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# California Residential Efficiency Market Share Tracking: Lamps 2007

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# California Lamp Report 2007

## 1. Introduction

The California Lamp Report 2007 presents the analysis of lamp sales for residential use in California and the U.S. from 1999 through 2007.[1] Itron, Inc. (Itron) is an independent evaluation firm retained by California's Investor Owned Utilities (IOUs) to conduct this annual research. This lamp sales analysis is one component of the larger California Residential Market Share Tracking (RMST) project, which has monitored the market penetration of energy efficient measures in California since 1999. The RMST supports California's investor-owned utilities (IOUs) in their program planning and efforts to measure statewide and IOU-specific program milestones for promoting short-term adoption of measures and longer-term market acceptance of energy efficient technologies. In addition to lamps, the RMST estimates the average efficiency rating and market penetration of high efficiency refrigerators, clothes washers, dishwashers, and room air conditioners.[2] In addition to the California IOUs, beneficiaries of this research includes federal and state agencies, regional and state energy efficiency organizations, trade organizations, and equipment manufacturers, distributors, and retailers.

### *Overview of Data Included in this Study*

Historically, estimates of the market penetration of highly efficient lighting technologies relied on industry shipments data, consumer self-reports, "secret shoppers," and other market-actor surveys. These data sources lack the detail necessary for a comprehensive analysis of unit sales and market penetration. The data used for the analysis presented in this report contain the level of detail needed to offer a comprehensive look at the market for lamps. Specifically, point-of-sale (POS) data representing four major retail channels through which lamps are sold (**food, drug, mass merchandiser, and hardware stores**) contain line-item detail[3] on monthly lamp sales for both California[4] and the U.S. These data are analyzed

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1 A eight-page companion report titled *California Lamp Trends 2007* summarizes the findings in this report.

2 Separate annual reports are available for HVAC equipment and appliances and are available for download from www.calmac.org. The most recent available titles are *California Residential Efficiency Market Share Tracking – Appliances 2006* and *California Residential Efficiency Market Share Tracking – HVAC 2005.* The 2007 Appliance update will be available in late 2008.

3 Each line item contains detailed information such as the manufacturer, UPC, watts, package size, price, and quantity sold.

4 The California data are further subdivided into the California electric IOU service territories: Pacific Gas & Electric Company (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric Company (SDG&E).

and aggregated to estimate overall lamp sales in the residential lighting market and to characterize lamp sales trends over time, by lamp types, in different geographic regions, and through various retail channels. Including a national comparison area provides a context in which to evaluate the success of California's energy efficiency programs.

### *Increased State, Regional, and National Interest*

Efficient lighting has been of increasing interest since the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) created the dedicated fluorescent fixtures and screw-based compact fluorescent lamp (CFL) portion of the ENERGY STAR® program. Many areas of the country have focused on efficient lighting in order to implement a variety of market transformation programs, and many utilities and energy efficiency organizations have adopted the ENERGY STAR platform as the basis for their lighting initiatives. The primary objective of this study is to provide insight and trends of the residential lamp market that will inform the development and re-design of energy efficiency programs administered in California over time. The California IOUs have supported energy efficient lamps through the statewide Residential Lighting and Appliance downstream rebate program (pre-2004) as well as individual utility upstream lighting programs (post-2004).

The importance of understanding the CFL market – in terms of total sales and market penetration – has grown in recent years not only in California, but at the state, regional, and federal levels. Many utilities and other energy efficiency organizations hope to meet their have increased energy efficiency and demand reduction goals by increasing the distribution of CFLs in the marketplace. The importance of CFLs in energy efficiency program portfolios has, in turn, increased the demand for more timely and comprehensive information about the CFL market. Several organizations have developed data collection efforts to estimate the total number of CFLs sold in the U.S. in 2007. While none of these data sources alone provide the answer, the combination of several data sources could possibly allow us to estimate the total CFLs sold in California and in the U.S. Itron has participated in numerous meetings relating to the CFL market and supporting data, and continues to coordinate with interested stakeholders.

According to several web sources, national CFL sales have increased dramatically in 2007, (by approximately 300%) compared to 2006 (although there is considerable uncertainty in these sales estimates). Other potential data sources available are listed below and explained in more detail in Section 5.

- ***ENERGY STAR.*** CFL sales data is currently collected by The Cadmus Group (CADMUS) in support of the EPA's ENERGY STAR program. This data includes ENERGY STAR qualified CFLs from five major national retailers. Data covering 2007 Quarters 1 and 2 was released by the EPA in early 2008, however data for 2007 Quarters 3 and 4 have not been finalized or released by the EPA.

The data presented in Section 5, supplied by CADMUS for use in this report, include their total 2007 estimates.

- ***18Seconds.org.*** CFL sales data presented on this website is collected by AC Nielsen in conjunction with Yahoo! and Wal-Mart. These data overlap the RMST data in that they include many of the same market channels.

### *Notable Changes in the Analysis and Report*

Unlike previous reports, **the estimated home improvement center sales data for the years after 2003 have been eliminated from this report**. In particular, data reported for home improvement centers prior to 2003 are actual sales data. Previous reports estimated sales through the home center market channel after 2003. Due to increasing uncertainty surrounding these estimates, Itron has eliminated the post-2003 estimates. Additionally, Itron is no longer weighting up the estimate of total sales through the entire mass merchandiser market channel to account for the portion of sales from a major "big box" mass merchandisers that ceased providing detailed data in 2002. Detailed data are still available for the other large mass merchandiser stores in both California and the rest of the U.S., and are included in the analysis.

### *Overview of Report*

The remainder of this report is organized as described below.

- **Section 2** discusses the POS data used for the analysis and details how the lamp data are classified.
- **Section 3** presents the analysis of residential-use screw-based lamps by retail market channel and by lamp type (Section 3), and provides a detailed analysis of medium screw-based lamp (MSLB) sales.
- **Section 4** includes a presentation of units sales over time, market shares by lamp type, sales by retail market channel, and sales by equivalent wattages. This section also includes analysis that summarizes retail prices.
- **Section 5** compares the RMST with other sources of data including recent CA Program Evaluations, and the CA IOU Program Tracking data, as well as looking at sources that collect data for the channels not covered by RMST.
- **Section 6** summarizes the efforts to estimate the price elasticity and the cross-price elasticity of CFLs and incandescents.
- **Section 7** summarizes ongoing efforts to coordinate with other organizations to develop more comprehensive analyses of CFL sales.

# 2. Data Sources

## *Point-of-Sales Data*

Most large retail stores today employ bar code scanners and computers to maintain product inventory, pricing, and sales data. These data are sampled and aggregated by specialized market research firms and are available for a wide range of consumer products. Itron identified the numerous research firms that supply POS data and evaluated their data for use in this study. Ultimately, POS data were purchased for the retail channels through which residential lamps are typically sold: food stores, drug stores, mass merchandisers, and home/hardware stores. Most lamps for residential use are sold through these channels, and the data analyzed in this report do not include sales through other relatively smaller channels, such as club warehouse stores, the Internet, small independent stores, and direct sales from the manufacturer to the consumer.[5]

The POS lamp data are received in an unprocessed spreadsheet format and then converted into a structured electronic database categorized by various levels of product efficiency and performance. These data include Universal Product Code (UPC), lamp-type indicator, location sold, retail sales channel, and monthly counts of units sold for nearly 25,000 different lamp types. For the 2007 analysis, Itron included historic pricing data for all lamp types.

### ***POS Data from Food Stores, Drug Stores, and Mass Merchandisers***

Consumer sales data for food, drug, and mass merchandisers are obtained from ACNielsen.[6] These data are collected from a sample of food stores with annual revenue over $2 million, drug stores with annual revenue over $1 million, and mass merchandisers with annual revenue over $1 million from major metropolitan areas across the U.S. Data from grocery stores are collected in 52 regions and data from drug stores and mass merchandisers are collected from 11 regions.

ACNielsen uses a stratified sample design to measure consumer sales across different geographic regions and retailers and projects sample data from individual stores to represent sales data across a given region. This projection is based on a "ratio estimation" procedure, which uses a combination of total store counts and dollar sales volume to weight store-level data up to a regional level. ACNielsen uses this same process to project regional data to national data. The sample selection process also accounts for socioeconomic differences (i.e., urban/rural areas, ethnicity, and income). This sampling strategy provides a complete picture of these retail channels, taking into account variances by retailer, geography, and other factors.

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5 Discussions with industry professionals estimate lamp sales outside the major retail channels at 10% to 20%.

6 ACNielsen Company, Schaumburg, IL. www2.acnielsen.com.

A couple of caveats with respect to these data should be noted. First, sales data for food stores, mass merchandisers, and drug stores cover only specific major metropolitan and regional areas. As such, Itron used U.S. Census Bureau[7] population data to scale these regional and metropolitan sales to the California state level and to individual IOU service territories. Specifically, sales data from California metropolitan areas were expanded to represent sales data for the entire state using population as the weighting factor. Total California sales were then proportioned to each of the IOU service territories and areas not covered by the IOUs by using a combination of utility service area maps and population data. This approach required certain assumptions about the demographic similarities of parts of California relative to the entire state, and is likely not as accurate as the results that could have been obtained by developing a customized (and costly) sample in all parts of the state. This scaling process is likely to be reasonably accurate for grocery stores, where original sample sizes were substantial, but less precise for mass merchandisers and drug stores, due to of the relatively small sample size.[8]

Second, these data only cover stores above a certain sales volume threshold that use computerized inventory control. As such, it does not include smaller "mom and pop" shops, which might collectively account for 10 to 20% of overall lighting sales in food stores.[9] However, as discussed in more detail in Section 5, the number of upstream rebated CFLs in small grocery stores have skyrocketed over the last few years. It is therefore likely that they account for much more than 20% of the CFL sales in food stores.

***Hardware and Home Improvement Center Stores***

Consumer sales data for national and independent hardware and home improvement center stores are obtained from Activant.[10] Activant collects hardware and home improvement center (H&H) data from stores across four distinct regions: Northeast, Midwest, South, and West. The four main characteristics behind the stratified sample selection process are retailer, geographic region, store type, and store size. Sample stores have been chosen to represent all stores across these four characteristics. Activant scales the sample data to the regional or national level by comparing individual store sales volumes and number of stores

7 U.S. Census Bureau data obtained from www.census.gov for July 1998, July 1999, and July 2000.

8 Using population weighted expansion factors is a reasonable approach. However, the project team recognizes that it does assume that lamp sales per household through these channels in areas outside the regions covered by the data are the same. To the extent promotional and product offering differ by mass merchandisers across regions, this assumption could lead to over or under reporting sales of certain lamp types.

9 From conversations with lighting industry professionals.

10 Activant, formerly CCI/Triad Vista (www.activant.com).

to overall sales for a given region.[11] Itron and Activant also worked to develop a similar system to develop projections for California and for each electric IOU service area.

Unfortunately, as of December 2002 national chain home centers no longer provide point-of-sale (POS) data for lamps. Beginning in the second quarter of 2001, combined sales data for H&H were available, making it possible to determine 2002 and 2003 sales for home centers. For years after 2004, only hardware store sales are reported.

