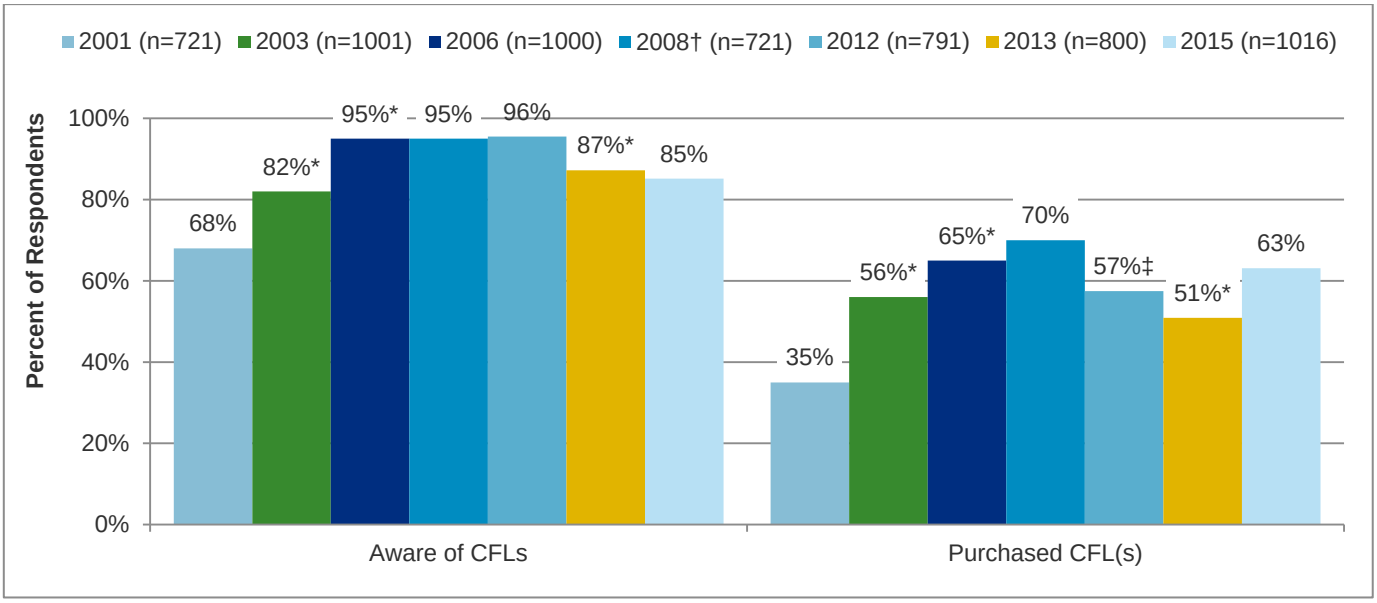
Results for CFL purchase rates among PG&E, SCE, and SDG&E residential electric customers over time are more difficult to compare. The surveys conducted in 2001, 2003, 2006, 2008, and 2015 ask respondents whether they had ever purchased CFLs, while the 2012 and 2013 surveys asked only about CFLs purchased during the 2010-12 program period (and are thus incomparable with the other results). Even without the 2012 and 2013 survey results, CFL purchase rates show a general decline between 2008 and 2015 just as with awareness rates. In the same Pacific Northwest studies as mentioned above, CFL purchase rates also declined between 2012 and 2013 (from 77% to 70%)[90] and again from 2013 to 2014 (to 60%), but then held steady in 2015 (at 57%).[91] In the aforementioned Massachusetts study, the

83 DNV GL, 2014c.
84 Wal-Mart, 2006 and 2007.
85 KEMA, Inc., 2010.
86 DNV KEMA, 2013a.
87 DNV GL, 2015.
88 NMR Group, 2012.
89 The Cadmus Group, Inc., 2015. Note that study results from this period represent the results of phone and web surveys.
90 DNV KEMA, 2013a.
91 DNV GL, 2015.

percentage of customers who reported that they had ever used CFLs dropped from 78% in 2010 to 64% in 2012[92] and held steady at 62% through 2014.[93]

The reasons for declining purchase rates are also unclear and could be similar to the reasons for declining CFL awareness rates. Another possibility is that CFL purchase rates are gradually tapering off as consumers purchase and install more CFLs. Given their long lifetimes relative to incandescent lamps, consumers may be purchasing fewer CFLs because they do not feel they need more CFLs (i.e., because they already have several installed and in storage). Consumers may also be shifting toward purchases of other lamp technologies instead of CFLs.

**Figure 48: Awareness and purchases of CFLs among PG&E, SCE, and SDG&E residential electric customers, 2001—2015 (consumer telephone surveys)**




* Difference from prior study period is statistically significant (note: 2015 purchaser results compared to 2008).
† PG&E and SCE customers only.
‡ Purchaser results not comparable with prior study periods and thus not shown.
2001 data source: XENERGY Inc., 2002. 2003 data source: KEMA-XENERGY and Quantum Consulting, 2003. 2006 data source: Itron and KEMA Inc., 2007. 2008 data source: KEMA, Inc., 2009a.
2012 and 2013 data source: DNV GL, 2015.

## 5.1.2 CFLs compared to other lamp technologies

The 2015 PG&E, SCE, and SDG&E residential electric customer telephone surveys also included questions to address general awareness of LED lamps and EISA-compliant halogen lamps (to which we referred in the survey as "energy-efficient incandescent lamps"). As described above, the surveys included an unprompted question to gauge awareness of these lamp types ("Can you start by telling me what kinds of energy-efficient light bulbs you've heard of?"). If respondents did not mention LED lamps or energy-

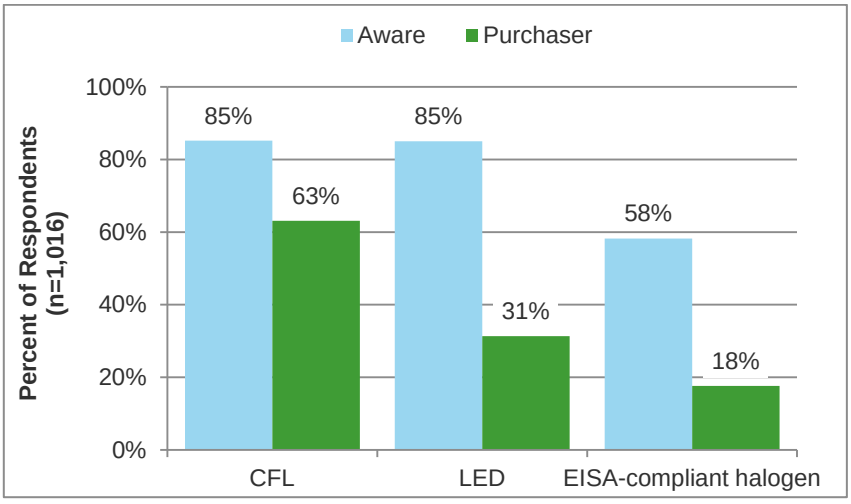
92 NMR Group, 2012. Note that the study does not address whether respondents have "ever purchased" CFLs and instead asks whether respondents have ever used of CFLs. These two groups (CFL users and CFL purchasers) are not exactly the same, but may be considered rough approximations that are useful for comparison.

93 The Cadmus Group, Inc., 2015. Again, note that study results from this period represent the results of phone and web surveys.

efficient incandescent lamps in response to the unprompted awareness question, the survey followed with prompted awareness questions that provided brief descriptions of each technology and asked respondents whether they were aware of each one.[94]

Among respondents who reported awareness of LED lamps (prompted or unprompted), we asked whether they had ever purchased LED lamps. Similarly, we asked respondents who were aware of energy-efficient incandescent lamps whether they had ever purchased them. Figure 49 shows the results for awareness and purchases of LED lamps and energy-efficient incandescent lamps based on survey results from 2015 compared with results for CFLs from the same period. As shown, awareness of CFLs and LED lamps was the same among PG&E, SCE, and SDG&E residential electric customers in 2015 at 85%, while awareness of energy-efficient incandescent lamps remained lower (at 58%). The percentage of respondents who reported having purchased CFLs as of 2015 was twice the percentage who reported having purchased LED lamps (63% versus 31%, respectively). For LED lamps, telephone survey results from 2008 suggest that approximately 55% of California residents were familiar with LED lamps at that time.[95] Results from 2015 suggest a significant increase over this earlier percentage. The percentage of respondents who reported having purchased energy-efficient incandescent lamps was much lower than for the other technologies in 2015 (18%).

**Figure 49: Awareness and purchases of LED lamps and EISA-compliant halogen lamps among PG&E, SCE, and SDG&E residential electric customers, 2015 (consumer telephone surveys)**




During the 2015 consumer telephone surveys, we asked consumers who reported that they had not purchased LED lamps why they had not done so. Nearly half stated that they had not purchased LED lamps because they did not need light bulbs (48%; n=493). Approximately 20% of respondents who had not purchased LED lamps before we fielded the survey (during the summer of 2016) said it was because

94 The prompted awareness question for LED A-lamps was: "Have you heard of LEDs? They are also known as light emitting diodes and are the most efficient light bulbs available today." The prompted awareness question for energy-efficient incandescent lamps was: "Have you ever heard of energy-efficient incandescent bulbs? These bulbs usually come in different wattages than regular incandescents, such as 29 Watts, 42 Watts, 53 Watts, or 72 Watts."

95 The Cadmus Group, Inc., *et al.*, 2009.

LED lamps are too expensive. Four percent said they hadn't purchased LED lamps because they were not sure how well the lamps would work, and the same percentage said they hadn't purchased LED lamps because they did not know enough about them. Three percent reported that they were not sure where to buy LED lamps.

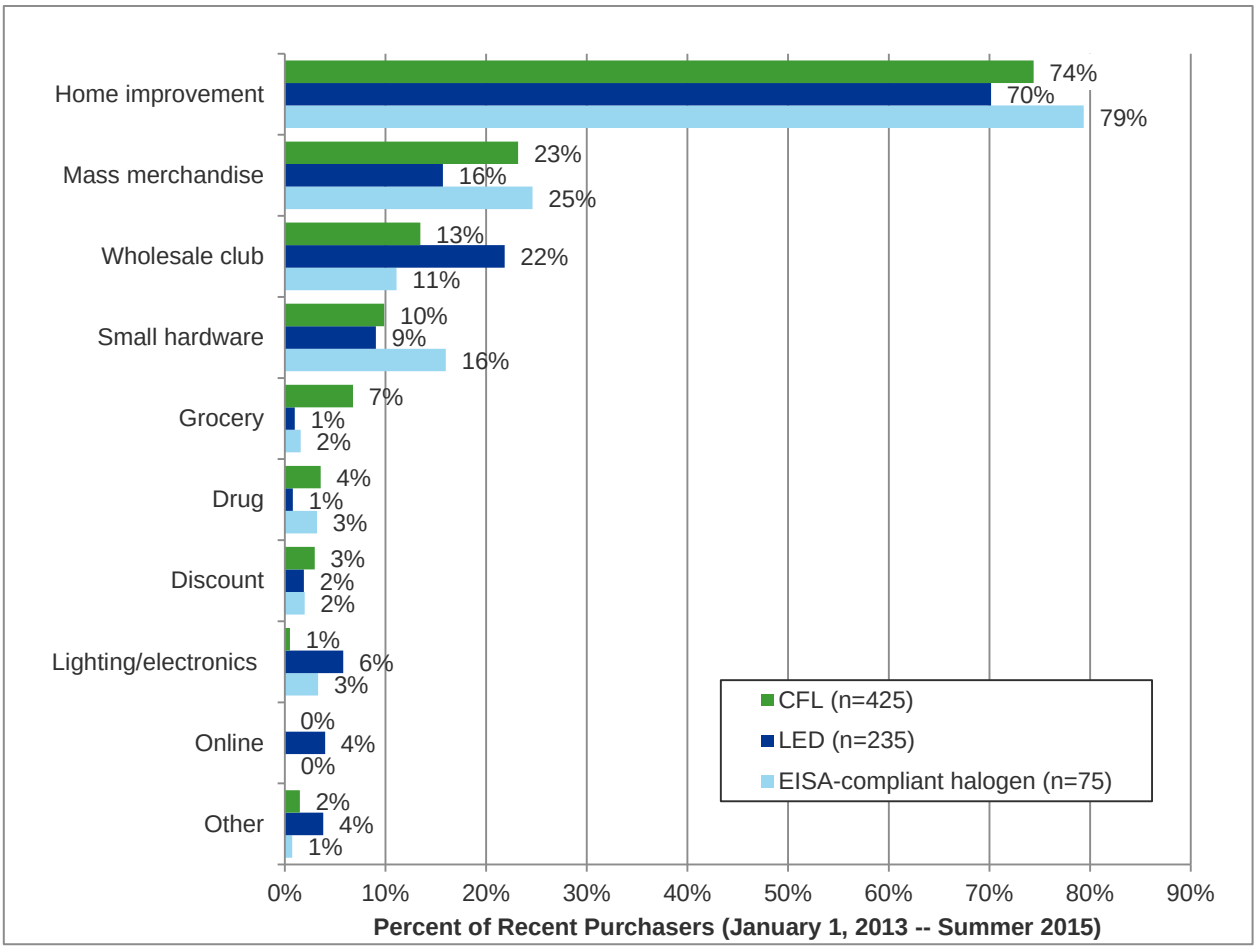
### 5.1.3 Recent purchase locations

The 2015 consumer telephone surveys included questions regarding recent purchases of CFLs, LED lamps, and EISA-compliant halogen lamps. In this context, we defined "recent" as "since January 1, 2013." DNV GL fielded the surveys during the summer of 2016, so "recent purchases" refers to the period between January 1, 2013 and summer 2016. Within that timeframe, approximately 43% of PG&E, SCE, & SDG&E residential electric customers reported that they purchased CFLs, 22% purchased LED lamps, and 7% purchased EISA-compliant halogen lamps (n=1,016).

We asked these consumers where they purchased each type of lamp, and categorized the retail store names they provided into retail channels. If respondents were not able to name the exact retail store, we followed with a question that asked them to identify the retail channel.[96] Figure 49 shows the responses to these two questions combined for each of the three technologies. As shown, the vast majority of purchasers of each of the three lamp technologies reported that they purchased their lamps most recently in home improvement stores (roughly three-quarters for each technology). After the home improvement channel, a higher proportion of CFL and EISA-compliant halogen purchasers cited mass merchandise stores as their purchase location than any other retail channels (23% and 25%, respectively), while a higher proportion of LED lamp purchasers cited wholesale clubs than other channels (22%). While these questions did not explicitly ask about online purchases, 4% of LED lamp purchasers mentioned having purchased LED lamps online recently, while none of the CFL or energy-efficient lamp purchasers mentioned the online channel.

[96] For CFLs, for example, we first asked, "At what stores did you purchase those CFLs?" (referring to lamps purchased since January 1, 2013). If the respondent could not name the store, we then asked, "Was it a discount store such as 99 Cents Only or Dollar Tree; a grocery store; a small hardware store; a lighting or electronics store; a drug store; a home improvement store such as Home Depot, Lowe's, or Orchard Supply; a mass merchandise store such as Wal-Mart or Target; a wholesale club store like Costco or Sam's Club; or some other type of store?" In the second question, we randomized the order in which we presented the retail channels each time we asked the question.

**Figure 50: Recent purchase locations (between January 1, 2013 and summer 2015) of CFLs, LED lamps, and EISA-compliant halogen lamps among PG&E, SCE, and SDG&E residential electric customers, 2015 (consumer telephone surveys)**




Note: Survey question allowed multiple responses.

During the 2015 consumer telephone survey, we asked PG&E, SCE, and SDG&E residential electric customers whether they had purchased any light bulbs (of any technology) online since January 1, 2013. Approximately 6% of consumers reported that they had done so (n=1,016).[97] Of these, 41% reported having purchased LED lamps online—more than twice as many as reported purchasing any other lamp technology (Table 16). Nearly three out of five respondents who made recent online lamp purchases reported having purchased their lamps from Amazon.com (57%; Table 17).

[97] Note that this is greater than the proportion who mentioned online purchases in response to the open-ended question regarding recent purchase locations above. This may be because telephone survey respondents either forgot about online purchases until prompted by the interviewer, or because they did not consider purchases outside of brick-and-mortar stores in response to the earlier survey questions regarding purchase locations.

**Table 16: Lamp technologies purchased online (between January 1, 2013 and summer2015), 2015 (consumer telephone surveys)**

| Technology | Online Purchasers (n=64) |
|---|---|
| LED | 41% |
| CFL | 17% |
| Traditional incandescent | 16% |
| Halogen | 15% |
| EISA-compliant halogen | 4% |
| Linear fluorescent | 1% |
| Other | 13% |
| Don't know | 11% |

Note: Survey question allowed multiple responses.

**Table 17: Online lamp purchase locations among online purchasers of any lamp type between January 1, 2013 and summer 2015 (consumer telephone surveys)**

| Online Retailer | Online Purchasers Who Could Name Retailer (n=56) |
|---|---|
| Amazon.com | 57% |
| Homedepot.com | 9% |
| 1000Bulbs.com | 6% |
| Walmart.com | 2% |
| Bulbs.com | 1% |
| Other website | 17% |
| Don't know | 11% |

Note: Survey question allowed multiple responses.

## 5.2 Lamp storage, installation, and disposal

Section 5.2 reviews storage, installation, and disposal of various lamp technologies among PG&E, SCE, and SDG&E residential electric customers over time. Key findings include:

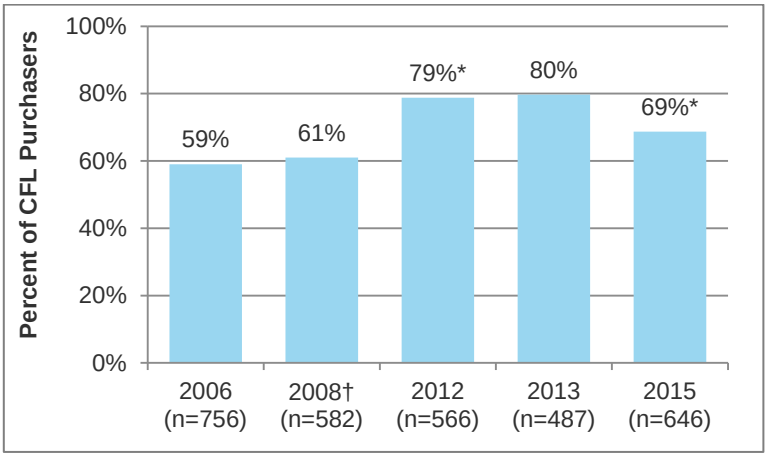
- In 2015, 7 out of 10 CFL purchasers were storing CFLs as of 2015, down significantly from 8 out of 10 in 2013. On average, purchasers had approximately 13 CFLs installed and 5 in storage per household in 2015. These quantities have held steady since 2012.
- In 2015, nearly two-thirds of CFL purchasers who were storing CFLs said that they were doing so because they wanted to have some on hand if an installed bulb burned out. Purchasers have consistently cited this reason for storing CFLs more than any other reason since 2006.

### 5.2.1 CFL and LED lamp installation and storage

This section presents consumer survey responses that pertain to the installation and storage of CFLs and LED lamps. Historical CFL data allow us to interpret trends over time, while comparable data for LED lamps are only available since 2015. As such, the figures in this section that compare results over time only reflect CFL responses, while CFL and LED results are discussed throughout the text.

Figure 51 shows the percentage of CFL purchasers in PG&E's, SCE's, and SDG&E's electric service territories who were storing one or more CFLs in 2006, 2008, 2012, 2013, and 2015. Results suggest no strong pattern in storage rates. Nearly 70% of CFL purchasers were storing CFLs as of 2015 (69%), down significantly from 80% in 2013. There were no statistically significant differences in the percentage of CFL purchasers who were storing CFLs between 2012 and 2013, but there was a significant difference in between 2008 and 2012. In comparison, 38.7% of 318 LED purchasers among PG&E, SCE, and SDG&E residential electric customers claimed to have at least one LED lamp in storage.[98] [99]

**Figure 51: Percent of CFL purchasers storing 1 or more CFLs among PG&E, SCE, and SDG&E residential electric customers, 2006, 2008, 2012, 2013, and 2015 (consumer telephone surveys)**




* Difference from prior study period is statistically significant.
† PG&E and SCE customers only.
2006 data source: Itron and KEMA Inc., 2007. 2008 data source: KEMA, Inc., 2009a. 2012 and 2013 data source: DNV GL, 2015.

Between 2006 and 2013, the number of CFLs in storage among CFL purchaser households increased from an average of 2.5 CFLs to an average of 5.5 CFLs and then held at roughly 5 CFLs through 2015 (Table 18)[100] The average number of lamps in storage increased between 2006 and 2008 and again between 2008 and 2012 by statistically significant margins, but did not change significantly between 2013 and 2015. The same pattern was apparent in the average number of CFLs installed among CFL purchasers between 2006 and 2015. In comparison, an average of 10.4 LED lamps were installed among the 318

98 DNV GL, 2015.

99 Note that respondents who claimed that more than 100 LED Lamps were installed or in storage, or indicated don't know to these questions were dropped from this analysis.

100 It is important to note that these data are based on consumer self-reports from telephone surveys. As such, the point estimates are less reliable than the directionality of changes between years.

respondents in PG&E, SCE, and SDG&E territories who purchased LED lamps.[101] Among these same purchases, 2.2 LED lamps were in storage on average.

**Table 18: Average number of CFLs installed and in storage among CFL purchasers in PG&E, SCE, and SDG&E residential electric service territories, 2006, 2008, 2012, 2013, and 2015 (consumer telephone surveys)**

| Year | Average # CFLs Installed | Average # CFLs in Storage | Number of CFL Purchasers |
|---|---|---|---|
| 2006 | 6.8 | 2.5 | 756 |
| 2008† | 10.3* | 3.6* | 582 |
| 2012 | 13.5* | 4.9* | 566 |
| 2013 | 13.3 | 5.5 | 487 |
| 2015 | 12.9 | 5.1 | 623 |

* Difference from prior study period is statistically significant.
† PG&E and SCE customers only.
2006 data source: Itron and KEMA Inc., 2007. 2008 data source: KEMA, Inc., 2009a. 2012 and 2013 data source: DNV GL, 2015.