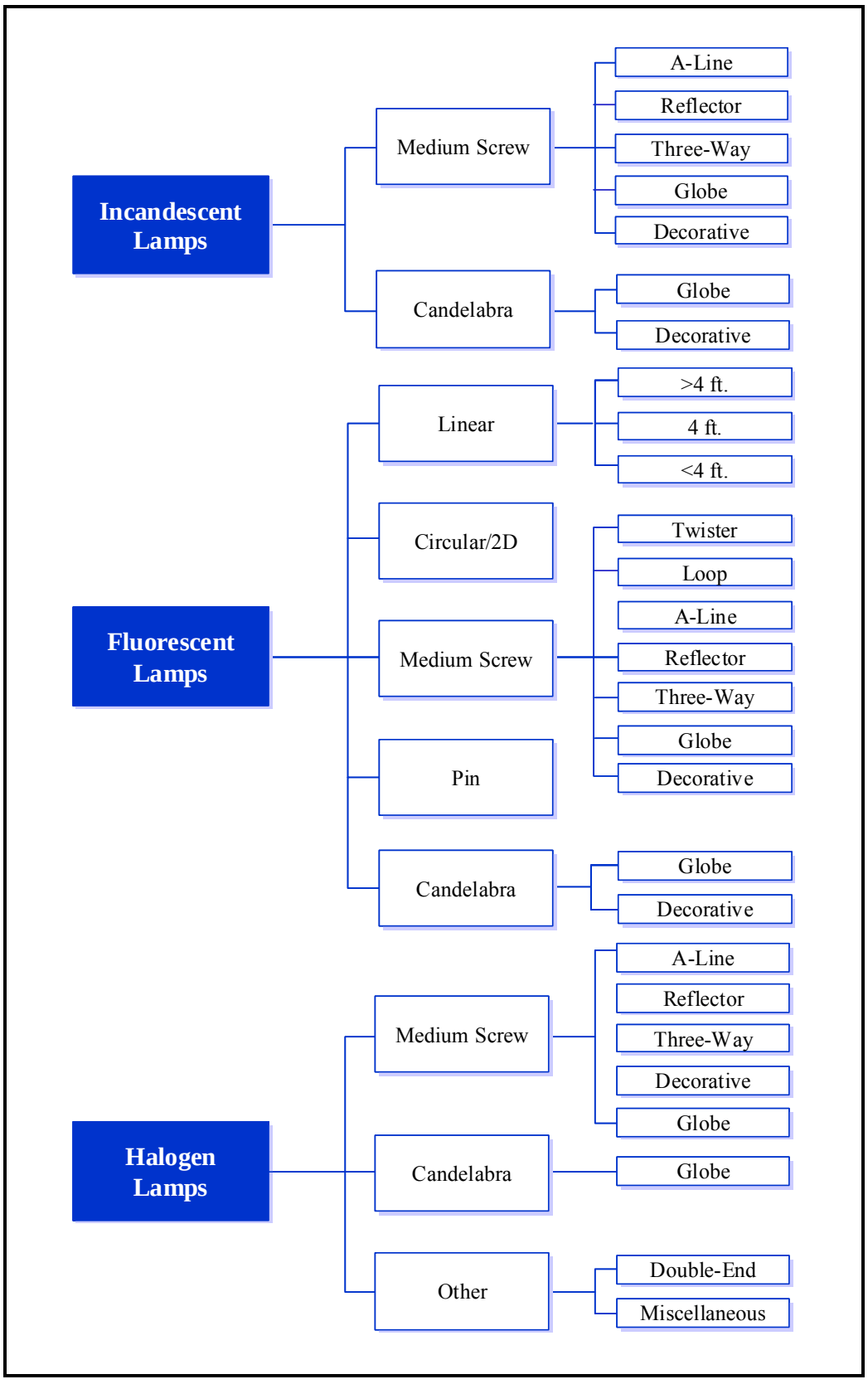
### *Classification of Lamp Types*

Each line item in the POS data is mapped to one of four major lamp types: fluorescent, halogen, incandescent, and special.[12] Fluorescents, halogens, and incandescent lamps are further broken down into subcategories based on lamp configuration and application, as shown in Figure 1. Specifically, lamps are first broken out by base type. Screw-Based Lamps (SBLs) are either medium or candelabra (small) sized, and are separated from all other base types. Most SBLs can be replaced by a CFL screw-based lamp. Other lamp types include pin-based lamps, such as linear and circular fluorescent tubes and double end halogen lamps. These lamp types are not included in the 2007 report, because Itron has opted to focus on the more dynamic screw-based lamp segment in greater detail.

[11] It should be noted that one strength of the Activant data is that it contains a census of store outlets for a number of the home improvement and hardware chains. As such, no weighting is required for these elements of the data.

[12] Special lamps are those not used for general household lighting and include bug lamps, Christmas lights, nightlights, and heat lamps among others.

**Figure 1: Lamp Classifications**



The POS data from ACNielsen and Activant are similar, but require different algorithms to classify the units sold by lamp type. Each data set contains at least one descriptor field that is key to identifying lamp type. Using a series of database queries, Itron identifies many of the lamps and classifies the remainder manually using manufacturer websites and catalogs.

The data representing sales through the food, drug, and mass merchandiser market channels include only one descriptor field. This field includes keywords and abbreviations that provided details about the lamp. The descriptor field uses consistent terminology and a key was provided for these abbreviations. Using this key, Itron runs a series of queries every time a new data set is received in order to search for keywords to classify the lamps.

The data including sales through the hardware and home improvement center market channels set includes five descriptor fields. The first four fields indicate categories for the lamps that are used to identify lamp types of the units sold. For many line items, however, the information in these fields did not provide the level of detail required to classify the lamps as needed by the project team. Itron classifies these units by using data contained in the fifth descriptor field. These descriptors are combined with information from lighting experts, lighting manufacturers' websites and catalogs, and publications in order to correctly classify the remaining lamps.

For both data sets, the descriptor fields sometimes contain ambiguous terms that could cause improper classification of lamps (i.e., a descriptor with keywords that could classify the line item into multiple lamp categories). To ensure data quality, Itron continually reviews the data manually and corrects the data where necessary.

## 3. Residential Screw-Based Lamp Sales

This section examines sales of all screw-based lamps identified for residential use, and includes details about sales by various lamp types. Itron performs analysis on the residential lighting market for interchangeable lamps, with an emphasis on sales of compact fluorescent lamps (CFLs). This analysis provides insight into the national (excluding California) and California residential lighting markets and the market in each IOU service territory.

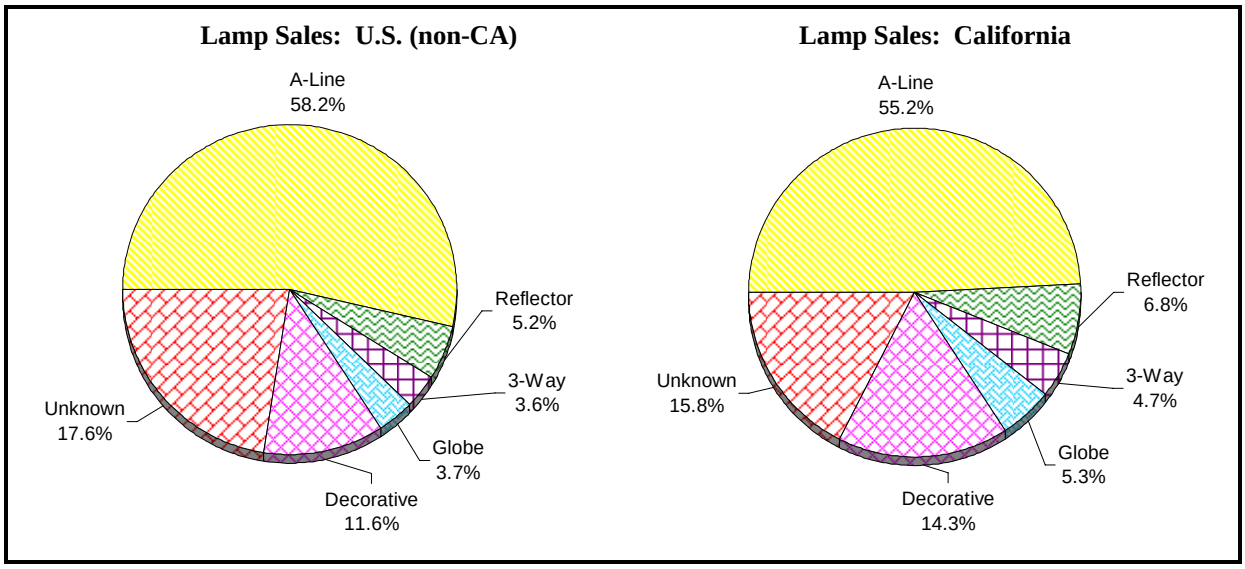
As explained above, the POS data from the available market channels were sorted into the following four categories: incandescent, fluorescent, halogen, and "special". Special includes lamps that are designed for specific purposes such as heat lamps, bug lights, black lights, and appliance lamps. Lamps sold through these channels are not necessarily used solely in the residential sector. For example, hardware stores and home improvement centers

sell to contractors, who then use the lamps in commercial jobs.[13] Using information from previous studies and lighting industry professionals, fluorescent and incandescent lamps found in packages greater than 12 and halogen lamps found in packages greater than eight are assumed to be for non-residential use and are removed from the analysis. Purchasing fluorescent lamps in such bulk is rare for residential consumers and is far more common for contractors. Additionally, Itron determined that the majority of high-intensity discharge (HID) lamps and fluorescent tubes greater than four feet are used in the commercial/industrial sector and were excluded from the analysis.

### ***Incandescent Lamp Sales***

Figure 2 presents sales of screw-based incandescent lamps by type for the U.S. and California and shows that A-line lamp sales dominate incandescent lamp sales; accounting for more than half of all incandescent unit sales. The analysis of incandescent lamps by type now includes decorative and globe lamps, which may have either medium or candelabra sized bases. There is also a large unknown segment of lamps, for which Itron was unable to determine a lamp shape, but are known to be screw-based.

**Figure 2: Incandescent Screw-Based Lamp Sales by Type – 2007**



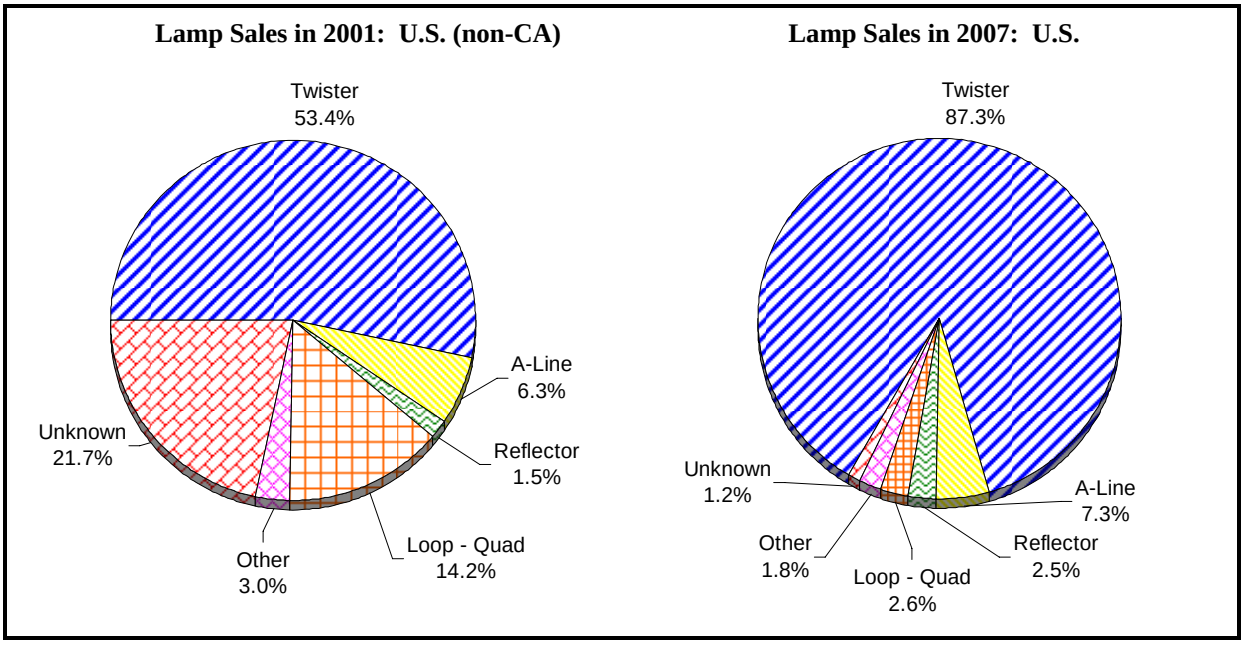

* POS data included in the figure above only includes sales through large food stores, drug stores, hardware stores, and some mass merchandisers.

[13] Ecos Consulting. *Lighting the Way to Energy Savings, Volume 2*. Prepared for the Natural Resources Defense Council. December 1999.

***Fluorescent Lamp Sales***

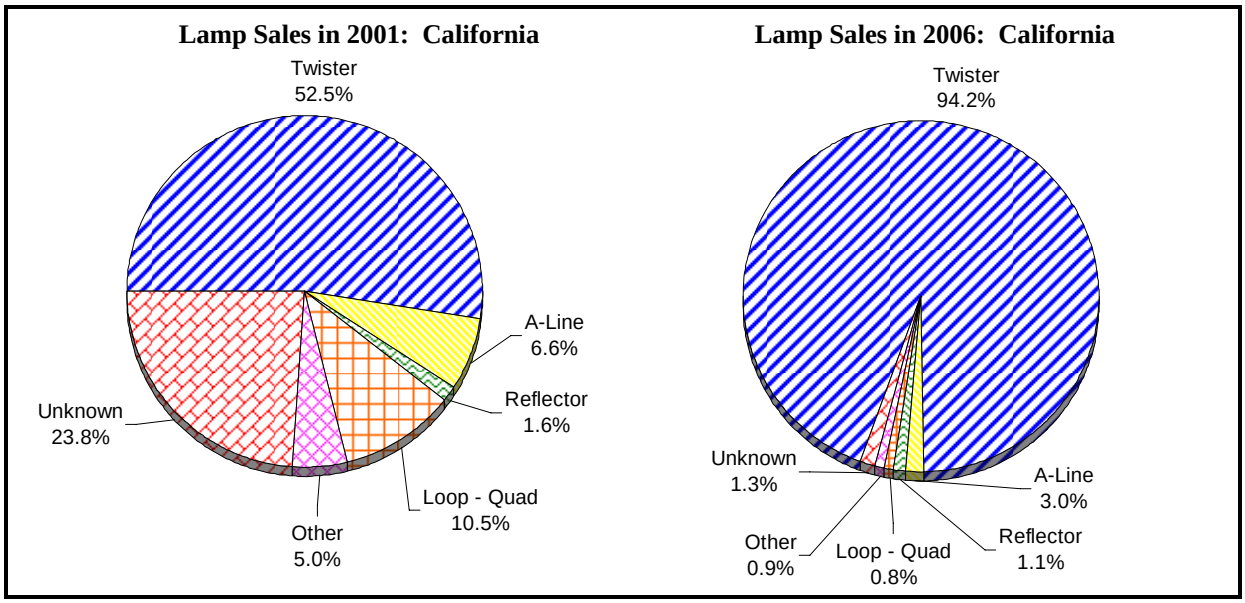
Figure 3 and Figure 4 present fluorescent screw-based lamp sales by type for the U.S. and California in 2001 and 2007. These charts no longer include fluorescent tubes because of Itron's decision to focus on the fluorescent lamps that are easily interchangeable with incandescent and halogen lamps. As shown, the majority of CFLs sold have been twisters, but in 2001 loop or quad shaped lamps also made up a significant portion of the CFL market. Itron was unable to retroactively determine a shape for several CFLs in 2001. This is due to the dynamic nature of the CFL market, with new lamps being developed and older lamps being retired at a constant and rapid pace.

**Figure 3: U.S. Fluorescent Lamp Sales – by Type – 2001 and 2007**




* POS data included in the figure above only includes sales through large food stores, drug stores, hardware stores, and some mass merchandisers.

**Figure 4: California Fluorescent Lamp Sales – by Type – 2001 and 2007**

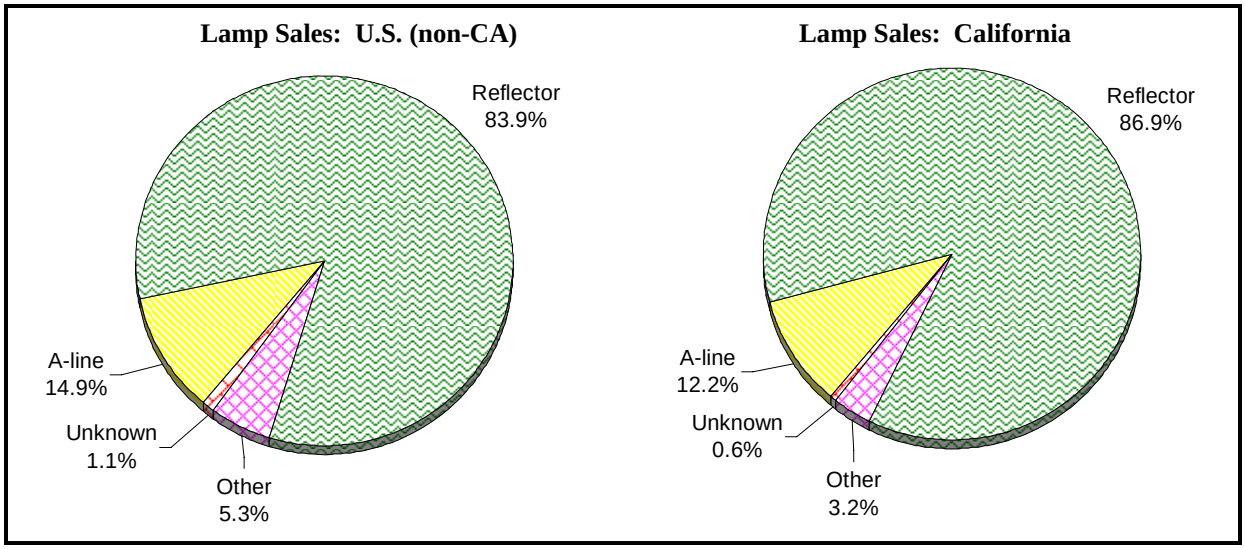



* POS data included in the figure above only includes sales through large food stores, drug stores, hardware stores, and some mass merchandisers.

***Halogen Lamp Sales***

Figure 5 presents residential halogen lamp sales by type for the U.S. and California. Of the three major residential lamp types, halogens contribute the smallest share to overall lamp sales. As shown in Figure 5, reflectors dominate halogen lamp sales. Only subtle differences continue to exist between the distribution in U.S. halogen sales and California halogen sales.

**Figure 5: Halogen Lamp Sales – by Type – 2007**




* POS data included in the figure above only includes sales through large food stores, drug stores, hardware stores, and some mass merchandisers.

### *Screw-Based Lamp Sales over Time*

An important element of this research is to determine the market share of energy efficient CFLs. This requires detailed analysis of CFLs and all possible substitutes (i.e., all SBLs). Table 1 provides a snapshot of total unit sales of residential medium screw-based lamps for calendar years 1999 through 2007. This table provides some perspective on the number of screw-based lamps sold annually across the rest of the U.S. (the U.S. excluding California), in California, and within each of California's electric IOU service areas.

As shown, sales of incandescent SBLs decreased in both California and rest of the U.S. between 2000 and 2001. Specifically, sales of medium screw-based incandescent lamps decreased by approximately 26 million (21%) in California and 35 million (4%) in the U.S. During this same period, CFL sales increased by nearly 12 million in the U.S. and 5 million in California. Unlike previous reports, Itron is no longer estimating home center sales for 2003 – 2007 and is no longer including sales from a major mass merchandiser after 2002. Therefore, the total number of lamps sold decreased significantly from 2002 to 2003.

**Table 1: Annual Screw-Based Lamp Sales (in thousands)**

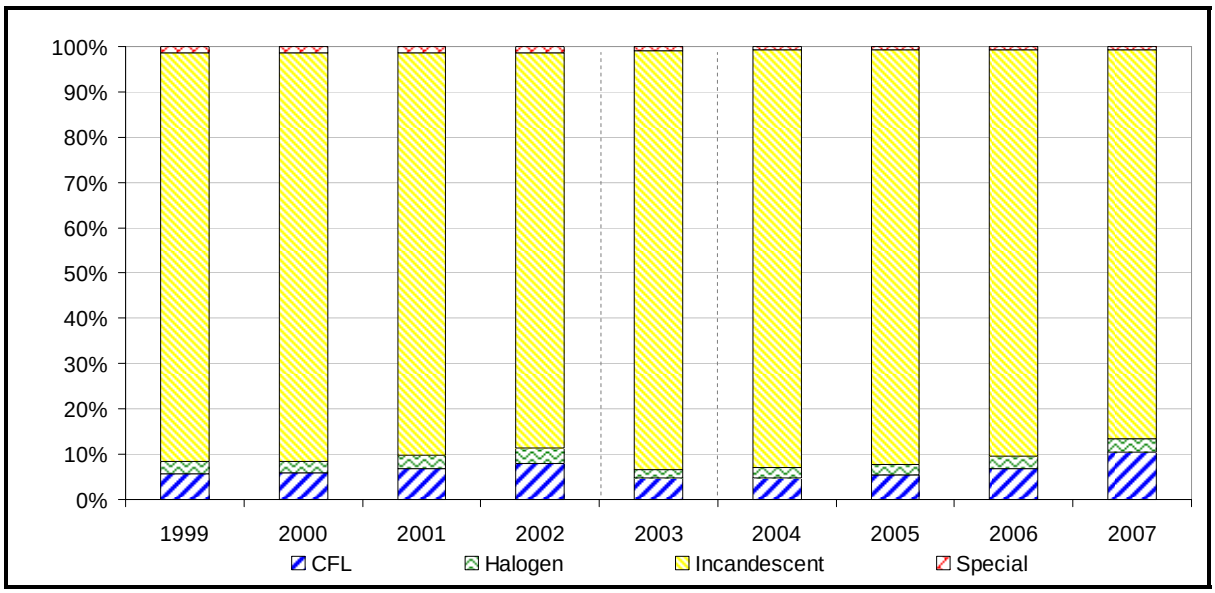
| | Compact Fluorescent Lamps | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Region** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** |
| U.S. | 7,079 | 28,135 | 24,315 | 11,689 | 11,646 | 15,481 | 22,743 | 48,376 |
| CA | 1,108 | 6,308 | 4,226 | 2,169 | 2,964 | 4,050 | 4,689 | 11,047 |
| PG&E | 402 | 2,657 | 2,048 | 1,056 | 1,330 | 1,694 | 2,420 | 4,923 |
| SCE | 311 | 1,956 | 1,138 | 544 | 778 | 1,210 | 1,222 | 3,226 |
| SDG&E | 148 | 554 | 335 | 201 | 342 | 511 | 286 | 973 |
| Other | 246 | 1,140 | 706 | 368 | 513 | 635 | 760 | 1,926 |
| | **Incandescent Lamps** | | | | | | | |
| **Region** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** |
| U.S. | 1,571,188 | 1,515,097 | 1,153,155 | 741,480 | 683,563 | 630,339 | 564,174 | 492,694 |
| CA | 135,146 | 110,990 | 100,837 | 62,720 | 59,802 | 55,574 | 52,106 | 43,759 |
| PG&E | 55,538 | 44,153 | 40,591 | 25,765 | 24,944 | 23,203 | 22,063 | 18,054 |
| SCE | 41,941 | 35,670 | 31,783 | 20,193 | 18,831 | 17,709 | 16,119 | 13,845 |
| SDG&E | 11,052 | 9,049 | 8,049 | 4,504 | 4,248 | 3,949 | 3,654 | 3,160 |
| Other | 31,945 | 26,560 | 25,083 | 16,539 | 15,679 | 14,419 | 13,646 | 11,546 |