When asked why they were storing CFLs, the majority of CFL purchasers in all five study periods stated that it was so they would have some on hand if an installed bulb burned out (approximately 63% of CFL purchasers in 2015; Table 19). The percentage of purchasers who cited this reason declined significantly from 2006 to 2008, and again from 2008 to 2012, but more than half of purchasers cited this reason in each study period. In 2013 and 2015, roughly fifteen percent of CFL purchasers stated that they were storing CFLs because they purchased more than they needed, down significantly from 2008. Other responses were mixed.

**Table 19: Reasons for storing CFLs among CFL purchasers in PG&E, SCE, and SDG&E residential electric service territories who were storing CFLs, 2006, 2008, 2013 and 2015 (consumer telephone surveys)**

| Reasons | Percent of CFL Purchasers | | | | |
|---|---|---|---|---|---|
| | 2006 (n=460) | 2008† (n=582) | 2012 (n=429) | 2013 (n=377) | 2015 (n=447) |
| So I have them on hand if a bulb burns out | 77% | 70%* | 54%* | 62% | 63% |
| Purchased more CFLs than I needed | 19% | 23% | 16%* | 14% | 15% |
| Bought them on sale | 6% | 11%* | 9% | 7% | 6% |
| Can't/won't use in certain applications/rooms | 3% | 4% | 1% | 2% | 1% |
| Other reasons | 7% | 13%* | 27%* | 24% | 18% |
| Don't know | 2% | 1% | 0% | 2% | 4% |

Note: Survey question allowed multiple responses.
* Difference from prior study period is statistically significant.
† PG&E and SCE customers only.
2006 data source: Itron and KEMA Inc., 2007. 2008 data source: KEMA, Inc., 2009a. 2012 and 2013 data source: DNV

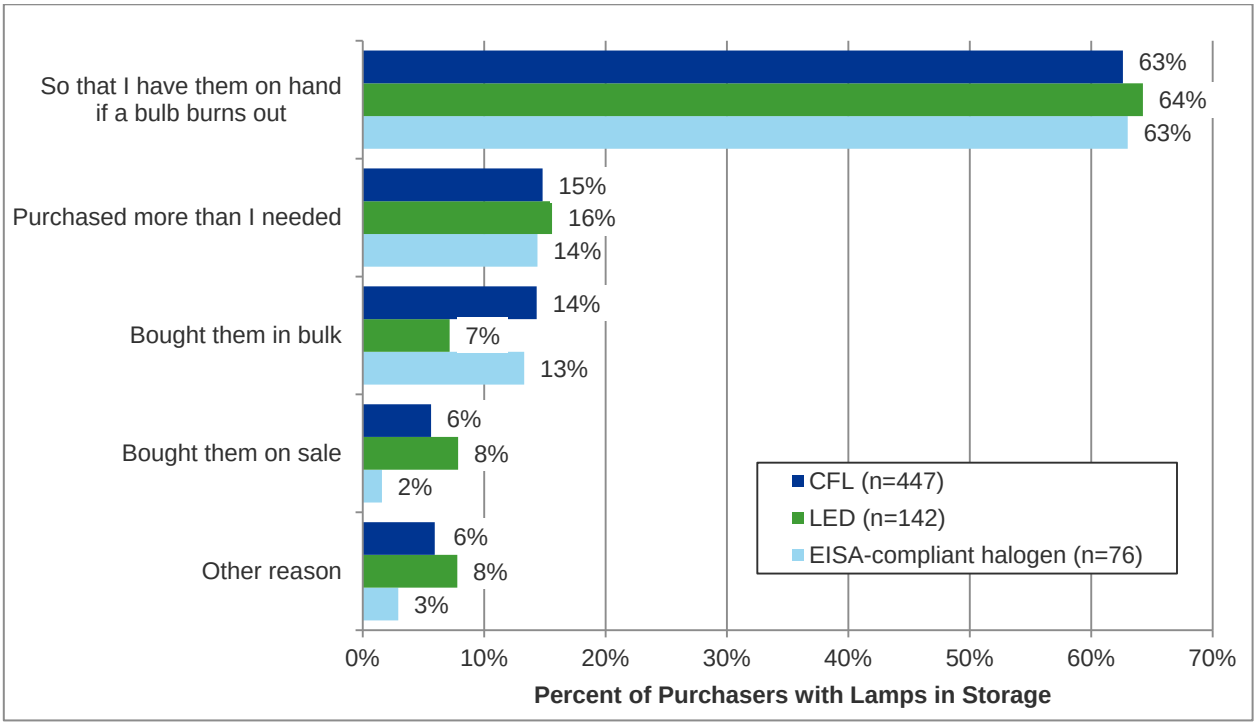
[101] DNV GL, 2015

GL, 2015.

### 5.2.2 Reasons for storing lamps

As with CFLs, we asked consumers who were storing LED lamps and/or EISA-compliant halogen lamps why they were doing so. Consumers gave similar reasons for storing lamps among each of the lamp technologies, with the primary reason being that consumers want to have a spare lamp or lamps on hand in case one of the lamps they have installed burns out (more than 60% of purchasers who were storing lamps of each technology; Figure 52). For each of the three technologies, roughly four times as many consumers cited this response compared to any other.

**Figure 52: Reasons for storing CFLs, LED lamps, and EISA-compliant halogen lamps among purchasers in PG&E, SCE, and SDG&E residential electric service territories who were storing lamps, 2015 (consumer telephone surveys)**




Note: Survey questions allowed multiple response

### 5.2.3 CFL Disposal

During the consumer telephone survey, interviewers asked respondents who currently had CFLs installed in their homes at the time of the 2012 and 2015 surveys[102] whether they ever had any CFLs that they needed to discard. As show (Table 20), approximately half of the respondents in each year said they had—50% in 2012 (n=942) and 53% in 2015 (n=602). Of these, more than one-third reported that they simply threw their unwanted CFLs in the trash in 2012 (38%). Disappointingly, this increased to nearly

[102] The 2013 survey did not include the battery of questions related to CFL disposal.

half of respondent who reported that they had previously disposed of CFLs in the 2015 survey (48%), a statistically significant change. Interestingly, however, the share of respondents who reported having taken spent CFLs to recycling centers also increased significantly between 2012 and 2015 (from 14% to 23%, respectively). The percentage of respondents who reported other methods of proper disposal—such as taking CFLs to a community hazardous waste disposal center or returning them to a retail store—both remained unchanged between years at roughly one-tenth of respondents each.

**Table 20: CFL disposal methods among PG&E, SCE, and SDG&E residential electric customers who have had one or more CFLs requiring disposal, 2012 and 2015 (consumer telephone surveys)**

| Response | Percent of Respondents | |
|---|---|---|
| | 2012 (n=493) | 2015 (n=468) |
| Threw them away / Threw them in the trash | 38% | 48%* |
| Took them to a recycling center | 14% | 23%* |
| Took them to a community hazardous waste disposal center | 11% | 11% |
| Returned them to a retail store | 9% | 8% |
| Haven't disposed of them yet | 7% | 6% |
| Put them in the standard glass/paper/plastic recycling bin | 4% | - |
| Gave them away | 2% | - |
| Other response | 9% | 4% |
| Don't know | 7% | 3% |

Note: Survey question allowed multiple responses.

Interviewers also asked respondents who were aware of CFLs at the time of the 2012 and 2015 surveys whether they had seen or heard information regarding how they should dispose of CFLs. Between 2012 and 2015, the percentage of respondents who replied that they had seen or heard such information dropped from 42% to 31% (n=942 in 2012 and 602 in 2015). Of these, the percentage who reported that they had seen or heard that CFLs must be recycled increased dramatically from 25% in 2012 to 45% in 2015; Table 21). Despite this increase, the proportion of the population of PG&E, SCE, and SDG&E residential electric customers who have seen or heard information regarding proper CFL disposal (i.e., that CFLs must be recycled) was less than 15% in both 2012 and 2015.

**Table 21: Messages seen or heard regarding proper CFL disposal among PG&E, SCE, and SDG&E residential electric customers who have seen or heard information regarding CFL disposal, 2012 and 2015 (consumer telephone surveys)**

| Response | Percent of Respondents | |
|---|---|---|
| | 2012 (n=418) | 2015 (n=271) |
| CFLs need to be recycled | 25% | 45%* |
| CFLs contain harmful/dangerous materials | 16% | 12% |
| Do not throw CFLs into the trash | 16% | 7%* |
| CFLs contain mercury | 14% | 7%* |
| CFLs should be returned to a retail store | 10% | 9% |
| CFLs are hazardous waste | 8% | - |
| CFLs need to be taken somewhere to dispose of them | 7% | - |
| CFLs need to be wrapped in paper/plastic before being thrown away | 4% | 8% |
| Other response | 11% | 9% |
| Don't know | 8% | 14% |

Note: Survey question allowed multiple responses.

## 5.3 Lamp purchasing decisions

Section 5.3 reviews lamp purchasing decisions including the reasons cited by consumers for choosing specific lamp technologies (CFLs or LED lamps), reasons for not selecting alternative lamp technologies, and timing of lamp purchasing decisions (i.e., planned versus impulse purchases). Key findings include:

- CFL purchasers and LED lamp purchasers both cited energy savings as their main reason for choosing their respective lamp technologies. More LED lamp purchasers cited length of lamp life or being good for the environment as reasons for purchasing LED lamps than CFL purchasers cited these reasons for purchasing CFLs, but more CFL purchasers cited low prices or prior experience with the technology as reasons for purchasing CFLs than LED lamp purchasers cited these as reasons for purchasing LED lamps.
- Lamp shoppers who did *not* purchase LED lamps cited lamp price far more often than any other reason followed by a lack of familiarity with the technology. Reasons cited by CFL non-purchasers as reasons for *not* selecting CFLs were more varied, but the top reason cited among CFL non-purchasers for not purchasing CFLs was a dislike of the quality or color of the light from CFLs.
- Nearly three-quarters of intercepted lamp purchasers during the 2014 and 2015 shopper intercept surveys told interviewers that they had planned to purchase replacement lamps that day, while more than one-quarter of shoppers made "impulse purchases." Impulse purchasing was lowest among halogen and incandescent lamp purchasers (13%-21% of purchasers said they hadn't planned to buy replacement lamps while shopping on the day we interviewed them) and highest among LED lamp purchasers (38%).

### 5.3.1 Reasons for purchasing CFLs or LED lamps

During the in-store shopper intercept surveys fielded in 2014 and 2015, field researchers asked CFL purchasers why they chose CFLs. We also asked LED lamp purchasers why they chose LED lamps. Respondents could provide multiple reasons for their choices if they wished.

Figure 53 combines results among CFL and LED lamp purchasers and shows the top reasons CFL purchasers provided for purchasing CFLs and the top reasons LED lamp purchasers provided for purchasing LED lamps across the 2014 and 2015 survey results.[103] As shown, more than half of CFL and LED lamp purchasers cited energy savings as a reason for choosing their selected technology (56% of CFL purchasers and 59% of LED purchasers). This was also the most frequently cited reason for choosing CFLs or LED lamps during the 2012 and 2013 intercept surveys when roughly two-thirds of CFL and LED lamp purchasers cited energy savings as a reason for choosing their lamp technology.[104]

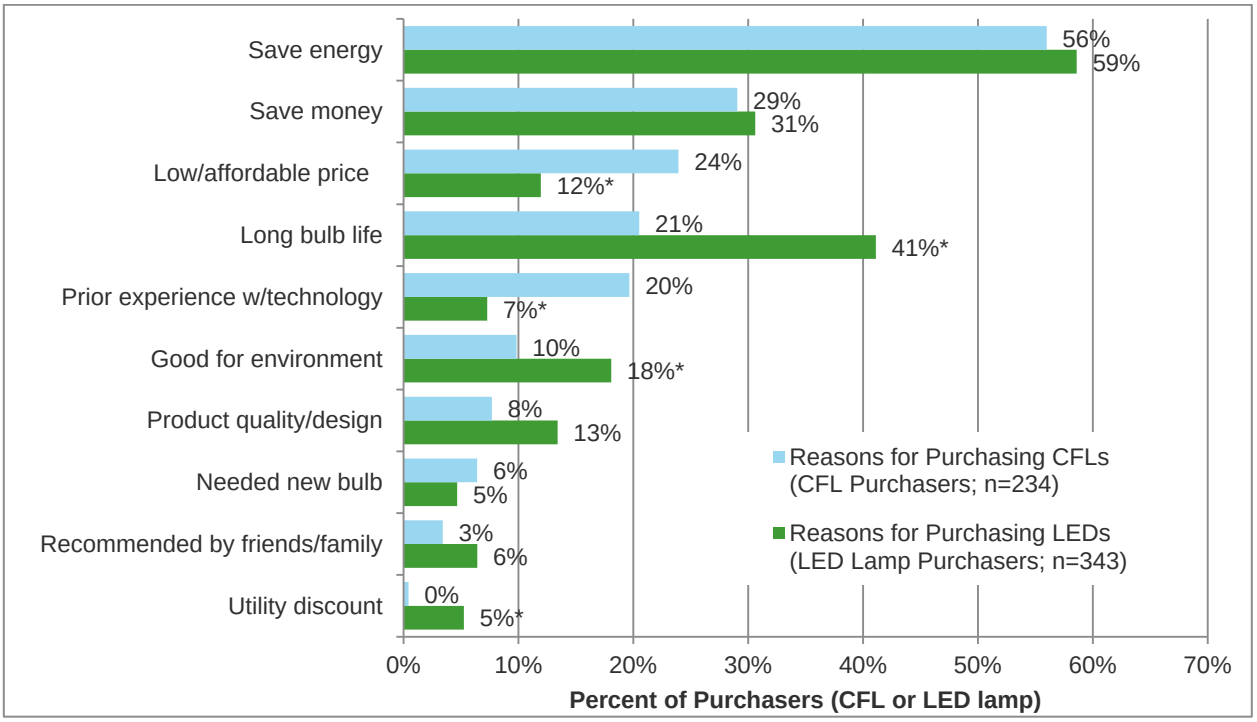
Similar proportions of CFL and LED lamp purchasers surveyed in 2014 and 2015 also mentioned money savings (29% of CFL purchasers and 31% of LED lamp purchasers), but while money savings was the second most frequently-cited reason among CFL purchasers, it was the third most frequently-cited among LED lamp purchasers. A significantly greater percentage of LED lamp purchasers cited the length of lamp life as a reason for purchasing LED lamps (41%) than CFL purchasers cited lamp life as a reason for purchasing CFLs (21%). Other noteworthy differences in the reasons provided by CFL purchasers versus LED lamp purchasers include:

- **Low or affordable price.** Not surprisingly (given that LED lamps are typically more expensive than CFLs), a significantly higher proportion of CFL purchasers mentioned this as the reason for their purchase than LED lamp purchasers (24% versus 12%, a statistically significant difference).
- **Prior experience with the technology.** Again, not surprisingly—given the relatively recent market introduction of LED lamps as compared with CFLs—a significantly greater percentage of CFL purchasers mentioned prior experience with the lamp technology than LED lamp purchasers (20% versus 7%, a statistically significant difference).
- **Good for environment.** The percentage of LED lamp purchasers who said that a reason for their purchase was that it is good for the environment was significantly higher than the percentage of CFL purchasers who cited this reason (18% versus 10%, a statistically significant difference).
- **Utility discount.** Five percent of LED lamp purchasers cited a utility discount as the reason for their lamp purchase, while no CFL purchases cited this as a reason for their purchase (5% versus 0%, a statistically significant difference).

103 To keep the size of the figure manageable, we show only the reasons cited by at least 3 percent of respondents in either group (CFL purchasers or LED A-lamp purchasers).

104 DNV GL 2014c.

**Figure 53: Top reasons for choosing CFLs (among CFL purchasers) and top reasons for choosing LED lamps (among LED lamp purchasers), 2014/2015 (shopper intercept surveys)**




* Difference from CFL Purchaser results is statistically significant at the 90 percent level of confidence.
Note: Figure combines results from 2014-15 and 2015-16 shopper intercept surveys.
Note: Survey questions allowed multiple responses.

## 5.3.2 Reasons for not purchasing alternative technologies

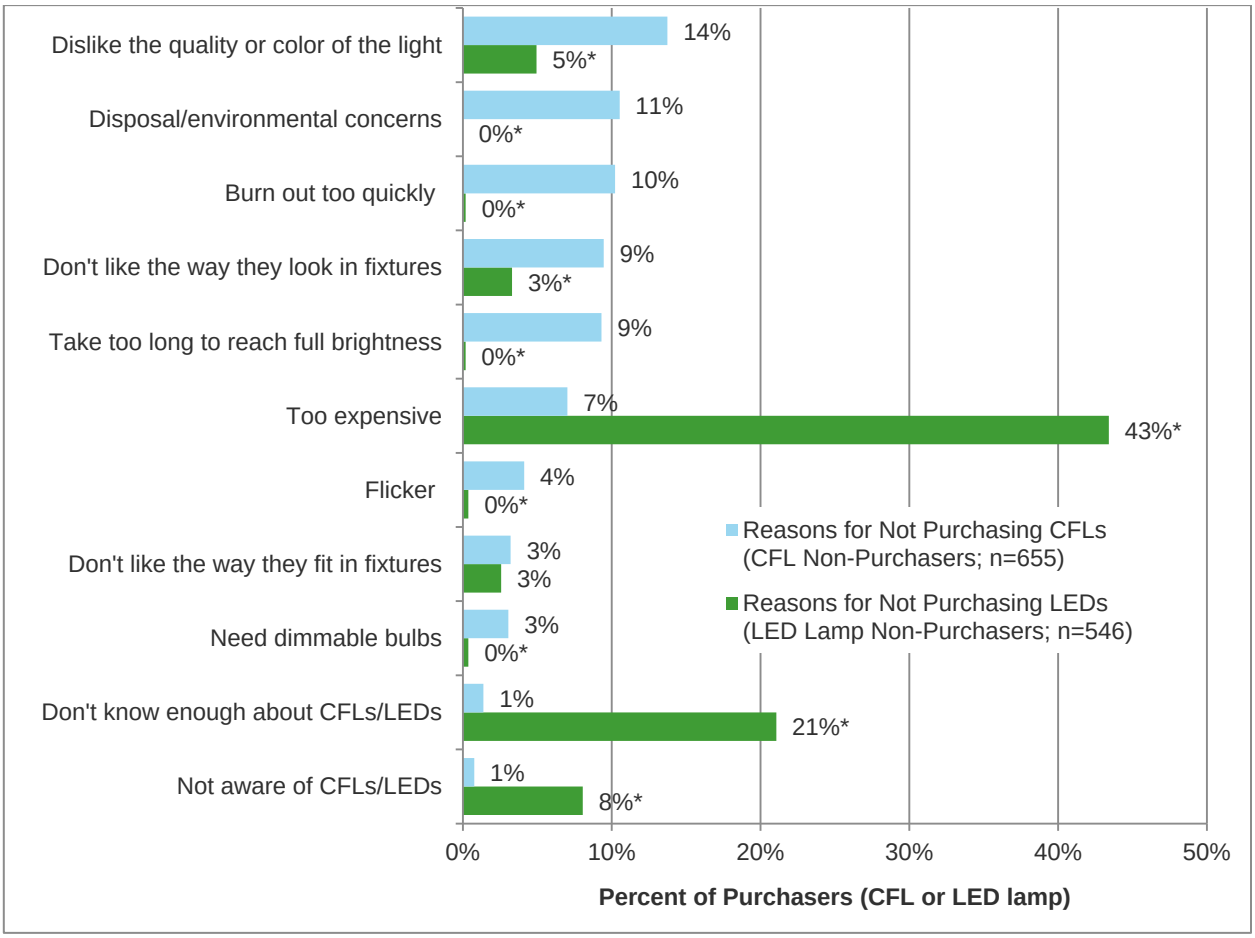
During the shopper intercept surveys, field researchers asked lamp purchasers who purchased any lamp technology other than CFLs (e.g., incandescent, halogen, or LED) why they did not choose CFLs. Researchers also asked purchasers who selected technologies other than LED lamps (e.g., incandescent, halogen, and CFL) why they did not choose LED lamps. These questions were constrained by the availability of the alternate technology in the particular store in which the shoppers were intercepted—for example, we did not ask non-LED purchasers why they didn't choose LED lamps if LED lamps were not available in the retail channel in which they were shopping. Of purchasers who selected neither CFLs nor LED lamps, field researchers asked both questions.

Figure 54 combines the responses to both questions across 2014 and 2015 shopper intercept survey results.[105] Results suggest that in most cases, respondents who did not choose CFLs had very different reasons for their selection than respondents who did not choose LED lamps; there were statistically significant differences in the vast majority of top responses provided by CFL non-purchasers versus LED lamp non-purchasers.

[105] Again, to keep the figure size manageable, we show only the reasons cited by at least 3 percent of respondents in either group (respondents who did not purchase CFLs and respondents who did not purchase LED A-lamps).

Among purchasers who did not select CFLs, the most frequently-cited reason was that they dislike the quality or color of the light (14%), while only 5 percent of respondents who did not purchase LED lamps mentioned this reason (this was also the top reason cited among CFL non-purchasers surveyed in the 2012 and 2013 shopper intercepts). The most frequently-cited reason among LED lamp non-purchasers for not selecting LED lamps is that they are too expensive (43%), while this reason was cited by only 7 percent of CFL non-purchasers as reasons for not choosing CFLs (this was also the top reason cited among LED non-purchasers surveyed in the 2012 and 2013 shopper intercept surveys). Another notable difference in results between CFL non-purchasers and LED non-purchasers is that 21% of LED non-purchasers stated that they did not purchase LED lamps because they do not know enough about the lamps compared to only 1% of CFL non-purchasers who did not know enough about CFLs.

**Figure 54: Reasons for not choosing CFLs (among CFL non-purchasers) and for not choosing LED lamps (among LED lamp non-purchasers), 2014/2015 (shopper intercept surveys)**




* Difference from Reasons for Not Purchasing CFLs is statistically significant at the 90% level of confidence.
Note: Figure combines results from 2014-15 and 2015-16 shopper intercept surveys.
Note: Survey questions allowed multiple responses.

### 5.3.3 Planned versus impulse purchases

During the shopper intercept surveys, DNV GL field researchers asked lamp purchasers whether or not they came to the store specifically to buy lamps. As shown in Table 22, slightly less than three-quarters of purchasers said that they planned to purchase replacement lamps when intercepted for the surveys, while more than one-quarter made unplanned or "impulse" purchases. The proportion of planned purchases and impulse purchases was similar among shoppers intercepted during the 2012 and 2013 surveys (76% and 24%, respectively).

Approximately, one-quarter of all purchasers planned to purchase lighting and chose to purchase LED lamps (24%), which represents the largest group of respondents (during the 2012 and 2013 surveys, the largest group of respondents was CFL purchasers who planned their CFL purchases). Another one-fifth of all purchasers planned to purchase lamps and chose to purchase CFLs (19%). Of all purchasers who reported that they planned their lamp purchase when they were intercepted ("planned purchasers"), one-third purchased LED lamps (33%), and another quarter of planned purchasers chose CFLs (26%).

Among intercepted shoppers who had lamps in their shopping carts or baskets but reported that they did not plan to purchase lamps during that shopping occasion—"impulse purchasers"—half purchased LED lamps (52%), and one-quarter of impulse purchasers chose CFLs.

**Table 22: Total planned versus impulse purchases by lamp technology, 2014/2015 (shopper intercept surveys)**

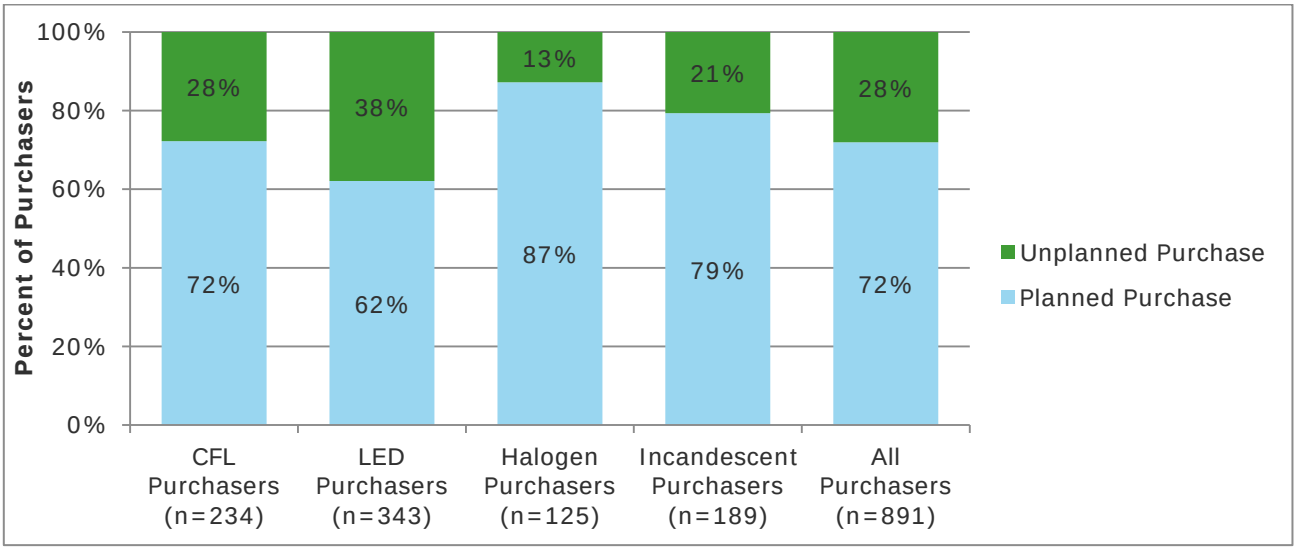
| Planned to Purchase Bulb(s)? | Lamp Technology Purchased | Number of Purchasers | Number of Packages Purchased | % of Total Purchasers* | % of Purchasers by Purchase Type* |
|---|---|---|---|---|---|
| Yes | CFL | 169 | 211 | 19% | 26% |
| | LED | 213 | 356 | 24% | 33% |
| | Halogen | 109 | 139 | 12% | 17% |
| | Incandescent | 150 | 217 | 17% | 23% |
| ***Subtotal – Planned Purchases*** | | ***641*** | ***923*** | ***72%*** | ***100%*** |
| No | CFL | 65 | 85 | 7% | 26% |
| | LED | 130 | 218 | 15% | 52% |
| | Halogen | 16 | 21 | 2% | 6% |
| | Incandescent | 39 | 50 | 4% | 16% |
| ***Subtotal – Impulse Purchases*** | | ***250*** | ***374*** | ***28%*** | ***100%*** |
| **Total** | | **891** | **1,297** | **100%** | |

Results may not total 100% because of rounding.
Note: Figure combines results from 2014-15 and 2015-16 shopper intercept surveys.

As described above, approximately three-quarters of all intercepted shoppers planned to purchase replacement lamps and one-quarter made impulse purchases (72% and 28%, respectively). When we examine the customer composition—planned versus impulse purchasers—for each technology (Figure 55), results suggest the same split among CFL purchasers: three-quarters reported that they planned to purchase replacement lamps and one-quarter reported that they did not (72% and 28%, respectively). A

slightly larger percentage of LED lamp shoppers purchased the LED lamps on impulse (38%), while a smaller percentage of halogen and incandescent lamp purchasers bought those lamp types on impulse (13% and 21%, respectively). The relatively high proportion of impulse purchases for LED lamps suggests a degree of openness among shoppers to try the new technology—perhaps if lamps catch their attention and/or if the price is acceptable.

**Figure 55: Planned Versus Impulse Purchasers by Lamp Technology, 2014/2015 (Shopper Intercept Surveys)**




Note: Results may not total 100% because of rounding.
Note: Figure combines results from 2014-15 and 2015-16 shopper intercept surveys.

## 5.4 Lamp installation intentions

During the shopper intercept surveys, field researchers identified purchasers of the following types of lamps:

- Spiral, A-lamp, reflector, and globe CFLs; and
- LED, incandescent, and halogen lamps of equivalent shapes (A-lamp, reflector, and globe lamps).

Researchers also identified whether each purchaser intended to install his or her new lamps in residential or non-residential applications. If the purchaser planned to install the lamp(s) in residential applications, field researchers then asked whether purchasers intended to install those lamps within the next week. If so, researchers asked detailed follow-up questions to gather information regarding the lamp technologies that purchasers intended to replace with their new lamps for up to two lamps per purchaser. Based on this approach, key findings include:

- More than 90 % of intercepted shoppers were purchasing one of the four CFL shapes of interest or incandescent, halogen, or LED lamps of equivalent shapes for residential use and planned to install them within one week of their purchases.

- Nearly 4 out of 5 incandescent lamps were purchased by shoppers intending to use them as replacements for other incandescent lamps.
- More than 40% of CFLs were purchased with the expectation of replacing other CFLs, and CFL purchasers expected that approximately the same proportion would replace incandescent lamps.
    - A higher percentage of CFL A-lamps were purchased with the expectation of replacing installed incandescent lamps (63%), while less than half of CFL spiral and reflector shapes were purchased with the intention of replacing incandescent lamps.
    - Reflector style CFLs had the highest CFL-to-CFL replacement expectations (50% of purchased reflector CFLs were intended to replace installed CFLs).
- Consumers purchased more than 40% of LED lamps with the intention of replacing CFLs, and nearly the same proportion was purchased with the intention of replacing CFLs.
    - Consumers purchased a higher percentage of LED reflector lamps with the intention of replacing incandescent lamps (45%) than LED A-lamps (41%) or globe shaped lamps (25%).
    - Consumers purchased nearly two-thirds of LED globe lamps with the intention of replacing CFLs (63%).
- Consumers purchased more than half of the halogen lamps with the expectation of replacing incandescent lamps and one-quarter were purchased with the intention of replacing other halogen lamps.

### 5.4.1 Planned lamp installations within one week of purchase

During the shopper intercept surveys, field researchers found that more than 90% of purchasers were acquiring CFL spirals, A-lamps, globes, or reflectors or incandescent, halogen, or LED lamps of equivalent shapes for residential use[106] and planned to install them within one week of their purchase—838 respondents representing 1,992 lamps.

Table 23 below provides details on the distribution of these lamps by technology and shelf survey phase. As shown, LED lamps represented nearly half of all lamps intended to be installed within a week when totaled across the two shelf survey phases as defined above (45%). CFLs represented approximately a quarter of lamps (26%), incandescent lamps 17% of lamps, and halogen lamps 13% of lamps across the two shelf surveys phases. During the 2012 and 2013 shopper intercept surveys, CFLs represented nearly half of all lamps intended to be installed within a week (47%) and LED lamps represented only 14% of lamps.

During the Winter 2014-15 phase, LED lamps represented 38% of lamps, and increased to 54% of lamps during the Winter 2015-16 phase. Installations of CFLs and incandescent lamps decreased between the two shelf survey phases, while installations of halogen lamps remained approximately the same.

[106] The data presented in this report are not intended to provide estimate the share of lamps installed in residential versus non-residential applications. The 2010-12 ULP impact evaluation report (WO28) estimated that approximately six to seven percent of upstream CFLs were installed in nonresidential applications. This estimate was based on onsite lighting inventory data collected for as part of the Commercial Saturation Study (CSS; WO24) and CLASS (WO21), not on shopper intercept survey results. For further detail regarding the split between residential and non-residential upstream CFLs, please refer to the WO28 impact evaluation report (DNV GL, 2014a).

An important caveat for these results is that these intercept surveys represent snapshots in time, as field researchers cannot predict exactly where and when they will encounter lamp purchasers. That is, while these shopper intercept surveys were conducted over the course of numerous hours in the retail stores, they may not represent the full suite of purchases that occur in these locations over time. The results are also un-weighted and thus do not represent (for example) the distribution of lamp sales across retail channels. While these results may not be statistically representative of lamp purchases in PG&E, SCE, and SDG&E territories over time, the data serve as directional indicators of the technologies and lamp types that consumers in these markets are purchasing and what technologies they might be replacing.

**Table 23: Lamps with planned installation in residential applications within one week of purchase by lamp technology and data collection period, 2014 and 2015 (shopper intercept surveys)**

| Technology | Number of Lamps | | | Percent of Lamps* | | |
|---|---|---|---|---|---|---|
| | 2014 | 2015 | Overall | 2014 | 2015 | Overall |
| Incandescent | 226 | 106 | 332 | 20% | 12% | 17% |
| CFL | 332 | 181 | 513 | 30% | 21% | 26% |
| LED | 424 | 468 | 892 | 38% | 54% | 45% |
| Halogen | 139 | 116 | 255 | 12% | 13% | 13% |
| **Total** | **1121** | **871** | **1,992** | **100%** | **100%** | **100%** |

Note: Results may not total 100% because of rounding.

### 5.4.2 Lamp technologies to be replaced

Among respondents who purchased the relevant lamp types and planned to install them within one week, field researchers administered a battery of questions to gather information regarding the lamp technologies that purchasers intended to replace with their new lamps.[107] Responses revealed that in some cases, shoppers were purchasing lamps to fill empty sockets (rather than to replace existing installed lamps). Figure 56 provides an overview of the results based on the type of lamp technology purchased by intercepted consumers. The x axis shows the lamp technology purchased (i.e., incandescent, CFL, LED, and halogen lamps), and the different colors within each stacked bar along represent the lamp technology that the consumer intended to replace with the new lamp (and cases in which the lamps will be installed in empty sockets).

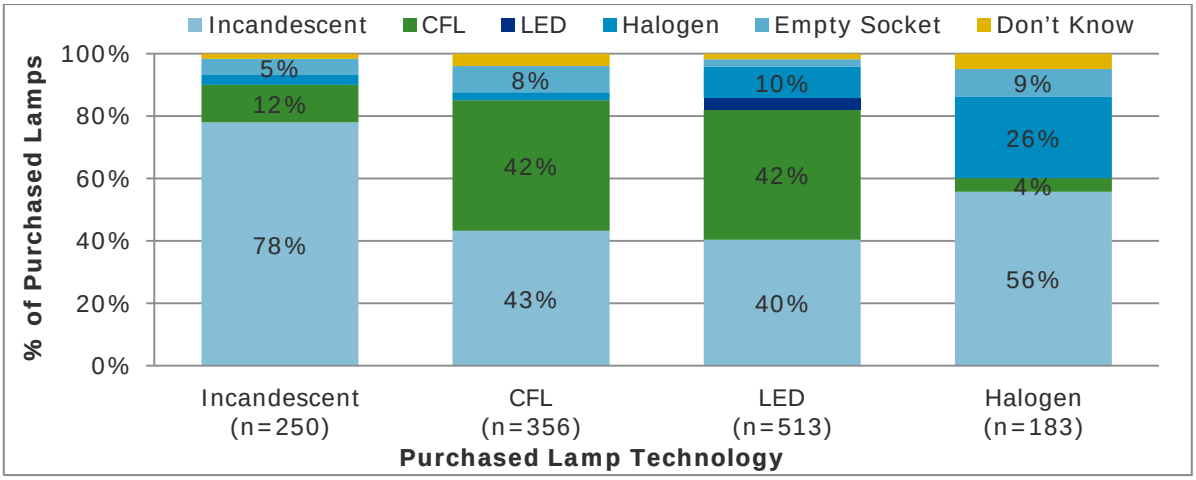
Results suggest that 42% of the LED lamps purchased with the intention of being installed in one week were intended to replace CFLs, and 40% with intentions of replacing incandescent lamps. Results were similar among CFL purchases, with 42% of CFLs purchased with the intention of replacing other CFLs and 43% with the intention of replacing incandescent lamps. Approximately 10% of the LED lamps were purchased with the intention of replacing halogen lamps.

More than three-quarters of incandescent lamps were bought with the intention of replacing other incandescent lamps (78%). This represents the highest proportion of lamps across the four lamp

[107] Interviewers asked purchasers detailed questions about their installation intentions for up to two of their purchased lamps. Thus, the number of lamps listed in Figure 56, Figure 57, and Figure 58 are lower than the number of lamps listed in Table 23.

technologies that were purchased with the intention of replacing incandescent lamps. More than half of halogen lamps were purchased with the intention of replacing incandescent lamps (56%). This represents the second highest proportion of lamps across the four lamp technologies that were purchased with the intention of replacing incandescent lamps. Approximately 12% of incandescent lamps were purchased with the intention of replacing CFLs, and approximately 4% of halogen lamps were purchased with the intention of replacing CFLs. Within each lamp technology, intercepted purchasers bought 2-9% of lamps with the intention of filling empty sockets.

**Figure 56: existing installed lamps (and empty sockets) as a percentage of purchased lamps by lamp technology, 2014/2015 (shopper intercept surveys)**




Note: Results may not total 100 percent because of rounding.
Note: Figure combines results from 2014-15 and 2015-16 shopper intercept surveys.

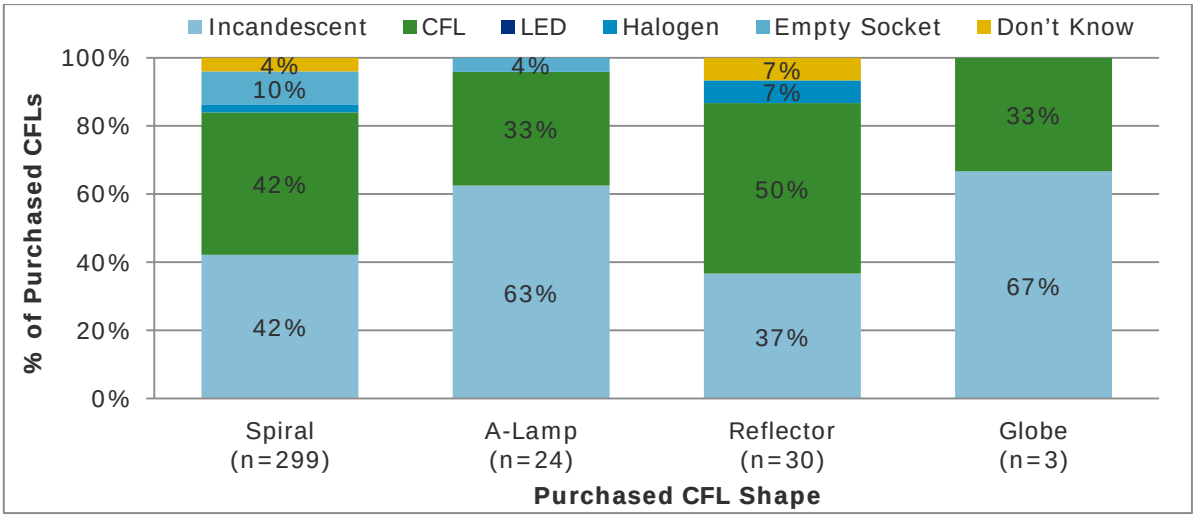
### 5.4.2.1 Technologies to be replaced with CFLs

Figure 57 provides additional detail regarding installation intentions for CFLs purchased by intercept survey respondents who planned to install them in residential applications within one week. The x axis shows the CFL shape purchased (i.e., spiral, A-lamp, reflector, and globe shapes), and the different colors within each stacked bar represent the lamp technology that the shopper intends to replace with the new CFL (again, the figure also includes cases in which the lamps will be installed in empty sockets).

Figure 56 above showed that approximately 42% of the CFLs purchased by intercepted lamp shoppers were bought with the intention of replacing other CFLs. Results in Figure 57 suggest that CFL-to-CFL replacement intentions are highest among purchasers of reflector CFLs, with 50% of reflector CFLs purchased with the intention of replacing other CFLs (of any lamp shape), followed by spiral CFLs (with 42% of spiral CFLs purchased with the intention of replacing other CFLs), and CFL A-lamps (with 33% of CFL A-lamps purchased with the intention of replacing other CFLs). A higher proportion of CFL A-lamps were purchased with the intention of replacing incandescent lamps than any other CFL shape (63%). During the 2012 and 2013 shopper intercept surveys, reflector CFLs represented the CFL shape that replaced the highest proportion of incandescent lamps compared to other shapes (59%). Note that the sample size for globe CFLs is especially small (n=3) and thus, caution should also be taken in interpreting or applying

results for this CFL shape in particular.

**Figure 57: Existing installed lamps (and empty sockets) as a percentage of purchased CFLs by CFL shape, 2014/2015 (shopper intercept surveys)**

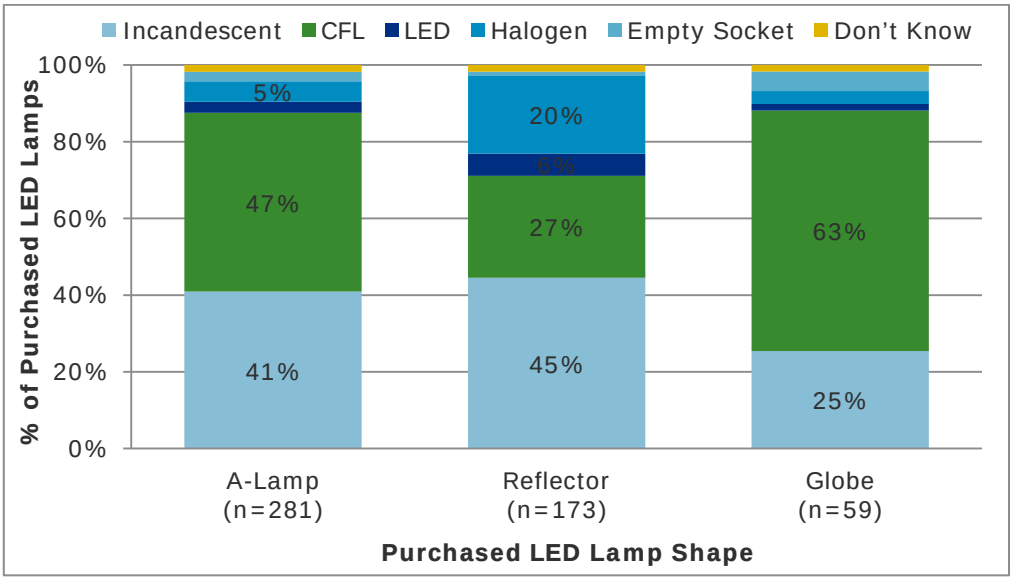



Note: Results may not total 100 percent because of rounding.
Note: Figure combines results from 2014-15 and 2015-16 shopper intercept surveys.

### 5.4.2.2 Technologies to be replaced with LED lamps

Figure 58 provides the same information as in Figure 57 above except for newly-purchased LED lamps instead of CFLs. Results suggest that nearly two-thirds of LED globe lamps were purchased with the intention of replacing CFLs (63%). Nearly half of LED A-lamps were purchased with the intention of replacing CFLs (47%), while only a quarter of LED reflector lamps were purchased with the intention of replacing CFLs (27%). A higher percentage of LED reflector lamps were purchased with the intention of replacing incandescent lamps than LED A-lamps (45% versus 41%, respectively). However, when intentions involving replacement of halogen lamps are also considered along with these results, the data suggest that an even higher proportion of LED reflector lamps are purchased with the intention of replacing incandescent or halogen lamps (approximately 65% for LED reflector lamps compared to 46% for LED A-lamps). Results were similar during the 2012 and 2013 shopper intercept surveys, though a higher proportion of LED A-lamps were purchased with the intention of replacing incandescent lamps during those surveys (57%).

**Figure 58: Existing installed lamps (and empty sockets) as a percentage of purchased LED lamps by LED lamp shape, 2014/2015 (shopper intercept surveys)**




Note: Results may not total 100% because of rounding.
Note: Figure combines results from 2014-15 and 2015-16 shopper intercept surveys.

## 5.5 Plug-in LED night lights

The 2015 consumer telephone survey included questions to gauge consumer awareness, purchase, and use of plug-in LED night lights because the IOUs included a number of these measures in their upstream lighting programs in past years. Approximately one-third of PG&E, SCE, and SDG&E residential electric customers reported that they were aware of plug-in LED night lights in 2015 (32%; n=1,016). A significantly greater percentage of homeowners reported awareness of LED night lights compared to renters (40% versus 27%, respectively).