* After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

### *Screw-Based Lamp Sales over Time*

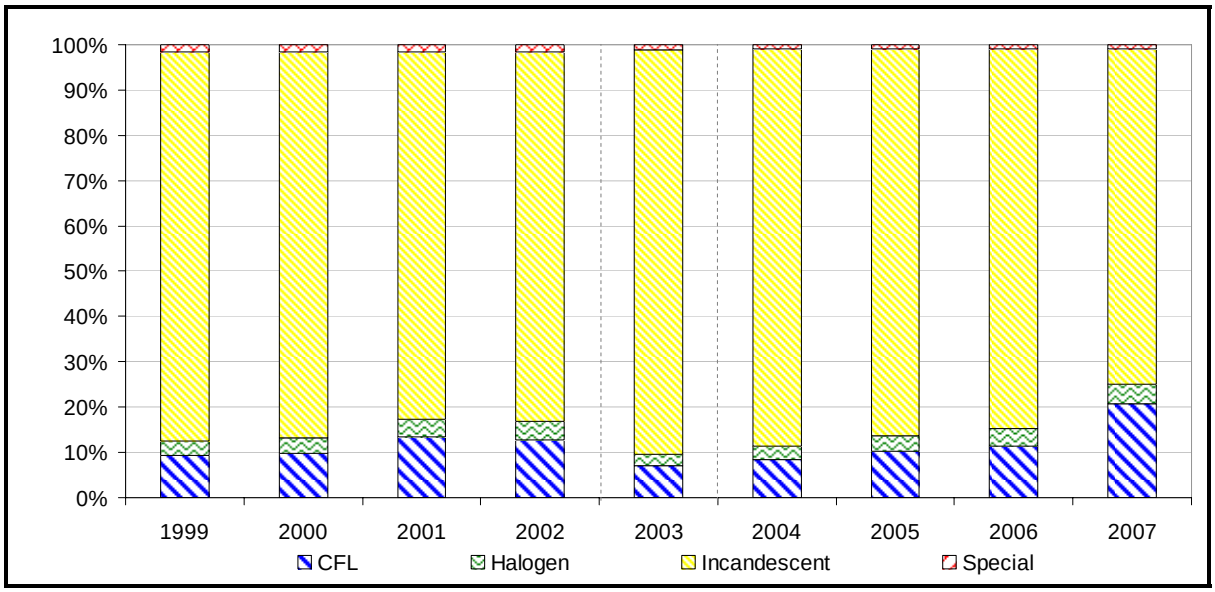
Figure 6 illustrates the sales distribution of screw-based incandescent lamps for the U.S. excluding California annually from 1999 through 2007, and Figure 7 illustrates the distribution of sales in California for the same time period. As can be seen, although incandescent lamps still make up the vast majority of all lamps sold, the share of CFLs has been steadily increasing, both nationally and in the state of California. Shares of halogen lamps have remained fairly steady through out the years, although they do fall from 2002 to 2003, when home centers stopped being included in the analysis. The share of CFLs continues to be larger in California than in the rest of the nation. As shown in the charts, although CFL sales are increasing greatly, there is still a tremendous opportunity for growth.

**Figure 6: Annual U.S. (non-CA) Lamp Sales**




* After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

**Figure 7: Annual California Lamp Sales**




* After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

### *Medium Screw-Based Lamps Sales*

This section focuses on the analysis of interchangeable incandescent and compact fluorescent medium screw-based lamps (MSBLs) sold for residential use.

### ***CFL Shares of MSBL Sales***

An important element of the RMST study is to determine the market share of CFL lamps in the residential sector. For purposes of this analysis, the market share of CFLs is the share of CFLs among lamps of similar type and application. Given this definition, the most logical comparisons are between the medium screw incandescent lamps, medium screw halogens, and medium screw CFLs. It should be noted that although pin-based CFLs could be a replacement for incandescent lamps, these CFLs require a special socket ballast or dedicated fixture to operate. Thus, for the comparisons presented in the following analysis, only medium screw-based CFLs were included because these can directly replace a medium screw-based incandescent or halogen lamp without changing or modifying the fixture. The share of CFLs may appear slightly smaller that in previous reports, because of Itron's decision to include previously excluded decorative and globe shaped lamps, the vast majority of which are incandescent lamps.

Figure 8 illustrates the share of medium screw-based CFLs as a percentage of all MSBLs sold by quarter for California and the U.S. As shown, the market share of CFLs in California more than tripled from the fourth quarter of 2000 to the first quarter of 2001 (1.0% to 3.8%) and during the second quarter of 2001, the market share of CFLs rose to approximately 7.6%. As previously mentioned, that peak in share coincides with California's energy crisis. The market share of CFLs in California decreased in 2002, but increased in 2003, reaching 4.6% in the second quarter of 2003 and then hovering around 3% during the last two quarters.

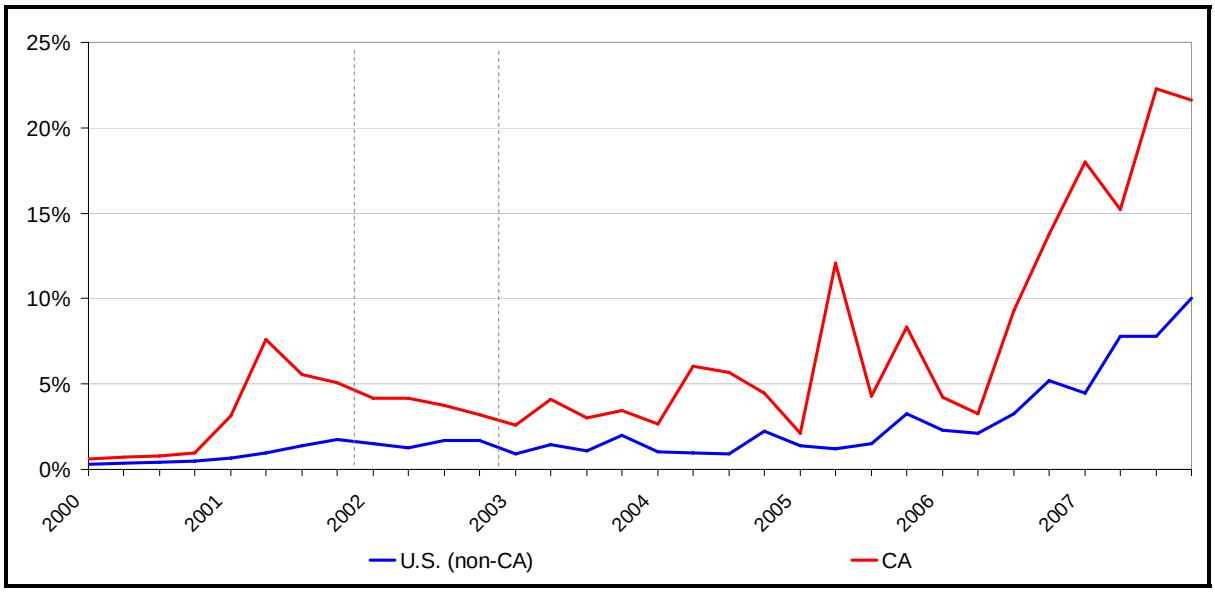
Over the next few years, the share of CFLs increased and decreased with the availability of very low priced multi-packs. During the first quarter of 2006, sales dipped substantially compared to the average of 2005. As part of the 2004-2005 Single Family Rebate Program Evaluation, KEMA Inc. investigated one reason for this decrease in 2006:

> "*the Geo Foundation lawsuit…had a significant impact on the availability of rebates from the 2006 SFEER Program and thus on the California CFL market as a whole. The language required participating suppliers to either prove that they had an agreement with the Geo Foundation as a licensee or provide a letter from a certified patent attorney that their product did not violate the Geo Foundation's patents. Even when the Geo Foundation lost the lawsuit … it took suppliers time to deliver the necessary supply. ... As a result most of the suppliers were unable to put rebated bulbs on the shelf until September 2006."*[14]

[14] *2004/2005 Statewide Residential Retrofit Single-Family Energy Efficiency Rebate Evaluation*. Itron, Inc., KEMA, Inc. October 2007.

As shown in Figure 8, shares of CFLs in California began to increase again by the fourth quarter of 2006, reaching its highest level ever in the third quarter of 2007 with over 22% of the medium screw-based lamp market.

**Figure 8: CFL Share of Medium Screw-Based Lamps**




* After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

## ***CFL Sales by Market Channel***

Figure 9 and Figure 10 present the quantity of CFLs sold nationally and in California, in the market channels covered by this analysis, since 2000 by market channel. Figure 9 shows that home improvement centers account for the largest share of CFL sales in the U.S. from 2000 to 2003, at which point Itron no longer received data for home improvement centers. In California, home improvement/hardware stores represented the largest suppliers of CFL for that same time period. Sales by mass merchandisers had been steadily increasing both in the rest of the county and in California. For example, in 2000 mass merchandisers sold approximately 8% of the CFLs sold in California but by 2002, nearly 20% of CFLs were sold through this market channel. However, after 2002, a large mass merchandise chain store ceased providing data, and is no longer included. Also, in 2003, Itron stopped receiving home improvement store data, and as of this report, we are no longer estimating sales through that market channel. From 2004 through 2007, sales in drug and food stores increased tremendously, while sales in the other channels remained fairly constant. This was due primarily to the very low-priced CFL multi-packs that were available in drug and food stores. Nationally, hardware sales are seasonal, increasing in the first and last quarter of the year. This is most likely due to a rebate program in a mid-western state.

**Figure 9: U.S. (non-CA) Medium Screw-Based CFL Sales by Retail Channel (in Thousands)**

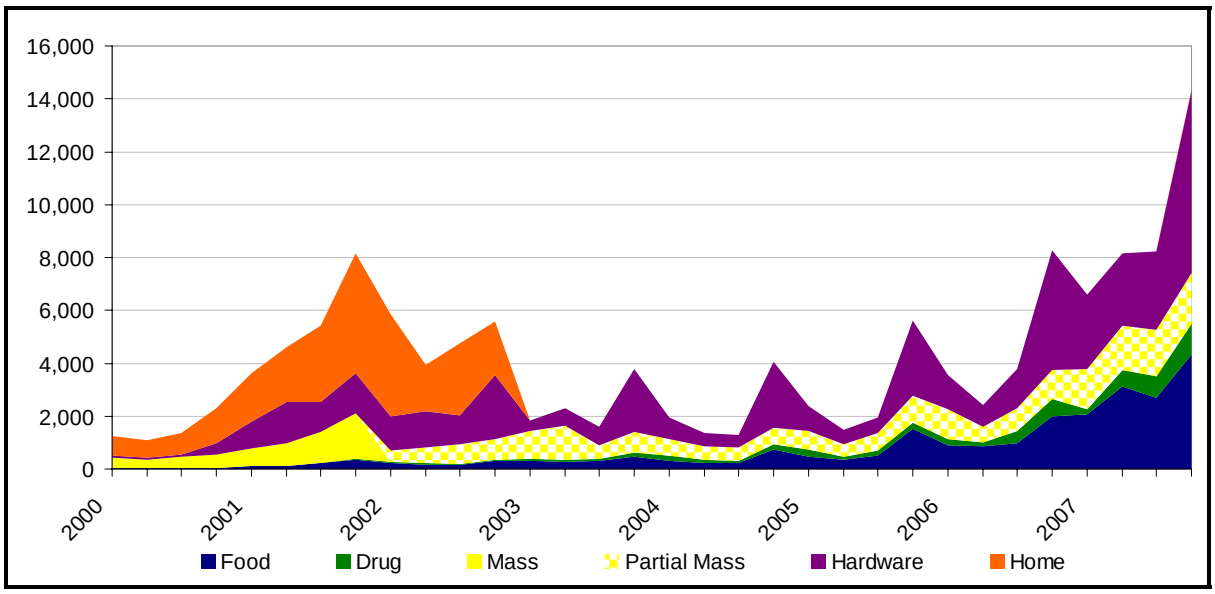
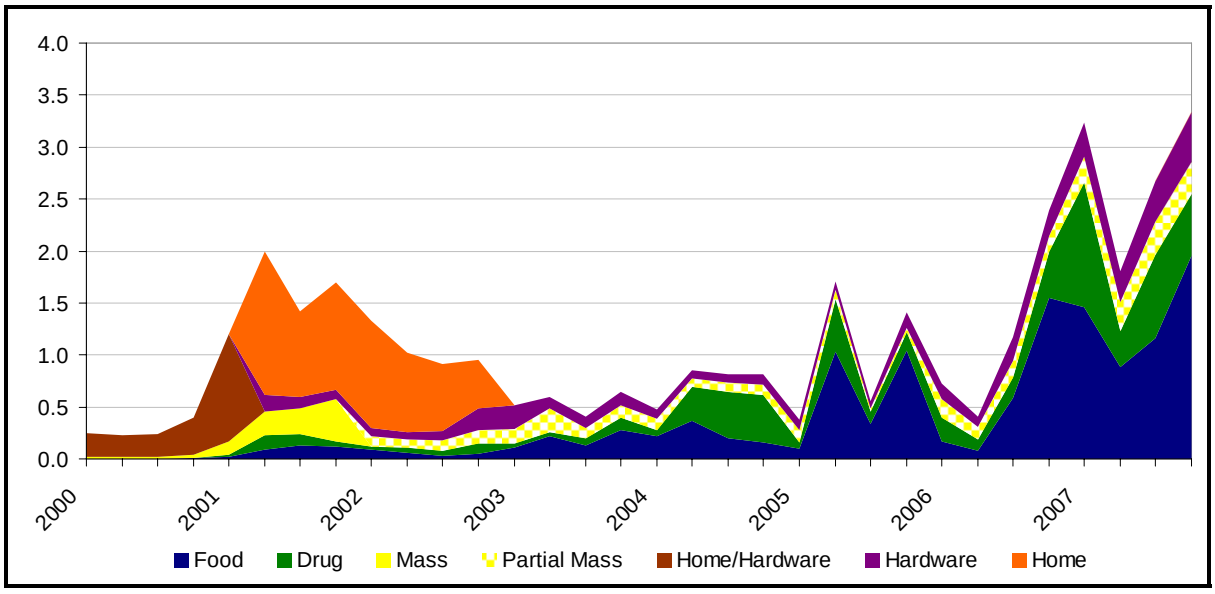



**Figure 10: California Medium Screw-Based CFL Sales by Retail Channel (in Thousands)**




***Incandescent Lamp Sales by Market Channel***

The following two figures illustrate quarterly incandescent MSBL sales by market channel. Figure 11 and Figure 12 show that the distribution of sales among channels has remained fairly constant. In addition, Figure 11 shows that mass merchandisers in the rest of the U.S. had sold a large share of medium screw-based incandescent lamps (35%) until 2002, when a mass merchandising chain that made up a significant portion of the market ceased providing

data. The overall trend show that year-on-year sales of incandescent lamps has been steadily decreasing since 2000.

**Figure 11: Medium Screw-Based Incandescent Sales by Retail Channel – U.S. (non-CA) (in Millions)**

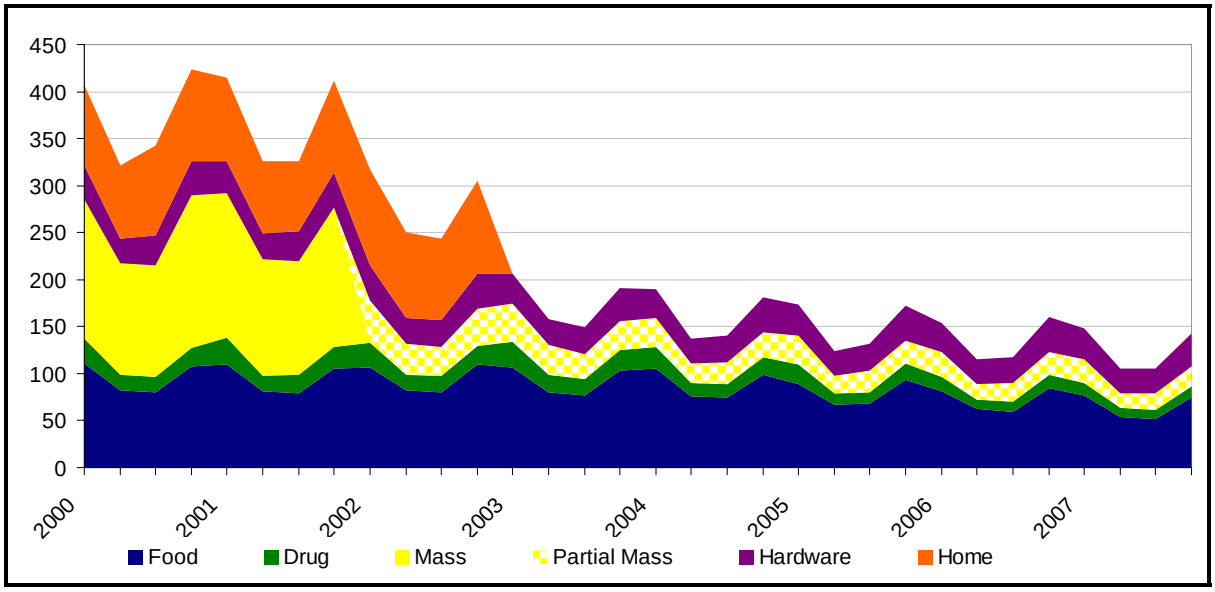
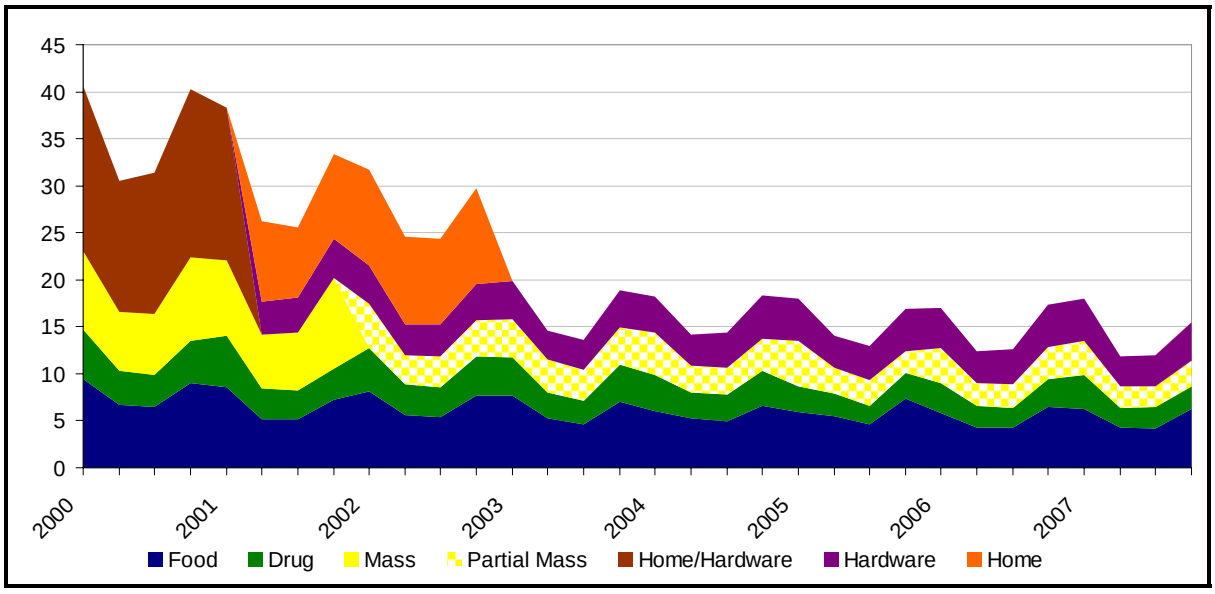



**Figure 12: Medium Screw-Based Incandescent Sales by Retail Channel – California (in Millions)**



***MBSL Shares and Prices of CFLs by Region***

For this report, Itron was able to perform analysis of MSBL sales in food, drug and hardware stores by four geographical regions (West, Midwest, South, and Northeast). Unfortunately, mass merchandiser sales were not available at the region level. Figure 13 presents the geographical regions used in the analysis.