We asked consumers who were aware of plug-in LED night lights whether they had ever purchased any, and 48% of aware respondents reported having purchased one or more of them at some point in the past (n=362), representing approximately 16% of all PG&E, SCE, and SDG&E residential electric customers. Purchasers report an average of 3 LED night lights installed per household, with a significantly greater number installed, on average, in larger homes (roughly 6 per home over 3,000 square feet) compared to mid-size homes (roughly 3 per home for homes between 2,000 and 3,000 square feet). On average, in each of these homes, one of the plug-in night lights replaced another, previously-installed night lights and two were new additions that did not replace other night lights.

Of respondents who purchased and installed one or more plug-in LED night lights (n=165):

- More than half reported that they had one or more installed in their bathrooms (55%; see Table 24). Other popular installation locations among users of LED night lights include bedrooms (44% of users); hallways and/or entryways (29%); kitchens (23%); and living rooms (10%).
- Eighty-three percent reported that their night lights had photo sensors versus manual on/off switches.

- Consumers reported that their plug-in LED night lights were on for an average of 6.98 hours per day.

**Table 24: Installation locations for plug-in LED night lights among PG&E, SCE, and SDG&E residential electric customers who purchased and installed plug-in LED night lights, 2015 (consumer telephone surveys)**

| Location | Percent of Respondents Who Purchased / Installed Plug-in LED Night Lights (n=165) |
|---|---|
| Bathroom | 55% |
| Bedroom | 44% |
| Hallway/entryway | 29% |
| Kitchen | 23% |
| Living Room | 10% |
| Garage | 4% |
| Dining Room | 4% |
| Family room/den | 2% |
| Laundry | 2% |
| Outside - entryway | 2% |
| Outside - porch/patio | 1% |
| Office | 1% |
| Basement | 1% |
| Closet | < 1% |
| Outside - other | < 1% |
| Other location | 4% |

Note: Survey question allowed multiple responses.

# 6. PROJECTED LAMP TECHNOLOGY CHOICES UNDER CHANGED REGULATORY AND MARKET CONDITIONS

In this chapter of the report, we explore how consumers' lamp purchasing decisions may have differed in 2015 under different market conditions. These conditions relate to three anticipated changes in the residential market for A-lamp replacements:

- Changing IOU program support for basic CFLs
- Declining CFL spiral and A-lamp prices
- Declining LED A-lamp prices

The objective of these analyses is to understand how consumers are likely to respond to changing market conditions in the future. To address this objective, the DNV GL team produced market share estimates for the various lamp types in the A-lamp replacement category (basic spiral CFLs, CFL A-lamps, LED A-lamps, traditional incandescent A-lamps, and EISA-compliant halogen A-lamps) under different scenarios. This section relies upon the LCM developed as part of the 2010-12 upstream lighting program impact evaluation to estimate the share of sales comprised by various lamp technologies in the A-lamp replacement category. [108] The market share estimates represent how consumers would have responded to different lamp prices in 2015 and suggests the future market potential for CFL and LED A-lamps.[109, 110]

## 6.1 Lamp Choice Model

The LCM determines A-lamp replacement market shares by technology as a function of the available technologies and their prices along with consumer demographics. We estimated the model using data collected during the shelf survey visits and in-store shopper intercept surveys we conducted in 2012, 2013, 2014, and 2015. The shelf survey data provide the market context—that is, details regarding the lamp technologies that are available, where they are available, and how much they cost. The intercept survey data reflect shopper characteristics (such as personal income and household characteristics) as well as the lamps customers chose under various market conditions including lamp availability and pricing. The LCM brings together the store context with the customer characteristics and choices.

The LCM estimates how consumer choices would have differed in 2015 if market conditions were different. The model reflects a snapshot of time in a market that is rapidly changing. As market conditions change, the model's ability to represent consumer choices changes as well. The principal limitations of the model (as it applies to the scenario analyses below) are as follows:

- **Moderate LED A-lamp availability.** The LCM constructs choices from shelf survey records. If a retail channel did not stock LED A-lamps at the time of the winter 2015-16 shelf surveys, the market share for LED A-lamps will be zero. Because the purpose of the model is to assess how consumer choices would have differed if market conditions were different during the 2015-16 timeframe, this is not a limitation per se, but it does affect our ability to predict how consumer choices might change in the

108 Please refer to DNV GL, 2014 for additional detail.

109 Note that we exclude lighting showrooms from these analyses due to the lack of shelf survey and intercept survey data.

110 Throughout Section 6 (and related subsections) we use the term "market share" to refer to the expected share of lamp sales..

future as LED A-lamp availability increases beyond the 50% of California retail stores in which they were available in 2015 (see Section 4.2.1.1 above for details).

- **Stable consumer perceptions.** As LED A-lamps become more common and less expensive, consumer perceptions and preferences regarding LED A-lamps may also change. The model does not attempt to capture how consumer preferences for LED A-lamps may change over time.
- **Opportunistic sampling approach.** The model reflects how consumers ranked their choices regarding which lamp technologies they would have purchased under different market conditions. While the model matches what intercept survey respondents reported, there is no guarantee that choices made by intercept survey respondents are consistent with choices in the overall market (because the intercept survey relies upon an opportunistic sample). If we had complete sales data (or share of total sales) for all technologies, we could ensure that the aggregate model results are consistent with the California market. However, the primary interest is not in the exactness of the market share estimates in each scenario, but rather the directionality of changes in market share estimates from scenario to scenario.[111]

The scenarios described below change the market context. The model then estimates how consumers respond to those market variations in terms of the replacement lamps they are expected to choose as a result. The model design also reflects the difference in choice sets by retail channel based on analyses of lamp technologies and four brightness categories (lumen bins) for lamps available in each store according to winter 2015-16 shelf survey results. The in-store shopper intercept survey presented only the lamp choices a consumer was likely to see at the time of the intercept survey in the specific retail channel in which survey took place. Field researchers intercepted each shopper after he or she selected a lamp for purchase. For each intercept survey, the lumen bin for the selected lamp constrained the lamp choices offered to the consumer in the modelling effort. Thus, a specific A-lamp replacement technology would only be offered as an alternate choice to the consumer if that lamp technology was available (per 2015-16 shelf survey results) in the relevant retail channel in the same lumen bin as the consumer's selected lamp.

Appendix D provides the coefficients for the LCM. For more background regarding the model, please refer to the 2010-12 upstream and residential downstream lighting impact evaluation report.[112]

## 6.2 Scenario analyses

DNV GL staff utilized the LCM to examine four sets of scenarios related to regulatory and market contexts and their implications for each technology's market share. The team developed these scenarios based on the recent and expected market developments described above—including elimination of IOU support for basic CFLs. This approach required developing a baseline scenario against which to compare these alternative scenarios. The team developed the baseline scenario based on current market conditions from shelf survey and in-store customer intercept survey data.

111 For example, the model results generally point to large market shares for CFL spirals and A-lamps. This result is consistent with shelf survey results from 2012 (in which MSB CFL A-lamps had the largest share of MSB A-lamp replacement stock) and in 2013 (when these products still maintained a high share of total lamp stock; see Figure 27 in section 4.2.2.3.1 above). However, the point estimates of baseline scenario market share for each technology differ from those in the shelf survey results. Note that DNV GL will attempt to address this shortcoming of the LCM in its impact evaluation of the IOUs' 2015 upstream and residential downstream lighting programs (forthcoming).

112 DNV GL, 2014a.

Programs are consistently offering fewer discounts on CFLs than in previous cycles. Our second scenario estimates a market in which CFL discounts are removed completely, and subsequent scenarios evaluate other potential changes in the market. The present-day market absent CFL discounts (the second scenario) offers a clear point to compare additional market adjustments. We therefore construct scenarios 3, 4a, and 4b based on the second scenario.

The scenario sets include:

1. **Baseline (observed)**: This business-as-usual scenario represents market conditions observed in 2015-16. The inputs to this scenario are lamp prices and availability as recorded during the winter 2015-16 shelf surveys.

2. **No IOU incentives for CFLs**: In 2009, the CPUC directed the IOUs to begin reducing incentive funding for basic CFL programs and redirecting that funding toward "advanced lighting programs and other lighting market transformation activities."[113] This direction may suggest a future in which the IOUs no longer offer incentives for basic spiral CFLs and possibly for CFL A-lamps as well. We structured the scenario analyses to reflect that spiral CFLs and CFL A-lamps may still be available without IOU incentives in California retail stores that sell replacement lamps. This scenario models the change in market share among A-lamp replacements as a result of CFL pricing changes that may occur in response to reduced incentive allocations for CFL A-lamps and basic spiral CFLs. The key difference between this scenario and the previous scenario is the change in CFL prices.

3. **Declining CFL prices**: This scenario models how consumer choices may have differed in 2015 if CFL spiral and A-lamp prices decreased by 50% from their full price without IOU incentives.

4. **Declining LED A-lamp prices**: The final elements that we added into our stream of scenarios were reductions in LED A-lamp prices. We modeled declining LED A-lamp prices in two separate scenarios:

    a. Scenario 4a: LED A-lamp prices decline by 25% per lamp

    b. Scenario 4b: LED A-lamp prices decline by 50% per lamp

    These price reductions reflect simple deductions from the LED A-lamp prices observed during the 2015-16 shelf survey visits.

    The key difference between scenarios 4a and 4b is the price of LED A-lamps. Scenarios 4a and 4b include only the stores that stocked LED A-lamps during winter 2015-16 (per shelf survey results). As such, the model does not reflect the anticipated expansion of LED lamp stocking beyond the stores that stocked them during this timeframe.

## 6.3 Key findings

Table 25 presents A-lamp replacement market share by lamp type for each scenario by retail channel.[114] Key findings include:

[113] CPUC, 2009.

[114] The table does not report confidence intervals around each of the market share point estimates. The uncertainty analysis included in the 2010-12 upstream and residential downstream impact evaluation report suggests that the LCM 90% confidence intervals of ±3% or better. The full uncertainty around the market shares depends both on the precision of the estimation and the assumptions of what lamps stores will stock in each of the scenarios.

- **There are minimal (if any) effects on market share from eliminating IOU discounts for spiral CFLs and CFL A-lamps when few such discounts are present.** Across all retail channels, field researchers found few IOU-discounted spiral CFLs and CFL A-lamps at the time of the 2015-16 shelf surveys relative to non-discounted lamp stock. As such, eliminating IOU discounts resulted in minimal (if any) changes in average lamp prices. Given this, it is not surprising that the effects on market share among A-lamp replacements were negligible.
- **In most channels with strong spiral CFL presence, a 50% reduction in price results in a noteworthy increase in market share.** The effects of reducing spiral CFL prices by 50% were most dramatic in the home improvement channel, in which market share increased by nearly 60% (from 25% market share to 39% market share). The effects were similarly strong in hardware stores, which exhibited a 46% increase in spiral CFL market share with a 50% reduction in price, followed by mass merchandise stores (37% increase) and drug stores (33% increase). Although the majority of grocery store also stocked spiral CFLs, reducing their prices by 50% resulted in minimal changes in market share. Fewer than half of discount stores stocked spiral CFLs during the winter 2015-16 period, so reduced prices for these products resulted in minimal movement in market share.
- **Minimal movement in CFL A-lamp market share with a 50% reduction in price.** When we reduced CFL A-lamp prices by 50%, we saw minimal movement in market share across channels (from no change to increases of no more than 2 percentage points). Although these lamps were not uncommon in terms of 2015-16 retail store stock, spiral CFLs were typically present in greater quantities and at lower price points. As such, CFL price reductions affected spiral CFL market share far more than CFL A-lamp market share.
- **Reductions in LED A-lamp prices resulted in moderate increases in LED A-lamp market share.** LED A-lamp price reductions of 25% increased their market share by two to 5 percentage points across channels, on average, and reductions of 50% increased their market share by 3 to 8 percentage points (although all but one channel were in the 6- to 8-point range). Recall that each scenario in our analyses builds on prior scenarios, so given the availability of spiral CFLs and CFL A-lamps at 50% of their regular prices, the CFLs remain the least-cost efficient lamp alternative even when we reduce LED A-lamp prices by 50%. Additionally, the fact that that LED A-lamps at all brightness levels (lumen bins) were not yet available in all retail channels during the winter 2015-16 period also limited their ability to achieve maximum market share.
- **Reducing CFL prices resulted in greater reductions in market share for traditional incandescent and EISA-compliant halogen lamp market share than reducing LED A-lamp prices.** Reducing LED A-lamp prices by 25% or 50% achieved reductions in inefficient lamp market shares of no more than 2 percentage points. Reducing spiral CFL and CFL A-lamp prices by 50% resulted in market share reductions for inefficient lamps of up to 10 percentage points. Again, these results likely reflect the lower price points for CFLs compared to LED lamps; reducing CFL prices by 50% brings them much closer to traditional incandescent and EISA-compliant halogen lamp prices than the same reduction would for LED A-lamp prices.

**Table 25: Modelled market share for A-lamp replacements by retail channel, A-lamp replacement type, and scenario (Lamp Choice Model)**

| Channel / Scenario* | A-lamp Replacement Type | | | | | Total |
|---|---|---|---|---|---|---|
| | Traditional Incandescent A-lamp | EISA-Compliant Halogen A-lamp | Spiral CFL | CFL A-lamp | LED A-lamp | |
| **Discount** | | | | | | |
| Baseline Scenario | 27% | 8% | 40% | 9% | 17% | 100% |
| No IOU Incentives for CFLs | 28% | 8% | 40% | 7% | 17% | 100% |
| CFL Price Reduction of 50% | 24% | 7% | 44% | 8% | 16% | 100% |
| LED Price Reduction of 25% | 27% | 8% | 40% | 7% | 18% | 100% |
| LED Price Reduction of 50% | 27% | 8% | 40% | 7% | 19% | 100% |
| **Drug** | | | | | | |
| Baseline Scenario | 15% | 20% | 40% | 2% | 22% | 100% |
| No IOU Incentives for CFLs | 15% | 20% | 40% | 2% | 22% | 100% |
| CFL Price Reduction of 50% | 6% | 16% | 53% | 4% | 20% | 100% |
| LED Price Reduction of 25% | 15% | 19% | 40% | 2% | 25% | 100% |
| LED Price Reduction of 50% | 14% | 18% | 39% | 2% | 27% | 100% |
| **Grocery - chain** | | | | | | |
| Baseline Scenario | 7% | 20% | 51% | 3% | 19% | 100% |
| No IOU Incentives for CFLs | 9% | 20% | 50% | 3% | 19% | 100% |
| CFL Price Reduction of 50% | 7% | 17% | 54% | 4% | 18% | 100% |
| LED Price Reduction of 25% | 8% | 18% | 49% | 3% | 22% | 100% |
| LED Price Reduction of 50% | 7% | 17% | 48% | 3% | 25% | 100% |
| **Grocery - independent** | | | | | | |
| Baseline Scenario | 4% | 23% | 55% | 2% | 16% | 100% |
| No IOU Incentives for CFLs | 5% | 23% | 54% | 2% | 16% | 100% |
| CFL Price Reduction of 50% | 4% | 20% | 58% | 3% | 15% | 100% |
| LED Price Reduction of 25% | 4% | 23% | 54% | 2% | 18% | 100% |
| LED Price Reduction of 50% | 4% | 22% | 53% | 1% | 19% | 100% |
| **Hardware** | | | | | | |
| Baseline Scenario | 29% | 31% | 28% | 2% | 10% | 100% |
| No IOU Incentives for CFLs | 30% | 31% | 28% | 1% | 10% | 100% |
| CFL Price Reduction of 50% | 19% | 29% | 41% | 2% | 9% | 100% |
| LED Price Reduction of 25% | 29% | 30% | 27% | 1% | 13% | 100% |
| LED Price Reduction of 50% | 28% | 29% | 26% | 1% | 16% | 100% |
| **Home improvement** | | | | | | |
| Baseline Scenario | 19% | 28% | 26% | 3% | 24% | 100% |
| No IOU Incentives for CFLs | 19% | 28% | 25% | 3% | 24% | 100% |
| CFL Price Reduction of 50% | 9% | 27% | 39% | 3% | 22% | 100% |
| LED Price Reduction of 25% | 19% | 28% | 24% | 3% | 26% | 100% |
| LED Price Reduction of 50% | 18% | 27% | 23% | 3% | 29% | 100% |
| **Mass merchandise** | | | | | | |
| Baseline Scenario | 24% | 30% | 35% | 0% | 11% | 100% |
| No IOU Incentives for CFLs | 24% | 30% | 35% | 0% | 11% | 100% |
| CFL Price Reduction of 50% | 13% | 29% | 48% | 0% | 10% | 100% |
| LED Price Reduction of 25% | 23% | 29% | 34% | 0% | 13% | 100% |
| LED Price Reduction of 50% | 23% | 28% | 34% | 0% | 16% | 100% |
| **Wholesale club** | | | | | | |
| Baseline Scenario | 0% | 29% | 32% | 0% | 40% | 100% |
| No IOU Incentives for CFLs | 0% | 29% | 32% | 0% | 40% | 100% |
| CFL Price Reduction of 50% | 0% | 29% | 34% | 0% | 37% | 100% |
| LED Price Reduction of 25% | 0% | 29% | 29% | 0% | 42% | 100% |
| LED Price Reduction of 50% | 0% | 28% | 26% | 0% | 45% | 100% |

Note: Results may not total 100% because of rounding.
* As noted above, we exclude lighting showrooms from these analyses due to the lack of shelf survey and intercept survey data.

## 6.4 Detailed results

The sections below present the market share results for lamps in the A-lamp replacement category by retail channel. Each figure presents the baseline scenario along with the other modelled scenarios by retail channel for discount, drug, independent grocery, chain grocery, hardware, home improvement, mass merchandise stores, and wholesale clubs.[115] The section closes with a summary table showing market shares by technology and retail channel for all five scenarios.

### 6.4.1 Discount stores

Discount channel stores cater to budget-minded consumers.[116] Stores in this channel tend to have a limited selection of lamps available and many have prices in the $1.00 range for each product they stock. Less than one in five discount stores in California stocked LED A-lamps in 2015 (17%) and approximately half stocked CFL A-lamps and spiral CFLs (Table 26).

**Table 26: Percent of discount stores stocking A-lamp replacements by lamp type, 2015 (retail store shelf surveys)**

| Lamp Type | Percent of Stores (n=29) |
|---|---|
| LED A-lamp | 17% |
| CFL A-lamp | 49% |
| Spiral CFL | 48% |
| EISA-compliant halogen A-lamp | 28% |
| Traditional incandescent A-lamp | 79% |

Figure 59 shows the market shares resulting from scenario analyses in discount stores. Spiral-style CFLs have the highest market share in this channel, ranging from 40 to 44% across all scenarios. Other key findings from these analyses include:

1. **Little impact from eliminating IOU incentives for spiral CFLs and CFL A-lamps**. The stores in this channel do not have a large selection of lamps. After the elimination of IOU incentives, there are very few opportunities for consumers to shift from purchasing CFLs to purchasing other A-lamp replacement technologies because spiral-style and A-lamp style CFLs already dominate the market share for lamps in this channel (at approximately 48%). The only beneficiary from this scenario in terms of market share is incandescent A-lamps, which would increase one percentage point to 28% of lamps in the A-lamp replacement category. The main reason for this lack of change is due a low incidence of program lamps in this channel during our 2015-16 retail store shelf surveys. Therefore, the effect of removing the incentives remains small.
2. **Lower CFL prices result in increased CFL market share.** Market share for CFL A-lamps and spirals increase when their prices decrease by 50% from their baseline price. CFL spiral market share increases by 4 percentage points and CFL a-lamp market share increases by 1 percentage point.

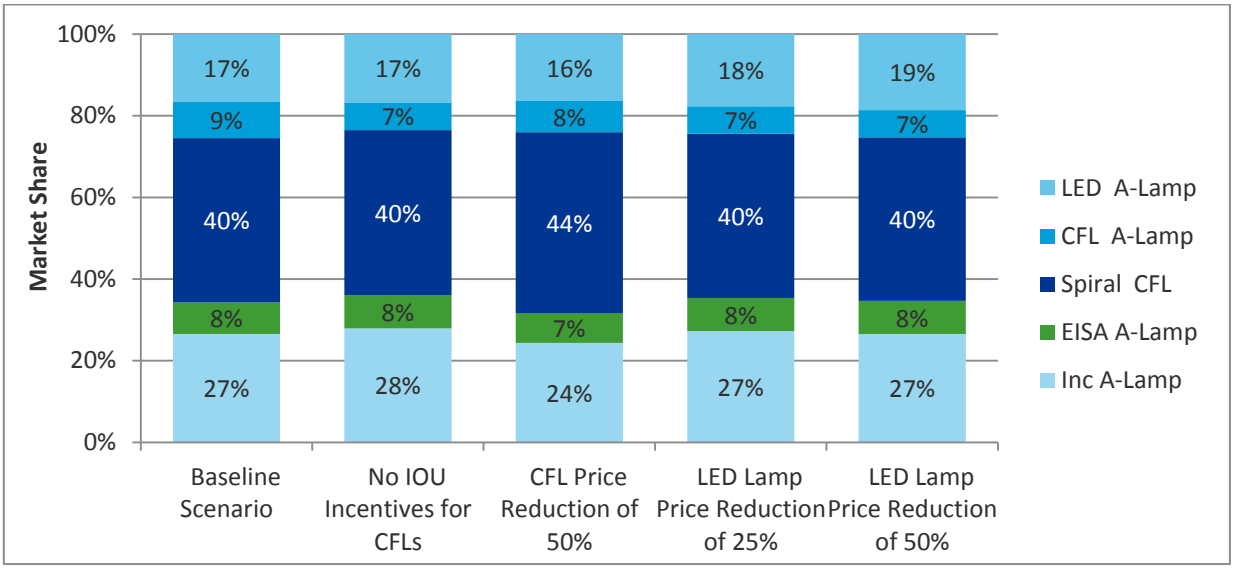
[115] We exclude lighting showrooms from the analyses due to the lack of shelf survey and intercept survey data for this channel.

[116] Please see the Retail Channel Overview provided in section 4.1.2.1 above for more details regarding characteristics of each channel.

These results suggest that reductions in CFL pricing may be somewhat effective in driving purchasers toward these A-lamp replacement technologies.

3. **Small growth in LED A-lamp market share with price reductions**. Reducing the price for LED A-lamps by 25% and 50% results in small gains in LED A-lamp market share from an initial 16% to 18% with a 25% price reduction and to 19% with a 50% price reduction. These changes come at the expense of spiral CFL and CFL A-lamp market shares.

**Figure 59: Modelled market share for A-lamp replacements in discount stores by lamp type and scenario (Lamp Choice Model)**




Note: Results may not total 100% because of rounding.

## 6.4.2 Drug stores

For replacement lamps, drug stores cater to convenience shoppers. Stores in this channel tend to have a limited selection of lamps and prices are typically higher than in many other channels (particularly big box stores). During the 2015-16 shelf surveys, nearly all drug stores stocked spiral CFLs (96%) and roughly 60% to 80% stocked each other replacement lamp type. Table 27 provides additional detail.

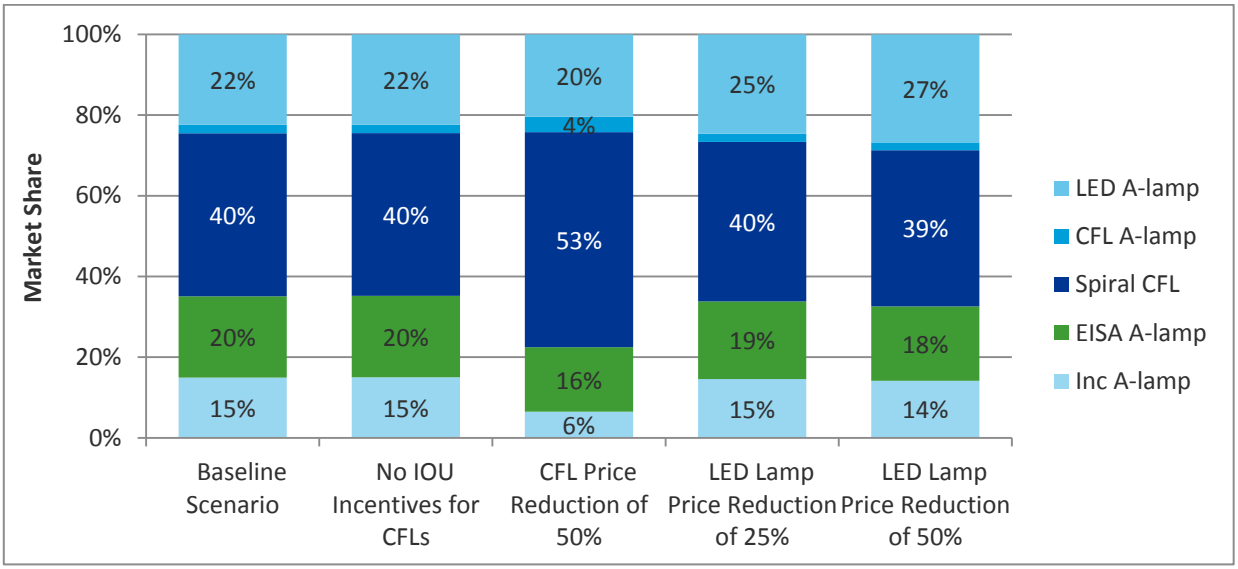
**Table 27: Percent of drug stores stocking A-lamp replacements by lamp type, 2015 (retail store shelf surveys)**

| Lamp Type | Percent of Stores (n=30) |
|---|---|
| LED A-lamp | 79% |
| CFL A-lamp | 61% |
| Spiral CFL | 96% |
| EISA-compliant halogen A-lamp | 82% |
| Traditional incandescent A-lamp | 82% |

Figure 60 shows the market shares from our scenario analyses for drug stores. As in discount stores, spiral-style CFLs dominate among the A-lamp replacements offered in this channel. Key findings include:

1. **No impact on replacement lamp market shares when IOU incentives for spiral CFLs and CFL A-lamps are eliminated**. Without discounts for spiral CFLs and CFL A-lamps, market shares for these A-lamp replacement types stay steady at 40% and 2%, respectively. As in discount store, this is due to low incidence of discounted lamps observed during retail store shelf surveys.
2. **CFL price reductions of 50% significantly increase CFL A-lamp market share.** Market shares for CFL A-lamps and spirals grow significantly when their prices decrease by 50% from their baseline price. Spiral CFLs increase from 40% market share to 53%, and CFL A-lamp market share increases from 2% to 4%. All other replacement lamp choices lose market share in this scenario with incandescent A-lamps losing 9%, EISA A-lamps losing 4% and LED A-lamps losing 2%. This again speaks to the likely impact that price reductions may have on CFL market share.
3. **Significant gains in LED A-lamp market share with price reductions**. Spiral CFLs and EISA-compliant halogen lamps lose market share When prices are reduced for LED A-lamps and backed by scenario 2, LED market share increases from 25% at a 25% price reduction over 2015-16 levels to 27% at a 50% price reduction. This growth diminishes the market share for all other lighting technologies except CFL A-lamps. Overall, model results suggest that drug stores could undergo a moderate shift in market share towards LED A-lamps as their prices decline.

**Figure 60: Modelled market share for A-lamp replacements in drug stores by lamp type and scenario (Lamp Choice Model)**




Note: Results may not total 100% because of rounding.

### 6.4.3 Grocery stores

Both independent and chain grocery stores cater to convenience shoppers when it comes to replacement lamps. These stores also tend to have a limited selection of lamps—for example, only 32% of grocery

stores visited during the winter 2015-16 period stocked LED A-lamps, and only 30% stocked CFL A-lamps—although it is noteworthy that more than four out of five grocery stores stocked spiral CFLs during this timeframe (Table 28). Grocery store prices tend to be higher for replacement lamps than in big box stores in particular.

**Table 28: Percent of grocery stores stocking A-lamp replacements by lamp type, 2015 (retail store shelf surveys)**

| Lamp Type | Percent of Stores (n=28) |
|---|---|
| LED A-lamp | 32% |
| CFL A-lamp | 30% |
| Spiral CFL | 82% |
| EISA-compliant halogen A-lamp | 41% |
| Traditional incandescent A-lamp | 55% |

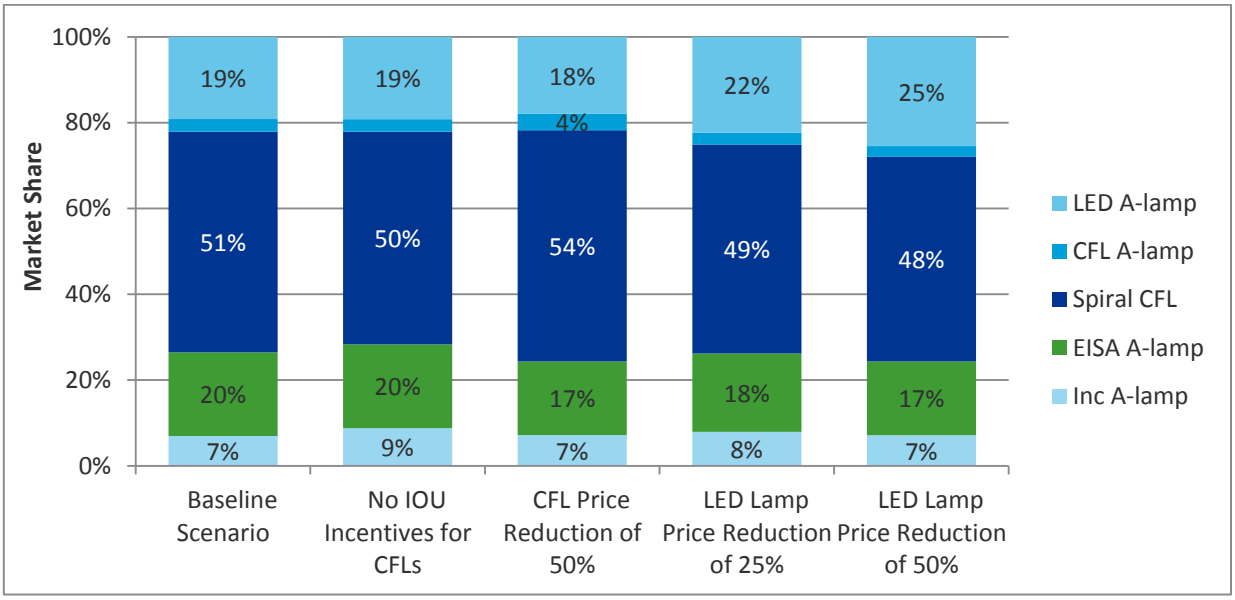
Figure 61 and Figure 62 show the market shares resulting from our scenario analyses for chain and independent grocery stores, respectively. In both cases, spiral CFLs dominate with over 48% market share in every scenario. Other key findings from these analyses are:

1. **Negligible impact from eliminating incentives for spiral CFLs and CFL A-lamps**. When eliminating incentives for CFL A-lamps and spiral CFLs, CFL A-lamps maintain their 3% market share while spiral CFL share drops by one percentage point (from 51% to 50%). This likely reflects the relatively low volume of program-discounted CFLs present in grocery stores during the 2015-16 shelf surveys relative to CFLs without program discounts.

2. **CFL price reductions of 50% increase their market share only minimally.** CFL A-lamps and spiral CFLs grow slightly as a percentage of the replacement lamp marketplace when their prices decrease by 50% from their baseline price. In chain grocery stores, spiral CFLs increase from 50% to 54% and CFL A-lamps increase from 3% to 4%. In independent grocery stores, spiral CFLs increase from 54% to 58% and CFL A-lamps increase from 2% to 3%. All other lamp choices lose market share in this scenario with LED A-lamps losing the least and EISA A-lamps losing the most.

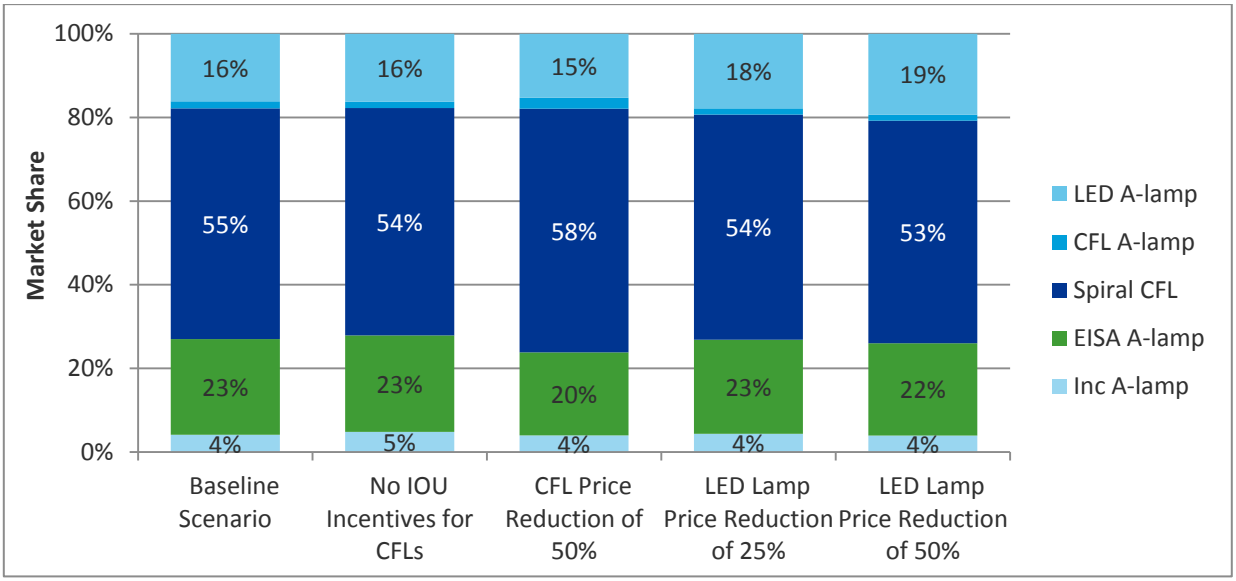
3. **Positive benefit to LED A-lamp market share from price reductions.** LED A-lamp market share increases with the addition of price reductions for LED A-lamps. At the highest price reduction of 50%, the model suggests chain grocery store LED A-lamp market share increases from 19% to 25%. This gain would be at the loss of market share for spiral CFLs (from 51% to 48%) and EISA-compliant halogen lamps (from 20% to 17%). Trends are directionally similar in independent grocery stores, but by roughly half the magnitude as in chain grocery stores. When LED A-lamp prices are cut by 50% in independent grocery stores, their market share increases from 16% to 19%, at the expense of spiral CFL market share (which drops slightly from 55% to 53%) and EISA-compliant halogen lamp market share market share (which declines from 23% to 22%).

**Figure 61: Modelled market share for A-lamp replacements in chain grocery stores by lamp type and scenario (Lamp Choice Model)**




Note: Results may not total 100% because of rounding.

**Figure 62: Modelled market share for A-lamp replacements in independent grocery stores by lamp type and scenario (Lamp Choice Model)**




Note: Results may not total 100% because of rounding.

### 6.4.4 Hardware stores

Hardware stores generally have a wider selection of lamps than other channels with the exception of home improvement stores. For example, during winter 2015-16, 100% of hardware stores stocked spiral

CFLs and 79% stocked LED A-lamps (Table 29). Interestingly, a greater share of discount and drug stores stocked CFL A-lamps than hardware stores.

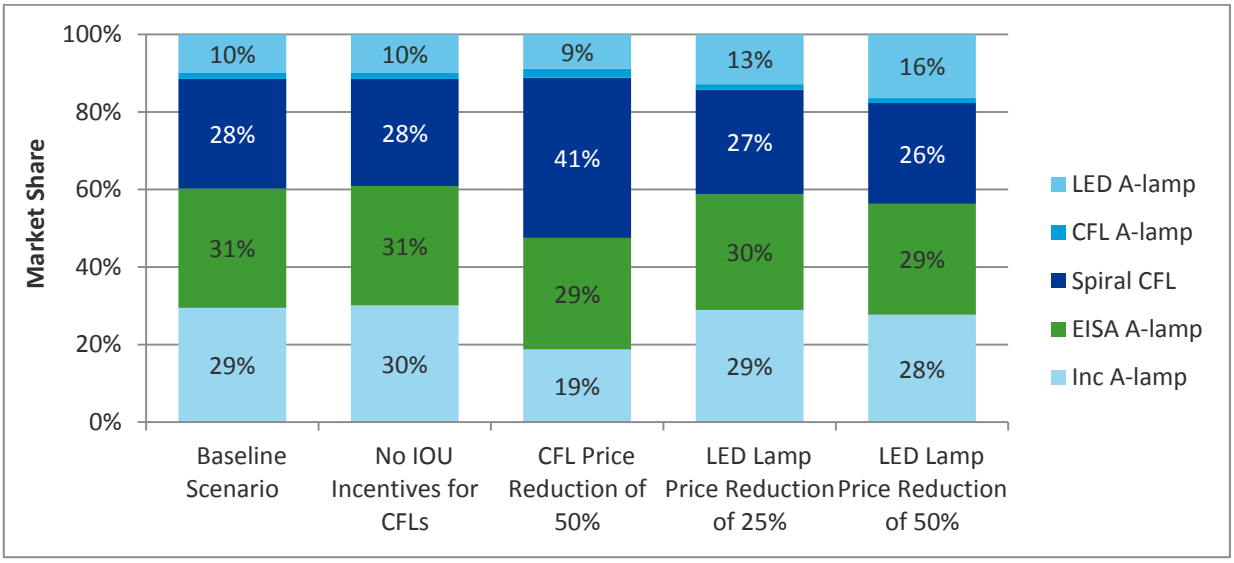
**Table 29: Percent of hardware stores stocking A-lamp replacements by lamp type, 2015 (retail store shelf surveys)**

| Lamp Type | Percent of Stores (n=29) |
|---|---|
| LED A-lamp | 79% |
| CFL A-lamp | 48% |
| Spiral CFL | 100% |
| EISA-compliant halogen A-lamp | 74% |
| Traditional incandescent A-lamp | 87% |

Figure 63 shows the market shares resulting from our scenario analyses for hardware stores. Incandescent A-lamps, EISA-compliant A-lamps, and spiral CFLs capture the highest market shares in this channel. Other key findings from these analyses are:

1. **Minor impact from eliminating IOU incentives for spiral CFLs and CFL A-lamps**. Without IOU discounts for spiral and A-lamp CFLs, incandescent A-lamps increase market share by 1 percentage point and CFL A-lamps decrease by the same percentage. There is no change in market shares for other lamp technologies. There is also a minimal of change in overall the average price for CFL A-lamps and spiral CFLs in this channel when IOU incentives are removed due to low incidence of observed program lamps relative to the entire lamp stock during the winter 2015-16 shelf surveys.
2. **CFL price reductions of 50% increase CFL market share.** Market share for CFL A-lamps and spiral CFLs grows significantly when their prices decrease by 50% from their baseline price. Spiral CFLs increase from 28% to 41% market share and CFL A-lamps stay the same at 2%. All other lamp choices lose market shares in this scenario—most notably, incandescent A-lamp market share drops by 10 percentage points. As with other channels, these results suggest that CFL price reductions have some impact on CFL market share within the A-lamp replacement category.
3. **Modest market share impacts with LED A-lamp price reductions**. LED A-lamps comprise 10% of A-lamp market share in the baseline scenario. Model results suggest that LED A-lamps will increase in market share to 13% with a 25% price reduction and to 16% with a 50% price reduction. Reducing LED A-lamp prices by 50% do not result in the same market share increases as for spiral CFLs when we reduced their prices by 50%, likely due to the lower price points for spiral CFLs when compared to LED A-lamps both at the baseline price and reduced price.

**Figure 63: Modelled market share for A-lamp replacements in hardware stores by lamp type and scenario (Lamp Choice Model)**




Note: Results may not total 100% because of rounding.

## 6.4.5 Home improvement stores

Stores in the home improvement channel typically have a wider selection of lamps than other channels. The vast majority of home improvement stores stocked all of the A-lamp replacement technologies during winter 2015-16 (Table 30). The only other channel in which all stores stocked LED A-lamps at this time is the mass merchandise channel.

**Table 30: Percent of home improvement stores stocking A-lamp replacements by lamp type, 2015 (retail store shelf surveys)**

| Lamp Type | Percent of Stores (n=31) |
|---|---|
| LED A-lamp | 100% |
| CFL A-lamp | 93% |
| Spiral CFL | 100% |
| EISA-compliant halogen A-lamp | 100% |
| Traditional incandescent A-lamp | 100% |

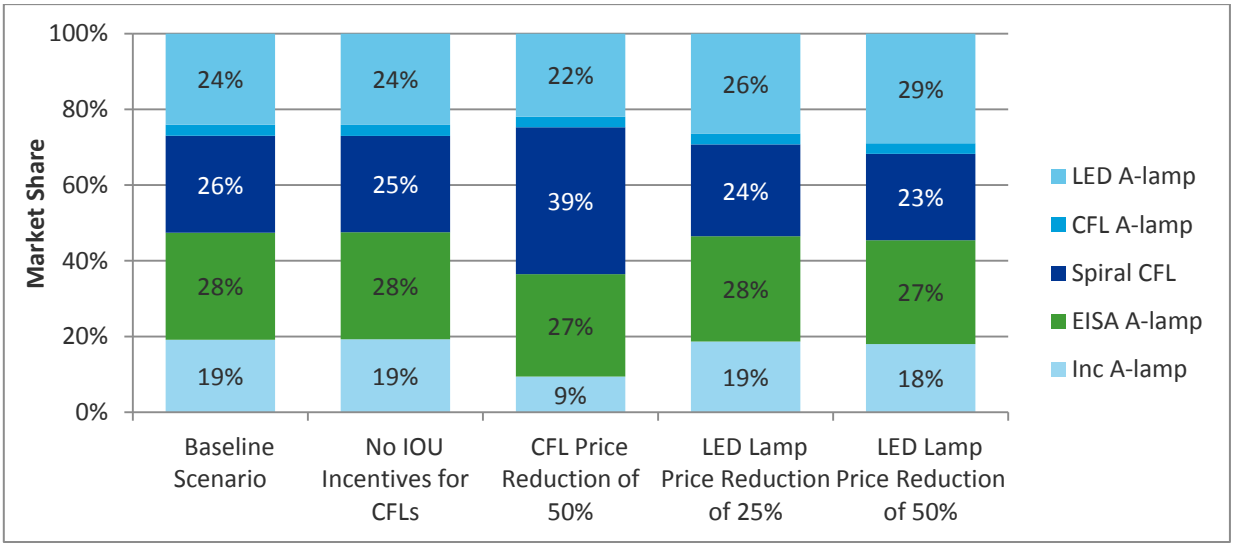
Figure 64 shows the market shares that result from the scenario analyses in this channel. Key findings from these analyses include:

1. **Low impact from eliminating incentives for spiral CFLs and CFL A-lamps**. When we eliminate discounts for spiral and A-lamp CFLs from home improvement stores, the model results suggest only a 1% decrease in spiral CFL market shares. As with other retail channels, this minor impact is likely due to the low incidence of program lamps modeled compared to the larger market.

2. **CFL price reductions of 50% increase spiral CFL market share.** Spiral CFL market share grows substantially when their prices decrease by 50% from their non-incentivized price in scenario two (25% to 39%). CFL A-lamps remain at 3% for all scenarios. All other lamp choices lose market share when the price of CFLs is reduced by 50%. Incandescent A-lamps lose the most market share (dropping from 19% to 9%). LED A-lamps lose 2 percentage points in market share (dropping from 24% to 22%) whereas EISA A-lamps lose only 1 percentage point (dropping from 28% to 27%).

3. **Moderate impacts on market shares with reduced LED A-lamp prices**. With a 25% discount for LED A-lamps, LED A-lamp prices remain higher than all other replacement lamp technologies. At a 50% discount for LED A-lamps, prices for all other A-lamp replacement types except spiral CFLs. The 25% price reduction helps LED A-lamps increase market share from 24% to 26% while a 50% price reduction increases their market share from 24% to 29%. When comparing these market shares to the second scenario, this increase is a modest 2 to 5% depending upon the size of the price reduction. With the exception of CFL A-lamps, the other lamp technologies lost some market share with the majority coming from spiral CFLs.