**Figure 13: Geographical Regions**

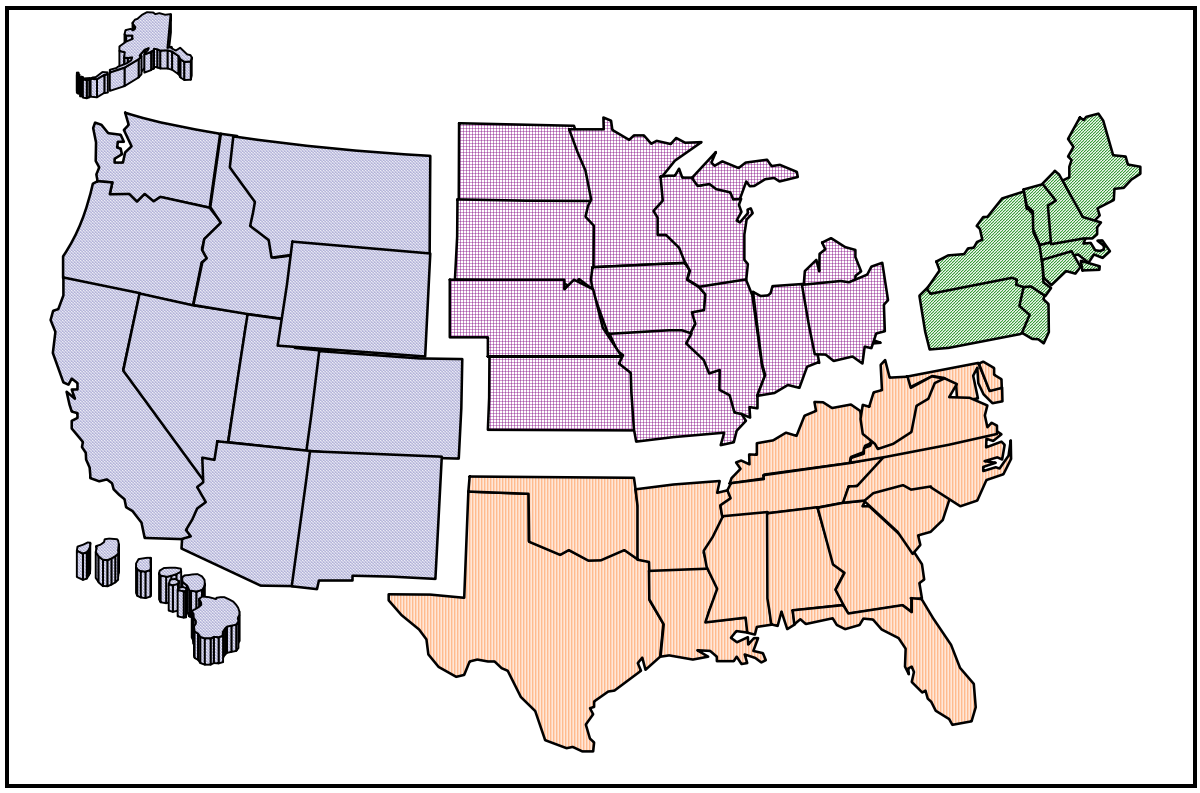
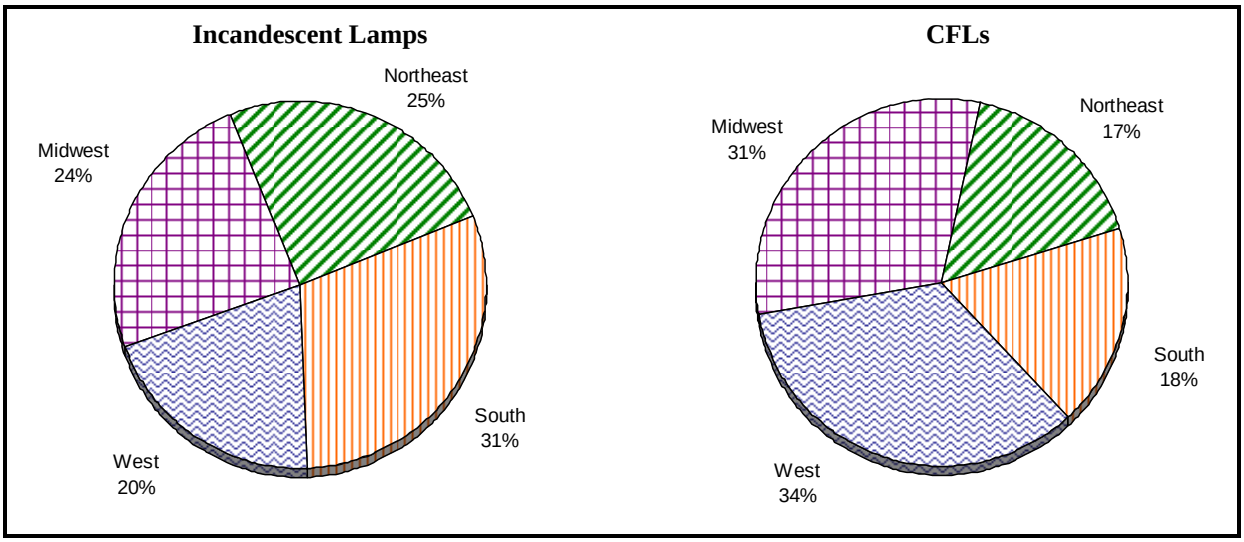


Figure 14 presents medium screw-based lamp sales by four geographical regions. As can be seen, while more incandescent lamps are sold in the South than in any other region, only 18% of the CFLs sold in the country are sold there. Conversely, 34% of CFL are purchased in the West, a region where only 20% of incandescent lamps are sold. This is most likely due to the large number of CFL rebate programs in the West, and the paucity of rebates available in the South.

**Figure 14: MSBL Sales by Geographical Region**



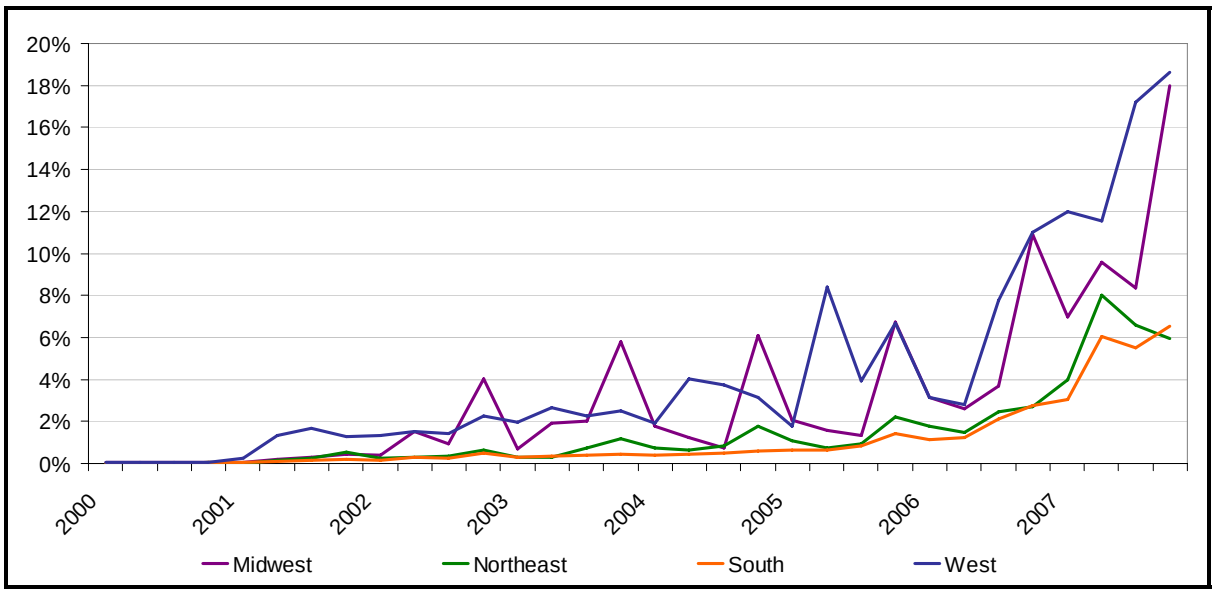

* POS data included in the figure above only includes sales through large food stores, drug stores, and hardware stores.

Figure 15 compares the CFL share of all MSBL from 2000 to 2007 for four geographical regions. As shown, the CFLs share has increased in all parts of the country, with the highest gains occurring in the West and Midwest. This is likely due to the presence of a large number of rebate and discount programs in these regions. The share of CFLs in the Midwest is much more seasonal than in other parts of the country, sharply peaking in the fourth quarter of each year. This is attributable to the cyclical nature of the rebate programs offered in this region, with the majority of rebated bulbs coming to market during the fourth quarter.

* POS data included in the figure above only includes sales through large food stores, drug stores, and hardware stores.

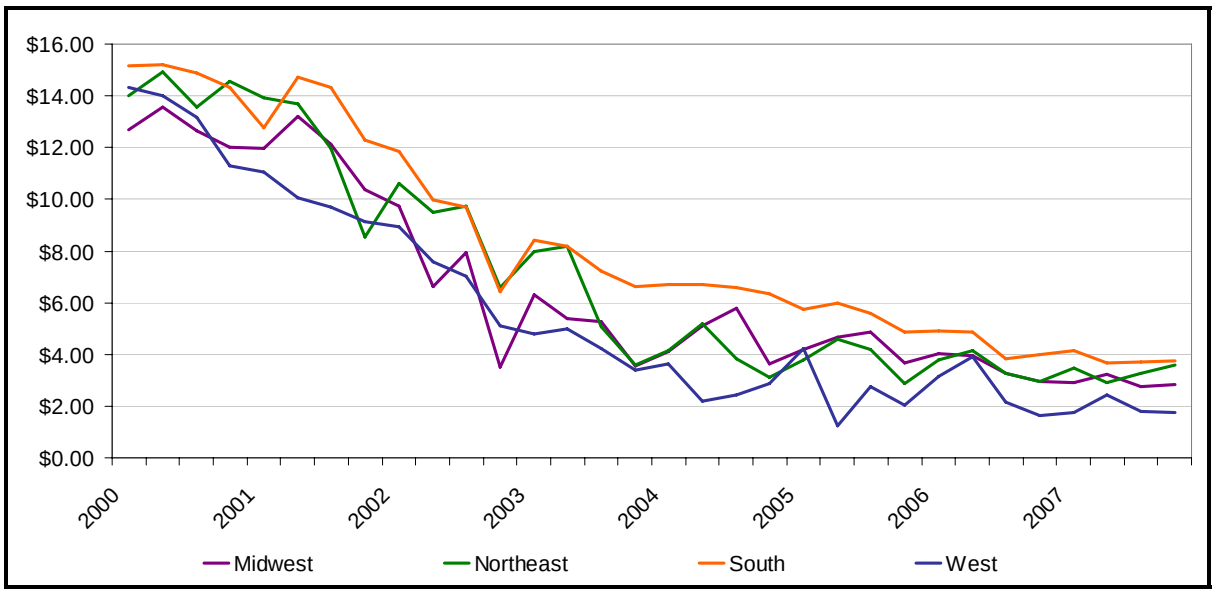
Figure 16 compares the average sales prices of CFLs in the four geographic regions. Sales prices have fallen in all regions, with the lowest prices occurring in the West. Prices are highest in the South, but a major retailer of CFLs with a high density of Southern stores does not provide data to the RMST project.

**Figure 15: CFL Share of MSBLs – by Region**




* POS data included in the figure above only includes sales through large food stores, drug stores, and hardware stores.

**Figure 16: Average CFLs Sales Price – by Region**



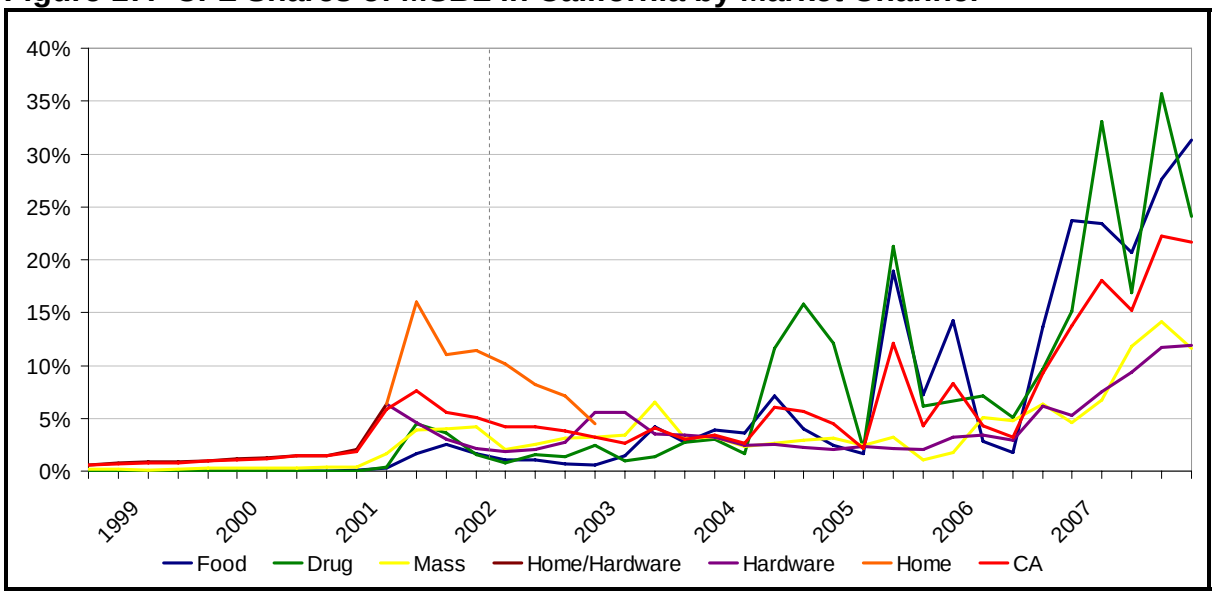

* POS data included in the figure above only includes sales through large food stores, drug stores, and hardware stores.