**Figure 64: Modelled market share for A-lamp replacements in home improvement stores by lamp type and scenario (Lamp Choice Model)**




Note: Results may not total 100% because of rounding.

### 6.4.6 Mass merchandise stores

Stores in the mass merchandise channel typically sell high volumes of lamps and offer a moderate to large selection. During winter 2015-16, nearly all mass merchandise stores stocked all of the A-lamp replacement types except CFL A-lamps, which only 13% of mass merchandise stores stocked at that time (Table 31).

**Table 31: Percent of mass merchandise stores stocking A-lamp replacements by lamp type, 2015 (retail store shelf surveys)**

| Lamp Type | Percent of Stores (n=29) |
|---|---|
| LED A-lamp | 97% |
| CFL A-lamp | 13% |
| Spiral CFL | 100% |
| EISA-compliant halogen A-lamp | 100% |
| Traditional incandescent A-lamp | 100% |

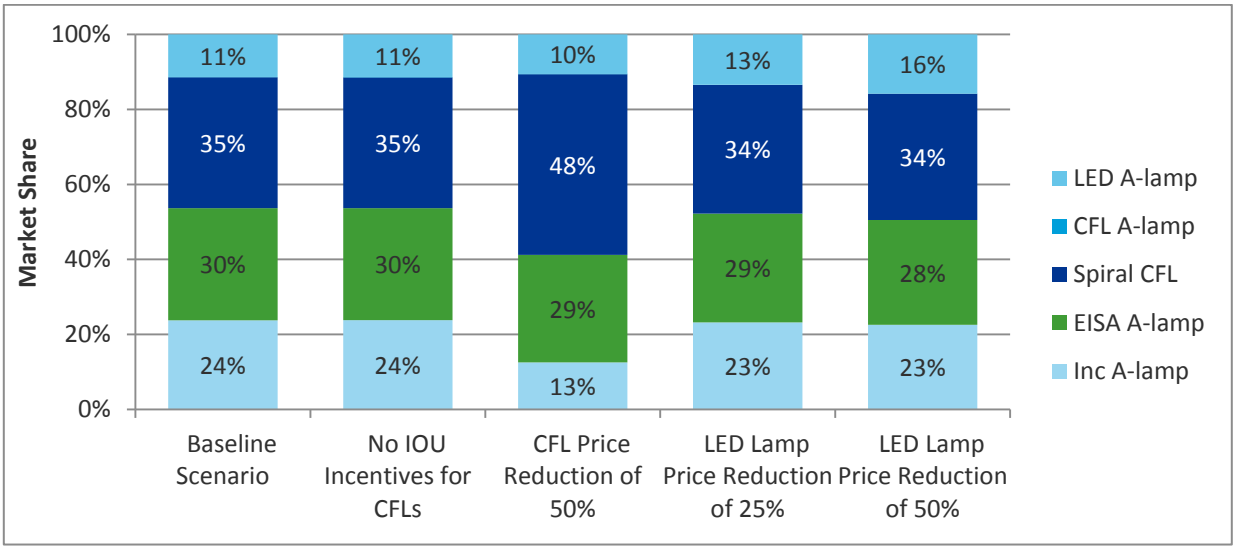
Figure 65 shows the market share results from our scenario analyses for this channel. Across scenarios, spiral CFLs have a slightly higher market share of incandescent A-lamp replacements than the other lamp types. Key findings from these analyses include:

1. **No impact from eliminating incentives for spiral CFLs and CFL A-lamps**. Very few spiral CFL or CFL A-lamps had IOU discounts in mass merchandise stores during the 2015-16 shelf surveys. Subsequently, removing IOU discounts had no impact on market shares within the A-lamp replacement category.

2. **CFL price reductions of 50% result in increased market share for spiral CFLs.** Spiral CFL market share increases from 35% to 48% when prices drop by 50%. The 50% price reduction has no effect on CFL A-lamps' presence in mass merchandise stores given their low market share in the baseline scenario (which reflects their absence from most stores in this channel). All other lamp choices in this category lose market share when CFL prices are reduced by 50% with the largest loss for incandescent A-lamps (which drop from 24% to 13% market share). EISA-compliant halogen and LED A-lamps each lose only one percentage point in market share.

3. **Small impacts from reduced LED lamp prices.** With a 50% discount, the average LED A-lamp price remains higher than average traditional incandescent A-lamp and EISA-compliant halogen A-lamp prices in mass merchandise stores. While this channel had broad availability of LED A-lamps during the winter 2015-16 period, the model shows LED A-lamp market share increasing by 5 percentage points (from 11% to 16%) from the second scenario to the scenario in which we reduced LED A-lamp prices by 50%. Note that while all mass merchandise stores had at least one LED A-lamp during the winter 2015-16 period, recall that the model also considers the brightness (lumen bin) for every lamp purchase simulation in the shopper intercept survey. If the shopper purchased an A-lamp replacement at a brightness level for which there was no LED A-lamp available, the survey did not offer an LED A-lamp to the shopper as part of the choice set. This results in an artificial ceiling for LED A-lamp market shares.

**Figure 65: Modelled market share for A-lamp replacements in mass merchandise stores by lamp type and scenario (Lamp Choice Model)**




Note: Results may not total 100% because of rounding.

## 6.4.7 Wholesale clubs

The stores in this channel typically sell a high volume of lamps and offer a limited selection (often only a few SKUs). During the 2015-16 period, 100% of wholesale clubs stocked LED A-lamps but only 3% stocked CFL A-lamps or EISA-compliant halogen A-lamps (Table 32). Only 13% stocked traditional incandescent A-lamps (and these stores are smaller players in this channel).

**Table 32: Percent of wholesale club stores stocking A-lamp replacements by lamp type, 2015 (retail store shelf surveys)**

| Lamp Type | Percent of Stores (n=31) |
|---|---|
| LED A-lamp | 100% |
| CFL A-lamp | 3% |
| Spiral CFL | 78% |
| EISA-compliant halogen A-lamp | 3% |
| Traditional incandescent A-lamp | 13% |

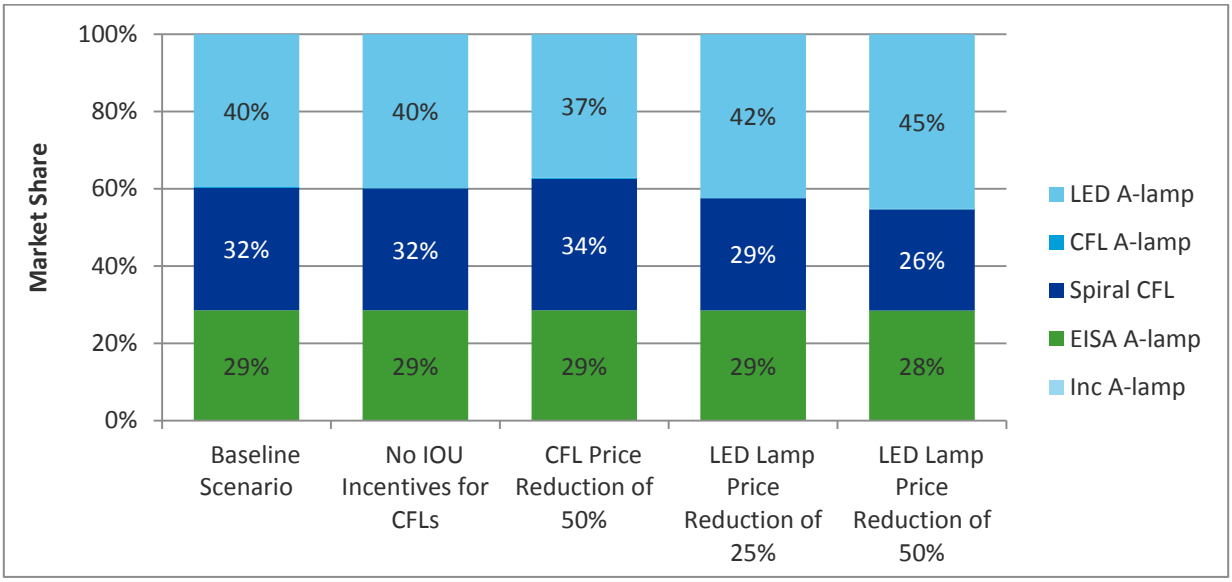
Figure 66 shows the market shares resulting from our scenario analyses for the wholesale club channel. Key findings from these analyses include:

1. **No shift in market shares when CFL incentives disappear.** During the winter 2016-17 period, there were few IOU-discounted CFL A-lamps or spiral CFLs in membership club stores. As such, there was no change in market share for any lamps in this replacement category when we eliminated CFL incentives in the model.

2. **CFL price reductions of 50% increase spiral CFL market share only marginally.** Spiral CFL market share grows minimally when their prices decrease by 50% from the baseline price (from 32% market share to 34%). The price reduction did not affect market share for CFL A-lamps given their minimal presence in this channel.

3. **Small increase in LED A-lamp market share with price reductions.** LED A-lamps have small gains in market share of 2 percentage points with a 25% price reduction (from 40% to 42%) and of 5 percentage points with a 50% price reduction (40% to 45%) when compared to the scenario they are built off, scenario two. These gains for LED A-lamps are primarily at the expense of spiral CFL market share. Given the small range of products available in this channel, the intercept survey's limitation of choice sets within lumen bins likely creates an artificial ceiling for LED A-lamp market share in this channel as in some others.

**Figure 66: Modelled market shares for A-lamp replacements in wholesale clubs by lamp type and scenario (Lamp Choice Model)**




Note: Results may not total 100% because of rounding.

# 7. CONCLUSIONS

The study results described above yield the following conclusions:

1. **At the national level, the ENERGY STAR-qualified CFL manufacturing landscape has contracted while the LED lamp manufacturing landscape continues to expand. This trend is likely to continue, given that forthcoming changes to the ENERGY STAR standard (ENERGY STAR 2.0) will increase the number of LED lamps that qualify and potentially eliminate CFLs. These changes aligned with lamp manufacturers' outlook on California lamp sales. These manufacturers expect CFL sales to decline and LED lamp sales to increase over the next several years.**

In 2016, ENERGY STAR listed 241 lamp manufacturing organizations as "ENERGY STAR partners" who had LED lamps and/or CFLs available. Two-thirds of these produced LED lamps exclusively, and the remainder were a mix of CFL and LED lamp producers.

More than two and a half times as many ENERGY STAR partners produced LED lamps in 2016 as produced CFLs. The number of ENERGY STAR LED lamp manufacturers increased by 20% between 2013 and 2016 (from 175 to 215 firms). In contrast, the number of ENERGY STAR partners producing CFLs dropped by 40% in the same timeframe (from 144 to 82 firms). A small number of firms manufactured the majority of ENERGY CFL models in 2016, while ENERGY STAR LED lamp manufacturers were each responsible for a smaller share of total ENERGY STAR LED lamp models available. This LED lamp manufacturer diversity may be reflected in the diversity of LED lamp models available in California big box stores (more than 80 models per store, on average) in 2015, and increase of more than 60% over 2014.

ENERGY STAR 2.0 will include many LED lamp models that do not currently qualify—and presently, there are no CFLs on the market that meet the standards. As such, we expect a continuation of this shift in the manufacturing landscape toward LED lamps and away from CFLs. Half of lamp manufacturers expect CFL sales to decline in the future and the majority of the remainder expect CFL sales to remain flat. Most manufacturers expect LED lamp sales to continue to increase.

2. **Smaller retail channels such as discount, drug, and grocery may not sell ENERGY STAR CFLs or LED lamps without ULP support. Big box channels are less limited in their ability to continue stocking ENERGY STAR lamps.**

In 2015, many of the manufacturers that supply the discount, drug, and grocery channels reported that they would not sell ENERGY STAR CFLs or LED lamps in these channels without support from the ULP. (Recall that more than 99% of IOU-discounted lamps in these channels in 2015 were CFLs, representing nearly 60% of all program-discounted CFLs in 2015.) All of the manufacturers who supply the mass merchandise stores and wholesale clubs reported that they would continue to supply ENERGY STAR CFLs to these channels in the absence of ULP discounts and most said they would continue to supply ENERGY STAR LED lamps. Four lamp manufacturers reported that they would not have been active in California in 2015 without the ULP.

3. **For lamps in the A-lamp replacement category, the lowest-cost option without IOU discounts in both 2014 and 2015 was the traditional incandescent A-lamp, followed by the EISA-compliant halogen lamp. When IOU discounts were available, however, the lowest-cost option shifted to CFLs (basic spirals in 2014 and A-lamps in 2015).**

In 2015, program-discounted CFLs were roughly half the cost of incandescent A-lamps or EISA-compliant halogen A-lamps. Without program discounts, relatively inefficient lamps become the lowest-cost option for consumers. Several manufacturers' representatives asserted that the majority of consumers will select EISA-compliant halogen lamps in the absence of program-discounted basic CFLs.

4. **The retail stock mix for residential replacement lamps continues to shift away from incandescent lamps and toward LED lamps.**

Although the share of California retail lamp stock comprised by traditional incandescent lamps dropped by about one-quarter between 2014 and 2015, they still comprised the largest share of lamps in 2015 (34%). Across all retail channels, CFLs comprised 25% of lamp stock and halogen lamps, 23%, with changes of only 1 percentage point between years. LED lamps nearly doubled their share of stock between years (from 9% to 17%). Big box stores largely drove the increase in LED lamp share, as LED lamps represented approximately a quarter of big box lamp stock in 2015.

5. **While the vast majority of lamp supplier representatives claimed that the CEC LED lamp specification caused negative market effects for LED lamps, some supplier representatives acknowledged that the specification pushed technological advancements and improved LED lamp quality. Additionally, retail stock data suggest that with discounts, MSB A-lamps that meet the CEC LED lamp specification are the least-cost LED A-lamp option available. These data further suggest that the percentage of LED A-lamps stocked in stores that are ENERGY STAR certified is increasing over time.**

About half of the manufacturers' representatives said they were aware of one or more issues with LED lamp quality or performance, primarily among non-ENERGY STAR lamps. They mentioned four types of quality issues: dimmability failure, lumen degradation, early lamp failure, and poor/unusual light quality. Nearly all attributed these quality issues to non-ENERGY STAR lamps produced with low-quality components.

Most lighting suppliers expressed negative reactions to the ULP requirements that LED lamps meet the CEC specification. They also reported numerous negative market effects including decreased program participation for LED lamps and difficulties competing against less expensive LED lamps that do not meet the specification. However, a few representatives acknowledged that the requirement is pushing technological advancement and improving LED lamp performance, and thus had a positive influence on LED lamp quality. Retail lamp stock data offer additional evidence that the CEC specification is advancing market quality. These data suggest that the percentage of ENERGY STAR LED lamps stocked in stores is increasing over time, and that with discounts, MSB LED A-lamps that meet the CEC specification are the lowest cost MSB LED A-lamp available.

6. **Lamp quality is less of a concern among consumers who had not purchased LED lamps than price and lack of familiarity with the technology. For CFLs, however, quality and performance were the chief concerns among consumers who had not purchased CFLs as of 2015.**

Shoppers who did *not* purchase LED lamps cited lamp price far more often than any other reason followed by a lack of familiarity with the technology. Reasons cited by CFL non-purchasers as reasons for *not* selecting CFLs were more varied, but the top reason cited among CFL non-purchasers for not purchasing CFLs was a dislike of the quality or color of the light from CFLs.

7. **Awareness of LED lamps among California consumers was on par with CFLs in 2015 (85% each). Purchase rates for LED lamps remained comparatively low, however, as did awareness and purchase rates for EISA-compliant halogen lamps.**

As of 2015, an equal proportion of California consumers reported awareness of CFLs and LED lamps (85%). Awareness of EISA-compliant halogen lamps remained lower, at less than 60% consumers. More than 60% of consumers reported having purchased CFLs during or before 2015, compared to roughly 30% for LED lamps and less than 20% for energy-efficient incandescent lamps.

8. **Aside from energy savings, expected useful life was the primary motivator among LED lamp purchasers in 2015, and price was the primary motivator among CFL purchasers.**

CFL purchasers and LED lamp purchasers both cited energy savings as their reason for choosing their respective lamp technologies more than any other reason. More LED lamp purchasers cited length of lamp life as a main reason for purchasing LED lamps. Many LED lamp purchasers also cited the lamps' environmental benefits as a motivating factor. More CFL purchasers cited low prices as a main reason for purchasing CFLs, and many also mentioned prior experience with the technology.

# A. APPENDIX A - REFERENCES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# B. APPENDIX B – SHELF SURVEY WEIGHTS

DNV GL developed storefront weights for California retail stores that sell replacement lamps in support of the CPUC's EM&V for the 2010–2012 program cycle, including WO13 (Lighting Process Evaluation and Market Characterization), WO28 (Residential/Advanced/Upstream Lighting Impact Evaluation), and WO54 (Market Assessment and Market Effects). In 2013, DNV GL completed this research effort, entitled the Survey of California Storefronts (SCS), and data obtained through the SCS enabled weighting of stores sampled in shelf survey research efforts conducted in 2012, 2013, 2014, 2015, and 2016. DNV GL developed storefront weights for stores in all seven channels in which shelf surveys were conducted, including:

- Discount
- Drug
- Grocery
- Hardware
- Home Improvement
- Mass Merchandise
- Membership Club

For further details on the methods and results of the SCS, please see Appendix B of the 2013 California Residential Replacement Lamp Market Status Report (DNV GL, 2014c).

Table 33 below presents a summary of the SCS sample design weights and the shelf survey storefront weights for the Winter 2012-2013, Summer 2013, Winter 2013-2014, and Winter 2015-2016 shelf surveys. The shelf survey storefront weights ranged in magnitude from 1.4 to approximately 338.

**Table 33: Summary of SCS storefront weights and shelf survey storefront weights, 2012–2015 (retail store shelf surveys)**

| Domain | | Survey of California Storefronts | | | | Winter 2012-2013 Shelf Surveys | | | Summer 2013 Shelf Surveys | | | Winter 2014-2015 Shelf Surveys | | | Winter 2015-2016 Shelf Surveys | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total Store-fronts | Sample | Min Sample Weight | Max Sample Weight | Sample | Min Sample Weight | Max Sample Weight | Sample | Min Sample Weight | Max Sample Weight | Sample | Min Sample Weight | Max Sample Weight | Sample | Min Sample Weight | Max Sample Weight |
| **IOU Territory** | PG&E | 7,544 | 177 | 17.7 | 83.6 | 75 | 7.9 | 335.5 | 76 | 7.9 | 334.2 | 75 | 7.9 | 334.2 | 76 | 7.5 | 338.1 |
| | SCE | 6,768 | 151 | 5.9 | 86.4 | 75 | 5.8 | 327.9 | 75 | 5.8 | 326.1 | 75 | 5.8 | 326.1 | 76 | 5.4 | 330.8 |
| | SDG&E | 1,417 | 81 | 6 | 25.7 | 50 | 1.4 | 178.5 | 50 | 1.4 | 172.8 | 50 | 1.4 | 172.9 | 55 | 1.4 | 192.9 |
| **Retail Channel** | Discount | 1,949 | 57 | 5.9 | 41.1 | 29 | 6.8 | 102.3 | 29 | 7.5 | 99.1 | 29 | 7.5 | 99.3 | 29 | 5.7 | 103.2 |
| | Drug | 2,323 | 58 | 16.6 | 46.5 | 29 | 8.3 | 120.7 | 29 | 9.3 | 118.1 | 29 | 9.3 | 118.3 | 30 | 6.9 | 120.8 |
| | Grocery | 8,072 | 218 | 14 | 83.6 | 28 | 151.8 | 335.5 | 28 | 160.1 | 334.2 | 28 | 159.9 | 334.2 | 28 | 146.8 | 338.1 |
| | Hardware | 1,511 | 25 | 6.3 | 86.4 | 29 | 5.4 | 84.4 | 29 | 5.9 | 79.9 | 29 | 5.9 | 80.1 | 29 | 4.9 | 89.4 |
| | Home Imprv | 351 | 9 | 12.3 | 56 | 28 | 1.8 | 19.6 | 29 | 1.9 | 18.1 | 28 | 1.9 | 19.1 | 31 | 1.6 | 19.3 |
| | Mass Merch | 1,368 | 31 | 18.2 | 53.6 | 29 | 5 | 77.4 | 29 | 5.5 | 75 | 29 | 5.5 | 75.2 | 29 | 4.4 | 81.6 |
| | Membership Club | 155 | 11 | 5.9 | 24 | 28 | 1.4 | 7.9 | 28 | 1.4 | 7.9 | 28 | 1.4 | 7.9 | 31 | 1.4 | 7.5 |
| **ULP Status** | Participant | 10,897 | 271 | 6 | 86.4 | 149 | 1.4 | 335.5 | 152 | 1.4 | 334.2 | 151 | 1.4 | 334.2 | 155 | 1.4 | 338.1 |
| | Nonparticipant | 4,832 | 138 | 5.9 | 67.4 | 51 | 1.8 | 329.3 | 49 | 1.9 | 331.3 | 49 | 1.9 | 331.3 | 52 | 1.6 | 327.9 |
| **Overall** | | **15,729** | **409** | **5.9** | **86.4** | **200** | **1.4** | **335.5** | **201** | **1.4** | **334.2** | **200** | **1.4** | **334.2** | **207** | **1.4** | **338.1** |

# C. APPENDIX C – ADDITIONAL DATA TABLES

**Table 34: Number of units discounted by the 2015 ULP by technology, unit type, and retail channel**

| Tech | Unit Type | Retail Channel | | | | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Discount | Drug | Grocery | Hardware | Home Improv | Ltg & Electronics | Mass Merch. | Wholesale Club | Other / Unknown | |
| CFL | Spiral lamp >30W | 736,786 | 6,632 | 1,369,423 | 159,770 | 10,121 | 0 | 305 | 172,407 | 59,480 | 2,514,924 |
| | Basic spiral lamp | 466,897 | 0 | 34,410 | 570 | 6,541 | 0 | 21,137 | 98,892 | 120 | 628,567 |
| | A-lamp | 575,018 | 860 | 558,214 | 71,520 | 14,674 | 0 | 1,297 | 0 | 261,120 | 1,482,703 |
| | Reflector lamp | 762,413 | 12,660 | 1,488,574 | 278,154 | 67,621 | 0 | 1,981 | 13,488 | 3,828 | 2,628,719 |
| | Globe lamp | 40,110 | 0 | 92,150 | 17,350 | 4,865 | 0 | 1,405 | 0 | 0 | 155,880 |
| | 3-Way lamp | 167,947 | 0 | 198,200 | 14,100 | 227 | 0 | 51 | 0 | 0 | 380,525 |
| | Indoor fixture | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 5 |
| | Other lamp | 8 | 0 | 0 | 0 | 256 | 0 | 0 | 0 | 0 | 264 |
| **CFL Subtotal** | | **2,749,179** | **20,152** | **3,740,971** | **541,464** | **104,305** | **0** | **26,181** | **284,787** | **324,548** | **7,791,587** |
| LED | Reflector lamp | 33,872 | 250 | 58,014 | 120,396 | 260,793 | 2,016 | 31 | 2,118,480 | 28,970 | 2,622,822 |
| | A-lamp | 121,510 | 300 | 266,677 | 196,722 | 374,953 | 2,016 | 7,297 | 2,716,038 | 53,610 | 3,739,122 |
| | Indoor fixture | 72 | 0 | 4,027 | 13,849 | 160,684 | 0 | 0 | 663,622 | 36,679 | 878,933 |
| **LED Subtotal** | | **155,454** | **550** | **328,718** | **330,967** | **796,430** | **4,032** | **7,328** | **5,498,140** | **119,259** | **7,240,877** |
| **Grand Total** | | **2,904,633** | **20,702** | **4,069,689** | **872,431** | **900,735** | **4,032** | **33,509** | **5,782,927** | **443,807** | **15,032,465** |

Source: 2015 ULP tracking data. Because the 2015 evaluation is not finalized yet, these numbers are subject to change.

**Table 35: Percent of units discounted by the 2015 ULP by technology, unit type, and retail channel**

| Tech | Unit Type | Retail Channel | | | | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Discount | Drug | Grocery | Hardware | Home Improv | Ltg & Electronics | Mass Merch. | Wholesale Club | Other / Unknown | |
| CFL | Spiral lamp >30W | 27% | 33% | 37% | 30% | 10% | 0% | 1% | 61% | 18% | 32% |
| | Basic spiral lamp | 17% | 0% | <1% | <1% | 6% | 0% | 81% | 35% | <1% | 8% |
| | A-lamp | 21% | 4% | 15% | 13% | 14% | 0% | 5% | 0% | 80% | 19% |
| | Reflector lamp | 28% | 63% | 40% | 51% | 65% | 0% | 8% | 5% | 1% | 34% |
| | Globe lamp | 1% | 0% | 2% | 3% | 5% | 0% | 5% | 0% | 0% | 2% |
| | 3-Way lamp | 6% | 0% | 5% | 3% | <1% | 0% | <1% | 0% | 0% | 5% |
| | Indoor fixture | 0% | 0% | 0% | 0% | 0% | 0% | <1% | 0% | 0% | <1% |
| | Other lamp | <1% | 0% | 0% | 0% | <1% | 0% | 0% | 0% | 0% | <1% |
| **CFL Subtotal** | | **35%** | **<1%** | **48%** | **7%** | **1%** | **0%** | **<1%** | **4%** | **4%** | **100%** |
| LED | Reflector lamp | 22% | 45% | 18% | 36% | 33% | 50% | <1% | 39% | 24% | 36% |
| | A-lamp | 78% | 55% | 81% | 59% | 47% | 50% | 100% | 49% | 45% | 52% |
| | Indoor fixture | <1% | 0% | 1% | 4% | 20% | 0% | 0% | 12% | 31% | 12% |
| **LED Subtotal** | | **2%** | **<1%** | **5%** | **5%** | **11%** | **<1%** | **<1%** | **76%** | **2%** | **100%** |
| **Grand Total** | | **19%** | **<1%** | **27%** | **6%** | **6%** | **<1%** | **<1%** | **38%** | **3%** | **100%** |

Source: 2015 ULP tracking data. Because the 2015 evaluation is not finalized yet, these numbers are subject to change.

**Table 36: Percent of stores stocking LED lamps that meet the CEC spec and do not meet the CEC spec**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | CEC Spec | Non-CEC Spec | n | CEC Spec | Non-CEC Spec | n |
| All Stores | 13% | 46% | 200 | 12% | 48% | 207 |
| Big Box | 21% | 99% | 85 | 20% | 100% | 91 |
| Non-Big Box | 12% | 39% | 115 | 11% | 41% | 116 |

**Table 37: Percent of stores carrying MSB CFLs by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 96% | 52% | 22% | - | 93% | 3% | - | - |
| Non-Big Box | 69% | 2% | 1% | - | 63% | 12% | - | - |

**Table 38: Percent of stores carrying MSB CFLs by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 88% | 67% | 84% | 8% | 88% | 5% | 61% | - |
| Non-Big Box | 53% | 34% | 29% | 4% | 50% | 13% | 37% | 1% |

**Table 39: Percent of stores carrying MSB CFLs by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 99% | 85% | 85% | 56% | 99% | 26% | 25% | 14% |
| Non-Big Box | 54% | 41% | 35% | 5% | 93% | 50% | 29% | 5% |

**Table 40: Percent of stores carrying MSB CFLs by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 86% | 69% | 65% | 71% | 83% | 75% | 24% | 13% |
| Non-Big Box | 19% | 17% | 20% | 12% | 10% | 18% | 21% | 11% |

**Table 41: Percent of stores carrying MSB LED Lamps by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 78% | 44% | - | 87% | 42% | - |
| Non-Big Box | 6% | - | - | 29% | 2% | - |

**Table 42: Percent of stores carrying MSB LED Lamps by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 76% | 80% | - | 81% | 90% | - |
| Non-Big Box | 24% | 5% | - | 26% | 6% | - |

**Table 43: Percent of stores carrying MSB LED Lamps by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 88% | 86% | 57% | 92% | 91% | 7% |
| Non-Big Box | 37% | 13% | - | 39% | 14% | - |

**Table 44: Percent of stores carrying MSB LED Lamps by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 98% | 93% | 78% | 96% | 96% | 89% |
| Non-Big Box | 30% | 15% | 3% | 34% | 20% | 13% |

**Table 45: Number of lamps by technology, 2012–2015 (retail store shelf surveys)**

| Lamp Technology | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|
| All CFL | 202,139 | 183,104 | 130,585 | 126,943 |
| Advanced CFL | 65,482 | 60,106 | 44,966 | 34,630 |
| Basic CFL (≤30 Watts) | 136,657 | 122,998 | 85,619 | 92,313 |
| Incandescent | 231,737 | 201,325 | 173,075 | 153,494 |
| Halogen | 61,578 | 84,132 | 98,609 | 112,485 |
| LED | 31,077 | 36,336 | 99,093 | 204,954 |
| **Overall** | **526,531** | **504,897** | **501,362** | **597,876** |

**Table 46: Percent of LED lamps that meet CEC spec and do not meet CEC spec**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | CEC Spec | Non-CEC Spec | n | CEC Spec | Non-CEC Spec | n |
| All Stores | 12% | 88% | 99,093 | 13% | 87% | 204,954 |
| Big Box | 11% | 89% | 95,572 | 9% | 91% | 195,138 |
| Non-Big Box | 15% | 85% | 3,521 | 27% | 73% | 9,816 |

**Table 47: Percent of EISA compliant and EISA non-compliant lamps stocked by store category, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 98% | 2% | 88% | 12% |
| Non-Big Box | 99% | 1% | 94% | 6% |

**Table 48: Number of EISA compliant and EISA non-compliant lamps stocked by store category, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 9,811 | 139 | 3,460 | 185 |
| Non-Big Box | 3,386 | 50 | 1,163 | 83 |

**Table 49: Percent of EISA compliant and EISA non-compliant lamps stocked by store category, medium high brightness lamps (1050-1490 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 52% | 48% | 100% | - |
| Non-Big Box | 80% | 20% | 100% | - |

**Table 50: Number of EISA compliant and EISA non-compliant lamps stocked by store category, medium high brightness lamps (1050-1490 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 6,978 | 4,822 | 14,354 | - |
| Non-Big Box | 1,499 | 297 | 3,416 | - |

**Table 51: Percent of EISA compliant and EISA non-compliant lamps stocked by store category, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 63% | 37% | 98% | 2% |
| Non-Big Box | 52% | 48% | 62% | 38% |

**Table 52: Number of EISA compliant and EISA non-compliant lamps stocked by store category, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 9,692 | 5,259 | 12,691 | 468 |
| Non-Big Box | 2,117 | 2,296 | 2,430 | 1,334 |

**Table 53: Percent of EISA compliant and EISA non-compliant lamps stocked by store category, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 35% | 65% | 86% | 14% |
| Non-Big Box | 33% | 67% | 68% | 32% |

**Table 54: Number of EISA compliant and EISA non-compliant lamps stocked by store category, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 10,453 | 14,985 | 31,240 | 5,421 |
| Non-Big Box | 2,007 | 4,257 | 1,491 | 1,668 |

**Table 55: Percent of MSB CFLs stocked by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 32% | 68% | 89% | - | 41% | 1% | - | - |
| Non-Big Box | 68% | 32% | 11% | - | 59% | 99% | - | - |

**Table 56: Number of MSB CFLs stocked by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 22,428 | 481 | 95 | - | 21,641 | 62 | - | - |
| Non-Big Box | 6,380 | 68 | 13 | - | 4,308 | 472 | - | - |

**Table 57: Percent of MSB CFLs stocked by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 43% | 11% | 15% | 38% | 41% | 1% | 6% | - |
| Non-Big Box | 57% | 89% | 85% | 62% | 59% | 99% | 94% | 100% |

**Table 58: Number of MSB CFLs stocked by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 9,125 | 558 | 966 | 366 | 5,407 | 58 | 1,132 | - |
| Non-Big Box | 2,825 | 1,111 | 958 | 91 | 2,650 | 1,384 | 1,749 | 176 |

**Table 59: Percent of MSB CFLs stocked by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 62% | 49% | 46% | 88% | 72% | 39% | 4% | 91% |
| Non-Big Box | 38% | 51% | 54% | 12% | 28% | 61% | 96% | 9% |

**Table 60: Number of MSB CFLs stocked by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 39,532 | 2,660 | 9,272 | 552 | 51,306 | 2,200 | 1,189 | 723 |
| Non-Big Box | 3,096 | 643 | 1,042 | 39 | 2,828 | 353 | 15,198 | 26 |

**Table 61: Percent of MSB CFLs stocked by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 80% | 63% | 57% | 80% | 91% | 26% | 65% | 19% |
| Non-Big Box | 20% | 37% | 43% | 20% | 9% | 74% | 35% | 81% |

**Table 62: Number of MSB CFLs stocked by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | 4,851 | 927 | 2,079 | 1,123 | 5,894 | 375 | 2,291 | 483 |
| Non-Big Box | 707 | 259 | 263 | 176 | 424 | 164 | 213 | 260 |

**Table 63: Percent of MSB LED Lamps stocked by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 93% | 100% | - | 85% | 89% | - |
| Non-Big Box | 7% | - | - | 15% | 11% | - |

**Table 64: Number of MSB LED Lamps stocked by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 4,026 | 575 | - | 9,324 | 254 | - |
| Non-Big Box | 105 | - | - | 241 | 17 | - |

**Table 65: Percent of MSB LED Lamps stocked by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 79% | 89% | - | 78% | 76% | - |
| Non-Big Box | 21% | 11% | - | 22% | 24% | - |

**Table 66: Number of MSB LED Lamps stocked by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 4,531 | 3,577 | - | 2,428 | 4,002 | - |
| Non-Big Box | 272 | 76 | - | 290 | 281 | - |

**Table 67: Percent of MSB LED Lamps stocked by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 79% | 89% | 100% | 79% | 71% | 100% |
| Non-Big Box | 21% | 11% | - | 21% | 29% | - |

**Table 68: Number of MSB LED Lamps stocked by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 19,599 | 15,292 | 132 | 81,252 | 13,862 | 89 |
| Non-Big Box | 575 | 170 | - | 2,893 | 833 | - |

**Table 69: Percent of MSB LED Lamps stocked by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 85% | 74% | 97% | 76% | 76% | 86% |
| Non-Big Box | 15% | 26% | 3% | 24% | 24% | 14% |

**Table 70: Number of MSB LED Lamps stocked by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | 14,075 | 6,153 | 9,710 | 21,856 | 17,994 | 2,386 |
| Non-Big Box | 410 | 748 | 62 | 962 | 1,844 | 216 |

**Table 71: Number of lamp models by technology, 2014 and 2015 (retail store shelf surveys)**

| Lamp Technology | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|
| All CFL | 1,108 | 1,096 | 1,103 | 980 |
| Advanced CFL | 633 | 671 | 714 | 616 |
| Basic CFL (≤30 Watts) | 475 | 425 | 389 | 365 |
| Incandescent | 1,516 | 1,373 | 1,361 | 1,245 |
| Halogen | 568 | 600 | 659 | 611 |
| LED | 349 | 359 | 684 | 863 |

**Table 72: Number of lamp models by technology and store category, 2014 and 2015 (retail store shelf surveys)**

| Lamp Technology | Big Box | | Non-Big Box | |
|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 |
| All CFLs | 719 | 594 | 719 | 664 |
| Advanced CFLs | 493 | 379 | 451 | 424 |
| Basic CFLs (≤30 Watts) | 226 | 215 | 268 | 242 |
| LEDs | 612 | 792 | 208 | 337 |
| Halogen | 444 | 455 | 507 | 424 |
| Incandescent | 890 | 863 | 1,154 | 1,052 |

**Table 73: Number of MSB A-lamp Replacement lamp models by technology, store category, and year (retail store shelf surveys)**

| Lamp Technology | Big Box | | Non-Big Box | |
|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 |
| CFL Spiral | 302 | 282 | 347 | 315 |
| CFL A-lamp | 66 | 34 | 64 | 69 |
| LED | 235 | 312 | 85 | 149 |
| Incandescent | 208 | 205 | 282 | 251 |
| Halogen | 155 | 160 | 173 | 180 |

**Table 74: Number of MSB Reflector lamp models by technology, store category, and year (retail store shelf surveys)**

| Lamp Technology | Big Box | | Non-Big Box | |
|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 |
| CFL Reflector | 117 | 79 | 108 | 98 |
| LED Reflector | 197 | 226 | 54 | 91 |
| Incandescent Reflector | 175 | 161 | 199 | 182 |
| Halogen Reflector | 151 | 159 | 186 | 135 |

**Table 75: Number of MSB Globe lamp models by technology, store category, and year (retail store shelf surveys)**

| Lamp Technology | Big Box | | Non-Big Box | |
|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 |
| CFL Globe | 32 | 15 | 30 | 25 |
| LED Globe | 34 | 50 | 8 | 18 |
| Incandescent Globe | 105 | 91 | 125 | 102 |
| Halogen Globe | 26 | 26 | 20 | 14 |

**Table 76: Number of LED lamp models that meet CEC spec and do not meet CEC spec**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | CEC Spec | Non-CEC Spec | CEC Spec | Non-CEC Spec |
| All Stores | 33 | 655 | 28 | 835 |
| Big Box | 28 | 557 | 19 | 717 |
| Non-Big Box | 11 | 168 | 15 | 263 |

**Table 77: Number of MSB CFL models with and without IOU discounts by store category and lamp shape, 2014 and 2015**

| Lamp Technology | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | IOU Discounted | | Non-IOU Discounted | | IOU Discounted | | Non-IOU Discounted | |
| | Big Box | Non-Big Box | Big Box | Non-Big Box | Big Box | Non-Big Box | Big Box | Non-Big Box |
| Spiral | 5 | 15 | 301 | 311 | 5 | 23 | 279 | 259 |
| A-lamp | 11 | 9 | 65 | 47 | - | 6 | 34 | 53 |
| Reflector | 16 | 11 | 113 | 91 | 3 | 16 | 79 | 69 |
| Globe | 8 | 3 | 32 | 24 | - | 2 | 15 | 19 |

**Table 78: Number of MSB LED models with and without IOU discounts by store category and lamp shape, 2014 and 2015**

| Lamp Technology | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | IOU Discounted | | Non-IOU Discounted | | IOU Discounted | | Non-IOU Discounted | |
| | Big Box | Non-Big Box | Big Box | Non-Big Box | Big Box | Non-Big Box | Big Box | Non-Big Box |
| A-lamp | 17 | 4 | 229 | 77 | 10 | 9 | 308 | 137 |
| Reflector | 12 | 5 | 192 | 50 | 19 | 7 | 219 | 83 |
| Globe | - | - | 34 | 8 | 2 | - | 50 | 18 |

**Table 79: Average number of MSB CFL models per store by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | | 2015 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Total Model Numbers | Spiral | A-lamp | Reflector | Globe | Total Model Numbers |
| Big Box | 6 | 1 | 0 | - | 103 | 5 | - | - | - | 77 |
| Non-Big Box | 3 | - | - | - | 95 | 2 | 0 | - | - | 86 |

**Table 80: Average number of MSB CFL models per store by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | | 2015 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Total Model Numbers | Spiral | A-lamp | Reflector | Globe | Total Model Numbers |
| Big Box | 3.8 | 1.1 | 1.5 | 0.1 | 95 | 3.5 | - | 1 | - | 66 |
| Non-Big Box | 1.8 | 0.5 | 0.4 | - | 109 | 1 | 0.1 | 0.5 | - | 81 |

**Table 81: Average number of MSB CFL models per store by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | | 2015 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Total Model Numbers | Spiral | A-lamp | Reflector | Globe | Total Model Numbers |
| Big Box | 3.8 | 2.7 | 2.4 | 0.9 | 134 | 5.4 | 0.5 | 0.4 | 0.3 | 119 |
| Non-Big Box | 1.7 | 0.6 | 0.6 | 0.1 | 106 | 1.5 | 0.4 | 0.2 | - | 113 |

**Table 82: Average number of MSB CFL models per store by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | | 2015 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Total Model Numbers | Spiral | A-lamp | Reflector | Globe | Total Model Numbers |
| Big Box | 2.9 | 1.6 | 1.7 | 1.7 | 98 | 3.1 | 0.2 | 1.2 | 0.2 | 72 |
| Non-Big Box | 0.4 | 0.3 | 0.4 | 0.2 | 67 | 0.2 | 0.3 | 0.4 | 0.1 | 73 |

**Table 83: Average number of MSB LED A-lamp models per store by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | Total Model Numbers | A-lamp | Reflector | Globe | Total Model Numbers |
| Big Box | 2.9 | 0.6 | - | 28 | 4.4 | 0.5 | - | 35 |
| Non-Big Box | 0.1 | - | - | 5 | 0.4 | - | - | 15 |

**Table 84: Average number of MSB LED A-lamp models per store by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | Total Model Numbers | A-lamp | Reflector | Globe | Total Model Numbers |
| Big Box | 3.5 | 3.8 | - | 80 | 4.3 | 3.4 | - | 60 |
| Non-Big Box | 0.3 | 0.1 | - | 26 | 0.4 | 0.3 | - | 26 |

**Table 85: Average number of MSB LED A-lamp models per store by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | Total Model Numbers | A-lamp | Reflector | Globe | Total Model Numbers |
| Big Box | 3.5 | 4.2 | 0.7 | 143 | 10.4 | 4.2 | 0.1 | 169 |
| Non-Big Box | 0.6 | 0.2 | - | 41 | 1.2 | 0.6 | - | 66 |

**Table 86: Average number of MSB LED A-lamp models per store by store category and lamp shape, medium low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | Total Model Numbers | A-lamp | Reflector | Globe | Total Model Numbers |
| Big Box | 5.9 | 4 | 2.2 | 143 | 6.9 | 9.8 | 4.2 | 209 |
| Non-Big Box | 0.5 | 0.3 | - | 38 | 1.1 | 0.9 | 0.3 | 74 |

**Table 87: Number of EISA-compliant and EISA Non-Compliant lamp models by store category, 2014 and 2015**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 109 | 86 | 148 | 53 |
| Non-Big Box | 128 | 93 | 167 | 53 |

**Table 88: Number of lamps by technology, store category, and year (retail store shelf surveys)**

| Lamp Technology | Big Box | | Non-Big Box | |
|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 |
| All CFL | 109,670 | 106,089 | 20,915 | 20,854 |
| Advanced CFL | 34,470 | 22,234 | 10,496 | 12,396 |
| Basic CFL (≤30 Watts) | 75,200 | 83,855 | 10,419 | 8,458 |
| Incandescent | 115,651 | 113,169 | 57,424 | 40,325 |
| Halogen | 80,614 | 96,257 | 17,995 | 16,228 |
| LED | 95,572 | 195,138 | 3,521 | 9,816 |

**Table 89: Number of MSB A-lamp replacement lamps by technology, store category, and year (retail store shelf surveys)**

| MSB Lamp Technology | Big Box | | Non-Big Box | |
|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 |
| CFL Spiral | 78,618 | 85,892 | 14,143 | 12,812 |
| CFL A-lamp | 4,744 | 2,815 | 2,091 | 2,393 |
| Incandescent A-lamp | 21,384 | 19,198 | 12,279 | 11,725 |
| Halogen A-lamp | 55,457 | 64,351 | 12,665 | 12,812 |
| LED A-lamp | 44,299 | 118,138 | 1,556 | 4,731 |

**Table 90: Number of MSB reflector lamps by technology, store category, and year (retail store shelf surveys)**

| MSB Lamp Technology | Big Box | | Non-Big Box | |
|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 |
| CFL Reflector | 12,421 | 4,674 | 2,276 | 3,491 |
| Incandescent Reflector | 22,407 | 20,398 | 4,925 | 2,430 |
| Halogen Reflector | 13,764 | 17,590 | 3,170 | 3,786 |
| LED Reflector | 25,985 | 36,338 | 1,030 | 3,044 |

**Table 91: Number of MSB Globe lamps by technology, store category, and year (retail store shelf surveys)**

| MSB Lamp Technology | Big Box | | Non-Big Box | |
|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 |
| CFL Globe | 2,041 | 1,206 | 318 | 462 |
| Incandescent Globe | 12,052 | 12,538 | 3,751 | 2,550 |
| Halogen Globe | 2,429 | 3,199 | 338 | 243 |
| LED Globe | 10,518 | 13,326 | 129 | 259 |