***MSBL Shares and Prices of CFLs in California by Market Channel***

Figure 17 presents the CFL share of MSBL in California from mid-1998 by market channel. The share of CFLs has increased greatly and fluctuated widely in the years since 2001. The first increase in CFL sales occurred in home centers, which accounted for the majority of the market from 2000 – 2003, when Itron stopped receiving home center data. However, since 2004 the highest shares of CFL sales and the greatest increases in CFL shares have occurred in food and drug stores.

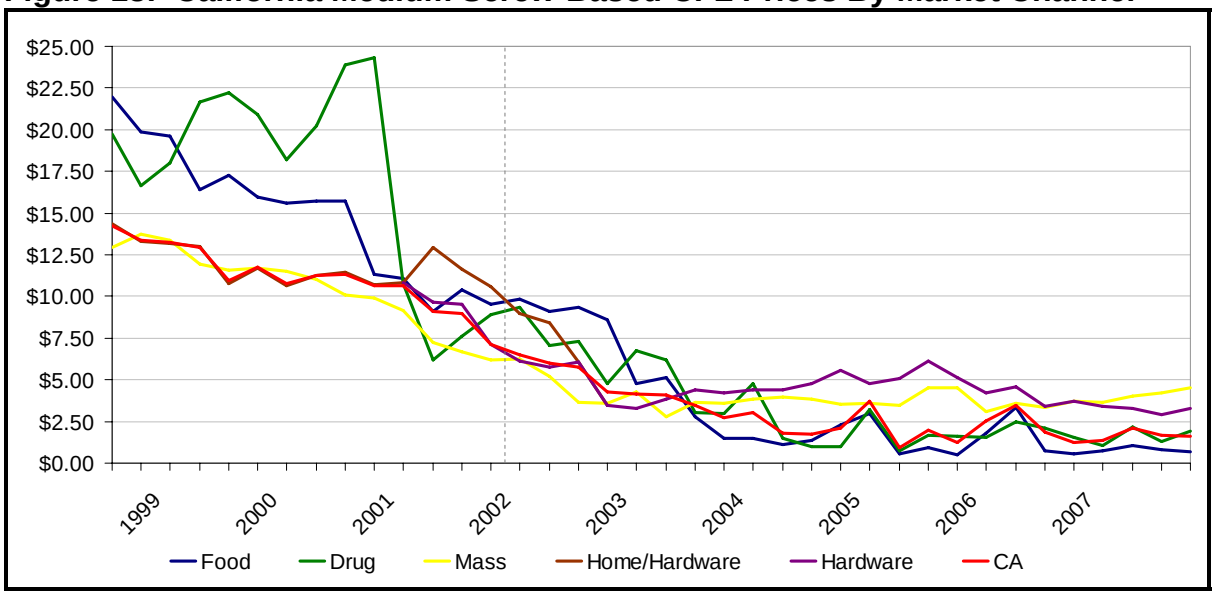
Figure 18 presents the average sales prices of a MSB CFL by market channel. As shown, the average price of CFLs have fallen dramatically since 2001 for all retail channels, and in 2005 reached its lowest level to date at $0.53 per bulb in food stores and $0.72 in drug stores.

**Figure 17: CFL Shares of MSBL in California by Market Channel**




*After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

**Figure 18: California Medium Screw-Based CFL Prices By Market Channel**

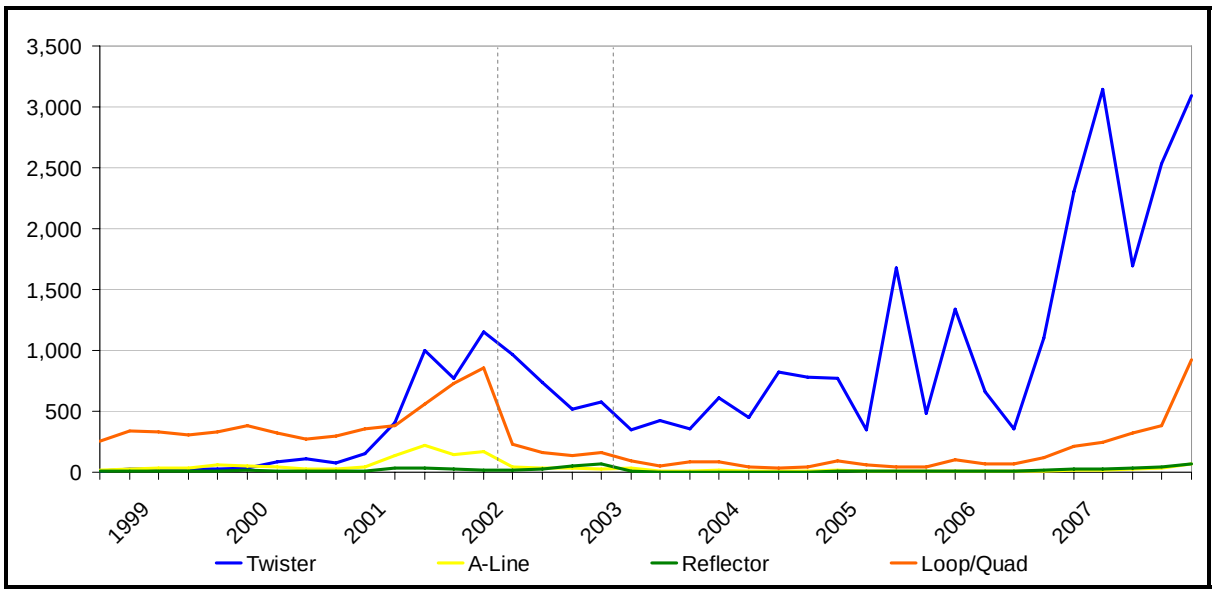



*After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

***MSBL Shares and Prices of CFLs in California by Lamp Shape***

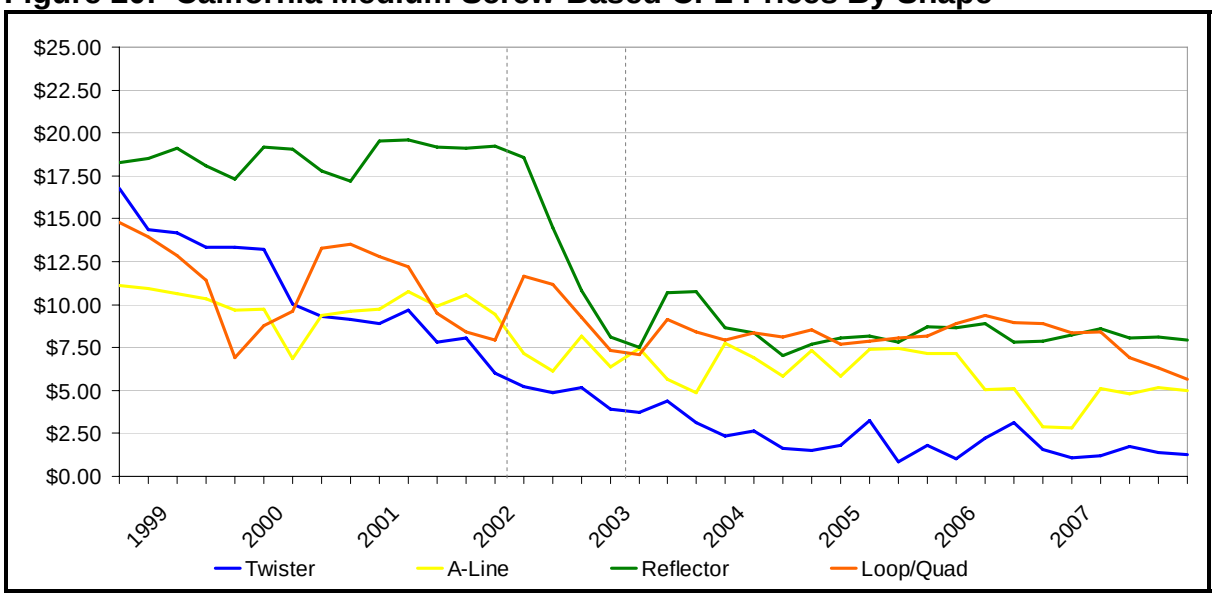
For the 2007 report, Itron analyzed medium screw-based compact fluorescent lamp sales by detailed lamp shape. The four lamp shapes that are detailed below are the most common CFL shapes: the "twister", a-line, reflector, and "loop" or "quad" shaped. As demonstrated in Figure 19, before 2001, the loop was a more popular shape than the twister in California, but after 2002 sales of loop shaped CFLs fell dramatically, and the twister became the highest selling CFL shape. Figure 20 presents the weighted average sales price for CFLs by bulb shape for the same time period. As can be seen, the average sales price for all CFLs shapes have decreased dramatically since 2000, especially for twister shaped CFLs. The very low twister prices occur in quarter with high sales of that CFL shape.

**Figure 19: California Medium Screw-Based CFL Sales By Shape (in Thousands)**




* After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

**Figure 20: California Medium Screw-Based CFL Prices By Shape**




* After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

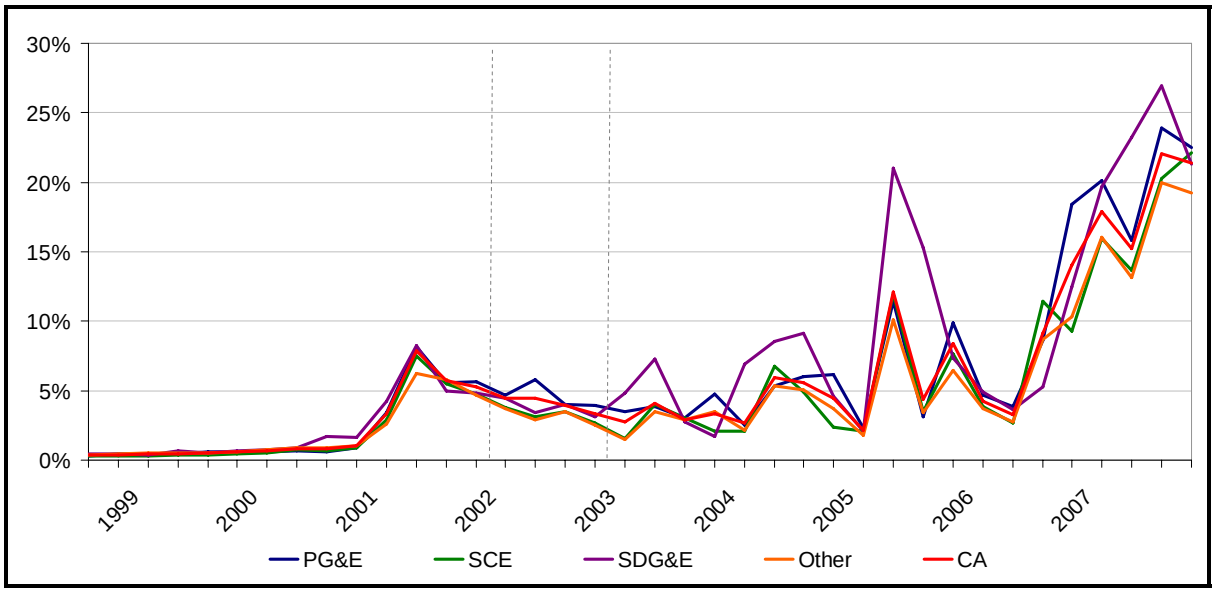
***MSBL Shares and Prices of CFLs in California by IOU Service Territory***

Figure 21 presents the sales of medium screw-based CFLs as a percentage of all MSBLs sold in each of the California IOU service territories and for the remaining non-IOU areas in California. CFL lamp share trends are similar across utility service areas prior to 2000.