**Table 92: Number of MSB CFLs with and without IOU discounts by store category and lamp shape, 2014 and 2015**

| Lamp Technology | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | IOU Discounted | | Non-IOU Discounted | | IOU Discounted | | Non-IOU Discounted | |
| | Big Box | Non-Big Box | Big Box | Non-Big Box | Big Box | Non-Big Box | Big Box | Non-Big Box |
| Spiral | 439 | 4,516 | 78,179 | 9,627 | 2,356 | 6,308 | 83,536 | 6,504 |
| A-lamp | 276 | 953 | 4,468 | 1,138 | - | 1,742 | 2,815 | 651 |
| Reflector | 1,525 | 875 | 10,896 | 1,401 | 68 | 2,931 | 4,606 | 560 |
| Globe | 216 | 122 | 1,825 | 196 | - | 310 | 1,206 | 152 |

**Table 93: Number of MSB LED A-lamps with and without IOU discounts by store category and lamp shape, 2014 and 2015**

| Lamp Technology | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | IOU Discounted | | Non-IOU Discounted | | IOU Discounted | | Non-IOU Discounted | |
| | Big Box | Non-Big Box | Big Box | Non-Big Box | Big Box | Non-Big Box | Big Box | Non-Big Box |
| A-lamp | 3,196 | 159 | 41,103 | 1,397 | 12,892 | 1,626 | 105,246 | 3,105 |
| Reflector | 9,017 | 288 | 16,968 | 742 | 11,662 | 1,085 | 24,676 | 1,959 |
| Globe | - | - | 10,518 | 129 | 250 | - | 13,076 | 259 |

**Table 94: Average Price per EISA compliant and EISA non-compliant lamp by store category, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | $1.98 | $4.58 | $1.89 | $4.44 |
| Non-Big Box | $2.72 | $6.81 | $2.24 | $5.17 |

**Table 95: Average Price per EISA compliant and EISA non-compliant lamp by store category, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | $1.81 | $1.78 | $1.70 | - |
| Non-Big Box | $2.92 | $2.25 | $2.62 | - |

**Table 96: Average Price per EISA compliant and EISA non-compliant lamp by store category, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | $1.71 | $1.58 | $1.48 | $0.96 |
| Non-Big Box | $3.15 | $1.71 | $2.39 | $0.55 |

**Table 97: Average price per EISA compliant and EISA non-compliant lamp by store category, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | $1.65 | $1.73 | $1.48 | $2.10 |
| Non-Big Box | $2.52 | $1.99 | $2.53 | $1.77 |

**Table 98: Average price per MSB CFL by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | $3.15 | $6.42 | $9.53 | - | $3.01 | $3.48 | - | - |
| Non-Big Box | $2.78 | $2.13 | $14.44 | - | $2.34 | $2.27 | - | - |

**Table 99: Average price per MSB CFL by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | $2.93 | $6.91 | $8.43 | $5.82 | $3.20 | $8.27 | $6.41 | - |
| Non-Big Box | $4.13 | $2.57 | $3.54 | $0.81 | $2.93 | $1.31 | $1.64 | $1.00 |

**Table 100: Average price per MSB CFL by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | $1.76 | $4.68 | $5.12 | $4.96 | $1.83 | $4.45 | $7.32 | $5.62 |
| Non-Big Box | $3.27 | $4.99 | $2.79 | $10.29 | $2.36 | $5.71 | $1.43 | $10.34 |

**Table 101: Average price per MSB CFL by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | | 2015 | | | |
|---|---|---|---|---|---|---|---|---|
| | Spiral | A-lamp | Reflector | Globe | Spiral | A-lamp | Reflector | Globe |
| Big Box | $2.14 | $4.68 | $6.47 | $5.19 | $1.98 | $6.94 | $6.53 | $5.58 |
| Non-Big Box | $3.75 | $8.25 | $7.80 | $6.73 | $4.12 | $8.25 | $11.70 | $1.94 |

**Table 102: Average price per MSB LED Lamp by store category and lamp shape, high brightness lamps (1490-2600 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | $18.87 | $27.65 | - | $11.93 | $26.08 | - |
| Non-Big Box | $21.35 | - | - | $21.77 | $32.91 | - |

**Table 103: Average price per MSB LED Lamp by store category and lamp shape, medium high brightness lamps (1050-1489 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | $12.85 | $22.51 | - | $12.29 | $17.70 | - |
| Non-Big Box | $14.37 | $7.71 | - | $18.85 | $28.57 | - |

**Table 104: Average price per MSB LED Lamp by store category and lamp shape, medium low brightness lamps (750-1049 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | $8.98 | $14.65 | $13.71 | $4.62 | $13.67 | $9.55 |
| Non-Big Box | $10.96 | $21.33 | - | $6.12 | $18.09 | - |

**Table 105: Average price per MSB LED A-lamp by store category and lamp shape, low brightness lamps (310-749 lumens), 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | A-lamp | Reflector | Globe | A-lamp | Reflector | Globe |
| Big Box | $9.01 | $13.38 | $8.32 | $5.68 | $10.40 | $8.56 |
| Non-Big Box | $11.48 | $12.67 | $15.80 | $9.67 | $13.78 | $14.12 |

**Table 106: Average price per LED A-lamp by store category and lumen Bin, 2014 and 2015 (retail store shelf surveys)**

| Lumen Bin | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | Big Box | Non-Big Box | Overall | Big Box | Non-Big Box | Overall |
| High Brightness (1490-2600 lumens) | $20.00 | $21.35 | $20.09 | $13.05 | $22.21 | $14.38 |
| Medium High Brightness (1050-1489 lumens) | $16.33 | $13.00 | $15.75 | $14.37 | $22.64 | $16.17 |
| medium low Brightness (750-1049 lumens) | $11.22 | $13.27 | $11.57 | $5.68 | $8.09 | $6.21 |
| Low Brightness (310-749 lumens) | $10.40 | $12.83 | $10.77 | $8.68 | $12.65 | $9.57 |
| Very Low Brightness (<310 lumens) | $9.37 | $13.78 | $10.16 | $7.70 | $11.14 | $8.34 |

**Table 107: Number of LED A-lamps by store category and lumen Bin, 2014 and 2015 (retail store shelf surveys)**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | Big Box | Non-Big Box | Overall | Big Box | Non-Big Box | Overall |
| High Brightness (1490-2600 lumens) | 4,601 | 105 | 4,706 | 9,735 | 258 | 9,993 |
| Medium High Brightness (1050-1489 lumens) | 8,108 | 348 | 8,456 | 6,754 | 604 | 7,358 |
| medium low Brightness (750-1049 lumens) | 35,035 | 758 | 35,793 | 95,650 | 3,762 | 99,412 |
| Low Brightness (310-749 lumens) | 32,940 | 1,383 | 34,323 | 58,476 | 3,606 | 62,082 |
| Very Low Brightness (<310 lumens) | 12,899 | 474 | 13,373 | 22,432 | 1,307 | 23,739 |

**Table 108: Average price per LED lamp that meets the CEC spec and do not meet the CEC spec**

| Store Category | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | CEC Spec | Non-CEC Spec | n | CEC Spec | Non-CEC Spec | n |
| All Stores | $ 9.43 | $ 11.91 | 99,093 | $ 5.33 | $ 9.01 | 204,954 |
| Big Box | $ 10.12 | $ 11.70 | 95,572 | $ 6.24 | $ 8.00 | 195,138 |
| Non-Big Box | $ 7.01 | $ 12.94 | 3,521 | $ 4.22 | $ 13.64 | 9,816 |

**Table 109: Number of EISA-compliant and EISA non-compliant lamps by store category, 2014 and 2015**

| Store Category | 2014 | | 2015 | |
|---|---|---|---|---|
| | EISA-Compliant | non-compliant | EISA-Compliant | non-compliant |
| Big Box | 36,871 | 25,205 | 61,947 | 6,412 |
| Non-Big Box | 9,009 | 6,900 | 11,200 | 3,159 |

# D. APPENDIX D – LAMP CHOICE MODEL COEFFICIENTS

Table 110 shows the coefficient values and statistical significance for each of the parameters in the A-lamp/spiral model. The pseudo $R^2$, which measures the overall fit, is 0.30. For a detailed discussion of the estimation results, please see Section 5.3.4.2 of the 2010-12 California Upstream and Residential Lighting Impact Evaluation (DNV GL, 2014a).

**Table 110: Estimated parameter values for the A-lamp/spiral model**

| Group | Parameter | Type | Value | T-Stat |
|---|---|---|---|---|
| Alternative Specific Constant | CFL Spiral | Choice | 0 | - |
| | CFL A-lamp | Choice | -0.79746 | -3.7453 |
| | Incandescent A-lamp | Choice | -0.87413 | -5.1504 |
| | EISA-Compliant Halogen A-lamp | Choice | -1.31773 | -8.3418 |
| | LED A-lamp | Choice | 0.853176 | 4.7815 |
| Price Sensitivity | Generic | Alternative | -0.38761 | -8.9913 |
| | CFL A-lamp | Alternative | -0.06483 | -0.9621 |
| | Incandescent A-lamp | Alternative | -0.4306 | -3.8479 |
| | EISA-Compliant Halogen A-lamp | Alternative | -0.04345 | -0.4721 |
| | LED A-lamp | Alternative | 0.15449 | 3.6883 |
| | Income over $100k: | | | |
| | CFL A-lamp | Alternative | 0.164027 | 3.3012 |
| | CFL Spiral | Alternative | 0.073821 | 2.1255 |
| | Incandescent A-lamp | Alternative | 0.099803 | 1.1583 |
| | EISA-Compliant Halogen A-lamp | Alternative | 0.347998 | 5.2427 |
| | LED A-lamp | Alternative | 0.070194 | 5.0905 |
| | Unknown income: | | | |
| | CFL A-lamp | Alternative | 0.045782 | 0.5892 |
| | CFL Spiral | Alternative | 0.069829 | 1.1076 |
| | Incandescent A-lamp | Alternative | 0.183467 | 1.2191 |
| | EISA-Compliant Halogen A-lamp | Alternative | 0.041417 | 0.3334 |
| | LED A-lamp | Alternative | 0.002311 | 0.0829 |
| | Planned purchase: | | | |
| | CFL A-lamp | Alternative | 0.004308 | 0.0879 |
| | CFL Spiral | Alternative | 0.108235 | 2.6963 |
| | Incandescent A-lamp | Alternative | 0.340987 | 3.1995 |
| | EISA-Compliant Halogen A-lamp | Alternative | 0.085603 | 1.0578 |
| | LED A-lamp | Alternative | 0.021143 | 1.358 |
| | 2015 Wave: | | | |
| | CFL A-lamp | Alternative | 0.140601 | 1.9862 |
| | CFL Spiral | Alternative | -0.08605 | -2.1331 |
| | Incandescent A-lamp | Alternative | -0.13123 | -1.3054 |
| | EISA-Compliant Halogen A-lamp | Alternative | 0.016253 | 0.1718 |
| | LED A-lamp | Alternative | 0.06728 | 2.7967 |

**Table 110 (Continued). Estimated parameter values for the A-lamp/Spiral model**

| Group | Parameter | Type | Value | T-Stat |
|---|---|---|---|---|
| Home Improvement Channel | CFL A-lamp | Individual | 0.459751 | 1.183 |
| | Incandescent A-lamp | Individual | -0.03807 | -0.1261 |
| | EISA-Compliant Halogen A-lamp | Individual | 0.337212 | 1.2575 |
| | LED A-lamp | Individual | 0.4112442 | 1.1147 |
| Hardware Channel | CFL A-lamp | Individual | 0.39939 | 0.9724 |
| | Incandescent A-lamp | Individual | 0.265353 | 0.769 |
| | EISA-Compliant Halogen A-lamp | Individual | 0.922213 | 2.663 |
| | LED A-lamp | Individual | -1.27952 | -1.613 |
| Mass Merchandise Channel | CFL A-lamp | Individual | 0.620558 | 1.8368 |
| | Incandescent A-lamp | Individual | -0.3634 | -1.3137 |
| | EISA-Compliant Halogen A-lamp | Individual | 0.987384 | 4.1785 |
| | LED A-lamp | Individual | -1.75261 | -2.837 |
| 2015 Wave | CFL A-lamp | Individual | -0.87492 | -2.4406 |
| | Incandescent A-lamp | Individual | -0.13003 | -0.4706 |
| | EISA-Compliant Halogen A-lamp | Individual | -0.95801 | -3.9106 |
| | LED A-lamp | Individual | -1.02795 | -2.5083 |

# E. APPENDIX E – REVIEWER COMMENTS AND AUTHOR RESPONSES

| Comment # | Commenter (self-identify by Party, PA, etc.) | Section (as shown in report document) | Page (as shown in report document) | Comment/feedback/change requested | DNV GL's Response |
|---|---|---|---|---|---|
| 1 | IOUs | Overarching | N/A | Although the report claims to be about the California market and specifically the 2013-2014 ULP program, it too often fails to differentiate that this is a review of historical information, and it cites information about the national market in a way that is irrelevant or confusing as applied to the California ULP program, a few of which are the list of manufacturers, the price averages, and information reflecting current market knowledge.<br><br>The study findings should avoid generalizations and blanket statements that do not differentiate between years or geographies without some qualifying language.<br><br>Care should be made to avoid statements about California that do not reflect or explain the programmatic and regulatory constraints, but instead lead to misinterpretation of utility program performance or compliance. | DNV GL has included additional qualifying language in advance of presenting national data, and elaborated on the implications of national findings as they pertain to California. See Sections 0.1, 0.3, 3, 4.1.1, 4.1.1.2, and 7 for these additions. DNV GL does believe that the context of ENERGY STAR partners and EISA regulations are important influences on the California lighting programs, and have clarified text to highlight that value.<br><br>DNV GL also appreciates the second and third points made by the reviewer, however some explicit examples would be helpful for report reviews in the future. |

| Comment # | Commenter (self-identify by Party, PA, etc.) | Section (as shown in report document) | Page (as shown in report document) | Comment / feedback / change requested | DNV GL's Response |
|---|---|---|---|---|---|
| 2 | IOUs | Overarching | N/A | The report cites several supplier responses focusing on the prominence of high-wattage CFLs. Specifically, the report states, "[suppliers] had changed their product mix to align with the increased program focus on specialty CFLs, notably high-wattage and other types." , "Three-quarters of the Manufacturer representatives said that the IOUs encouraged them to sell one or more specific types of CFLs through the ULP (particularly specialty CFLs)." and "Three of these [manufacturers] mentioned they sold some lamp types, such as high-wattage CFLs, that they would not otherwise have sold.". It is not a bad thing that retailers carry products they would not ordinarily carry. In fact, it is an important to see this as a market transformation outcome.<br><br>These statements and the accompanying market presence of high-wattage CFLs serve as an effective reinforcement of the criticism of the Wattage Reduction Ratio ("WRR") noted in Navigant's California LED Workpaper Update Study. As noted in the Navigant study, the unintended consequences of the WRR approach result in the PA's emphasis on high-wattage CFLs as one of the vehicles for delivering requisite program savings and to meet customer demands. | DNV GL appreciates the reviewer's comment and perspective. |

| Comment # | Commenter (self-identify by Party, PA, etc.) | Section (as shown in report document) | Page (as shown in report document) | Comment / feedback / change requested | DNV GL's Response |
|---|---|---|---|---|---|
| 3 | IOUs | 0.3 Conclusions | iii | In the 0.3 Conclusions section of the report it states, "When ULP discounts were available in 2014 and 2015, energy-efficient lamps were the least-cost option. Without the ULP, the least-cost option was an inefficient lamp."<br><br>This conclusion is somewhat general and lacks in some of the study detail found in the Detailed Findings and other sections of the report. For example, the report states, "According to many supplier representatives, the entry of low-cost, lower quality non-ENERGY STAR LED lamps into the California residential lighting market made it more difficult to sell LED lamps that met the CEC specification for LED lamps. Because of the lower price point of the non-ENERGY STAR LED lamps, the representatives claimed that their LED lamps that met the specification had difficulty competing against these lower quality LED lamps. According to these representatives, the LED lamps that met the specification were higher priced, on average, compared to the non-ENERGY STAR LED lamps, even when incentives were factored into the price.<br><br>Below we provide a selection of the complaints lodged by the supplier representatives on this topic." Also, the report states, "For lamps in the A-lamp replacement category, the lowest-cost option without IOU discounts in both 2014 and 2015 | DNV GL has added detail; to conclusion 3 in the executive summary and in Section 7 to note that CFL A-lamp and CFL spirals were the lowest-cost A-lamp replacement available with the ULP, and an incandescent was the lowest-cost A-lamp replacement available in the absence of the ULP. We believe the second part of this comment is captured in conclusion 5. |

| Comment # | Commenter (self-identify by Party, PA, etc.) | Section (as shown in report document) | Page (as shown in report document) | Comment/feedback/change requested | DNV GL's Response |
|---|---|---|---|---|---|
| 4 | IOUs | 4.1.2.2 Retailers in the 2013-14 ULP | 28 | Table 10 reports the percent of units discounted by the 2013-14 ULP by technology, unit type, and retail channel. Can the report also report the same data for 2015? | DNV GL agrees 2015 program tracking data are valuable, however the data reviewed in this report refer to data that were used to evaluate the 2013-14 program, and so DNV GL wishes to remain consistent in that focus. We therefore have added 2015 tracking data to Appendix C and directed the reader to it in section 4.1.2.2. |
| 5 | IOUs | 4.1.2.2.1 Differences between 2010-12 and 2013-14 ULP | 31 | It looks like there is a typo in the text marked in red font: "The average number of LED lamps shipped per year to big box stores increased by approximately 3,500% from the 2010-12 ULP to the 2013-14 ULP, while the quantity of LED lamps shipped to non-big box stores increased more than 750%% between program periods. During the 2010-12 ULP," | DNV GL has corrected this. |
| 6 | IOUs | 4.1.4.1 Detailed Findings | 47 | The report states, "Furthermore, data from recent shelf surveys in California suggest different trends than the sales trends that supplier representatives said were occurring in California." Can DNV GL expand on these different trends? | DNV GL has clarified this sentence in Section 4.1.4.1 |

| Comment # | Commenter (self-identify by Party, PA, etc.) | Section (as shown in report document) | Page (as shown in report document) | Comment / feedback / change requested | DNV GL's Response |
|---|---|---|---|---|---|
| 7 | IOUs | 4.1.5.2 | 51 | This finding suggests a higher NTGR than what was estimated in the 2013-14 ULP Impact Evaluation: "Half [of suppliers] reported that the program had influenced their decision to sell lamps that meet CEC specifications and another one-fourth mentioned the ULP had influenced the lamp shapes they offered." | DNV GL appreciates the reviewer's comment. |
| 8 | IOUs | 4.1.5.2 Supplier perspectives on the ULP | 51 | There appears to be a typo here: "Table 11Table 13 above), and continuity of ULP incentives throughout the 2013-14 program." | DNV GL has corrected this. |
| 9 | IOUs | 4.1.6.6 Manufacturer suggestions for products to include in the ULP | 8 | The report states that nine out of ten manufacturers suggested that the program should promote LED lamps that do not meet the CEC specification. This finding appears to be incorrectly displayed in Figure 14. Recommend this finding stand on its own as the first bar in Figure 14. | DNV GL has corrected this. |
| 10 | IOUs | 4.2.1.1 By technology | 14 | Figure 17 displays the percentage of stores carrying lamps by technology, 2012-2015 (retail store shelf surveys). Can the report break out LEDs by CEC-Spec and Non-CEC Spec? | DNV GL has added tables that present the percent of stores carrying CEC-specification and non-CEC-specification LED lamps in table 36. Because this addition would have figure 17 too large, we included these data in table form in Appendix C. |

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|---|---|---|---|---|---|
| 11 | IOUs | 4.2.2 Percentage of lamps | 22 | It appears that the "%" is missing from this sentence: "Out of all MSB CFLs stocked by California retailers, 19% were IOU-discounted in 2014 and 37 were IOU-discounted in 2015." | DNV GL has corrected this. |
| 12 | IOUs | 4.4 Lamp Pricing | 37 | The Navigant *California LED Workpaper Update Study* found that the 25th percentile is appropriate for characterizing the typical purchase price for all LED product categories. Navigant reported that an LBNL consumer survey found that more than 80% of respondents purchased a LED lamp at or below the 25th percentile. The 25th percentile is a good metric since it reflects typical purchase price and reduces outliers effects. Can DNV GL report LED prices at the 25th percentile in addition to straight averages in the report? | DNV GL has added the average prices of CEC-specification and non-CEC-specification LEDs in Appendix C (Table 108). DNV GL did not have the time or space to add the 25th percentile to this report, however, we point IOU readers to tables that we generated in the first half of 2016 that detail LED lamp prices, inclusive of the 25th percentile. Additionally, DNV GL will be publishing a hedonic model shortly that estimates prices based on lamp attributes, which will provide additional insight into lamp pricing. Please reach out to us with any questions on the location of these materials. |

| Comment # | Commenter (self-identify by Party, PA, etc.) | Section (as shown in report document) | Page (as shown in report document) | Comment/feedback/change requested | DNV GL's Response |
|---|---|---|---|---|---|
| 13 | IOUs | 4.4 Lamp Pricing | 37 | Since the IOUs are only allowed to incentivize CEC spec LEDs in their Upstream Lighting Programs, it is important to understand current and past prices for CEC spec LEDs in addition to all LEDs on average. Can the report include in the Tables (e.g. Table 40) CEC Spec LED prices? | DNV GL has added the percent of LED lamps that met and did not meet the CEC and CEC-specification (Table 46), the average number of CEC and non-CEC-specification model numbers (Table 76), and the average price of CEC-specification and non-CEC specification lamps (Table 108) in Appendix C due to the challenge that these additions would have made figures throughout the report too large. |
| 14 | IOUs | 5.2.1 CFL installation and storage | 54 | The report includes a section on "CFL installation and storage". Can the report include a similar section for LEDs? | DNV GL has added installation and storage results for LED lamps in section 5.2.1, and renamed this section to CFL and LED lamp installation and storage. |