Noticeable differences, however, first occurred in third quarter of 2000 when the CFL share in SDG&E territory spiked to almost 2%. This coinciding with customers' receiving high energy bills. In 2001, shares of CFLs in all of California skyrocketed, reaching over 8% in the PG&E service territory. By early 2003, shares in all regions had dropped considerably since the peak in 2001. Then in mid-2003, CFL shares in SDG&E's territory skyrocketed to 7%, nearly reaching its all-time high during the 2001 energy crisis. This short-lived increase was due to increased CFL sales in food stores during the first and second quarters of 2003 that were not seen in the rest of the state. Another increase in CFL shares occurred in 2004 in SDG&E's territory, reaching over 8%. This increase was driven by the low-cost CFL multi-packs sold by particular drug and grocery store chains with a higher per-capita concentration of stores in SDG&E territory than in the rest of California.

More recently, sales decreased dramatically in the first half of 2006. During this time, there were some issues in the CFL manufacturing industry which likely led to a delay in the IOUs starting their Upstream Lighting Programs. However, sales increased in the last two quarters, and continued to increase through out 2007, when they reached their highest level ever, at over one quarter of the market in SDG&E territory.

**Figure 21: CFL Share of Medium Screw-Based Lamps – California Electric IOUs**



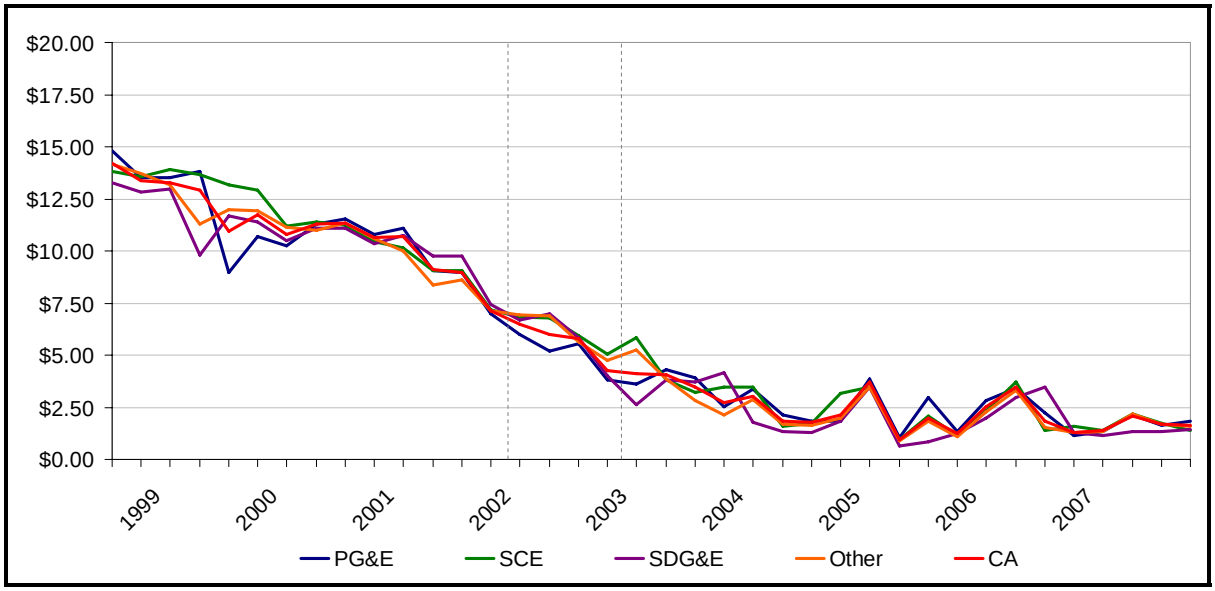

* "Other" includes regions in California not served by the three electric IOUs. After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

For the 2005 report, Itron completed an analysis of historic pricing data for compact fluorescent bulbs in California and the U.S for the first time. Itron will continue the analysis of pricing data for 2007 and in future reports. The point-of-sale data received included the average price by UPC, by region, and by channel. The historical pricing data includes all

regions and channels except for home centers after 2002, national food and drug store data before mid-2000 and the mass market retail channel.

Figure 22 presents the average retail sales price of a medium screw-base CFL from mid-1998 to 2006 in California by IOU. The average price of a CFL has fallen dramatically over the years, from $14 per lamp in the third quarter of 1998 in the PG&E service territory to a low of $0.56 per lamp in SDG&E during the second quarter of 2005. CFL prices increased slightly in 2006, to slightly more that one dollar per bulb at the end of the year. Because the pricing data is point-of-sales data, it includes any instant rebates or manufacturer buy-downs. The low prices seen below appear to be highly related to the periods of high sales that were shown in Figure 21. The periods of increased sales coincide with the availability of very low-priced multi-packs of CFLs.

**Figure 22: Medium Screw-Based CFL Average Sale Prices per Lamp by IOU**




* "Other" includes regions in California not served by the three electric IOUs. After 2002, data from a large mass merchandise chain store are no longer included, and after 2003, the data no longer include home improvement stores.

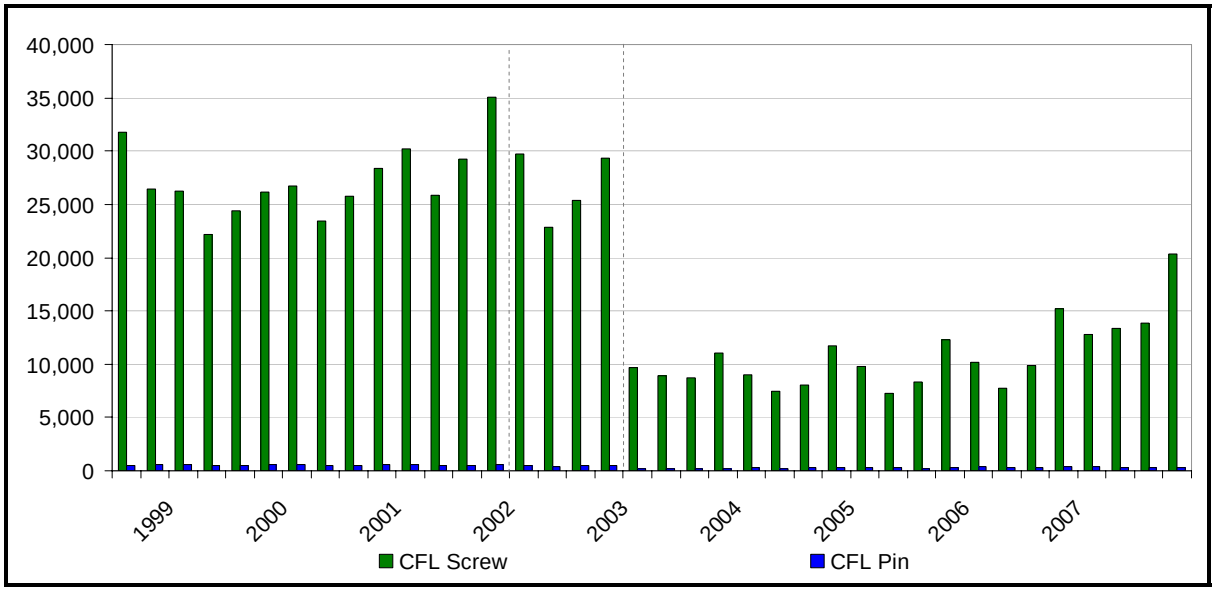
### *Comparison of Medium Screw-Based and Pin-Based CFL Sales*

Figure 23 and Figure 25 compare sales of screw-based CFLs and pin-based CFLs by quarter in the U.S., excluding California and in California, respectively. While medium screw-based CFL sales have increased significantly since 2001 and have varied widely from quarter to quarter, pin-based CFL sales have remained relatively constant in California and the U.S. over the last six years.

Figure 24 and Figure 26 present the average sales price for medium screw-based CFLs and pin-based CFLs in the U.S. (including California) and California exclusively. The prices of

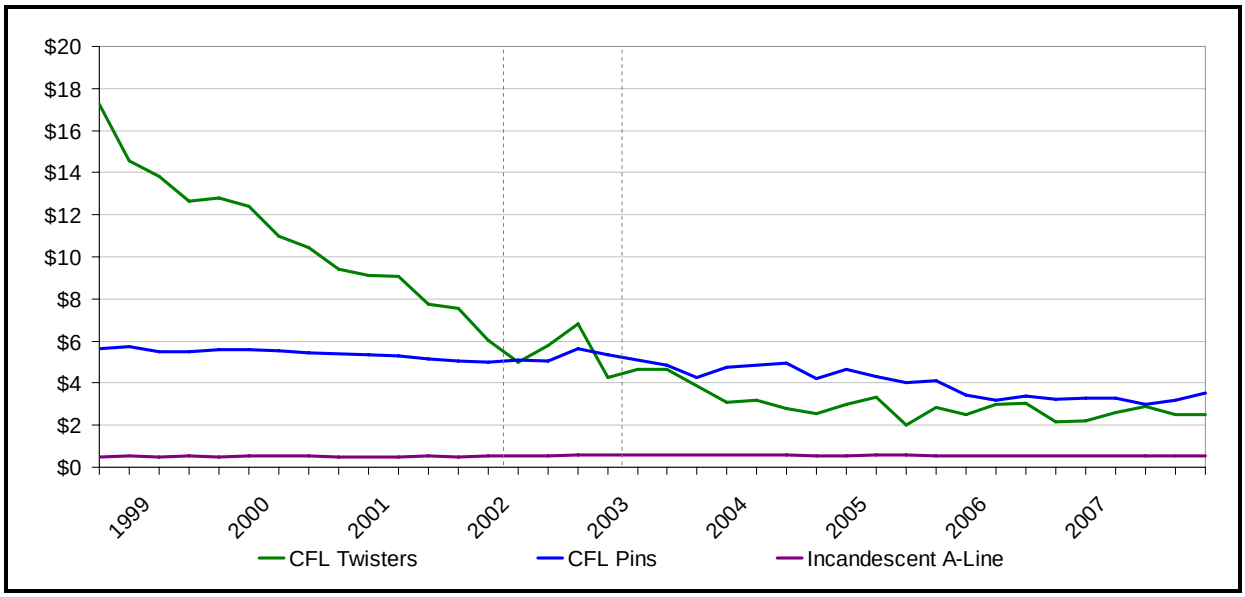
pin-based CFLs have remained fairly constant in since mid-1998, while the prices of screw based CFLs have fallen dramatically.

**Figure 23: Medium Screw-Based CFL Sales and Pin-Based CFL Sales – U.S. (non-California) (in Thousands)**



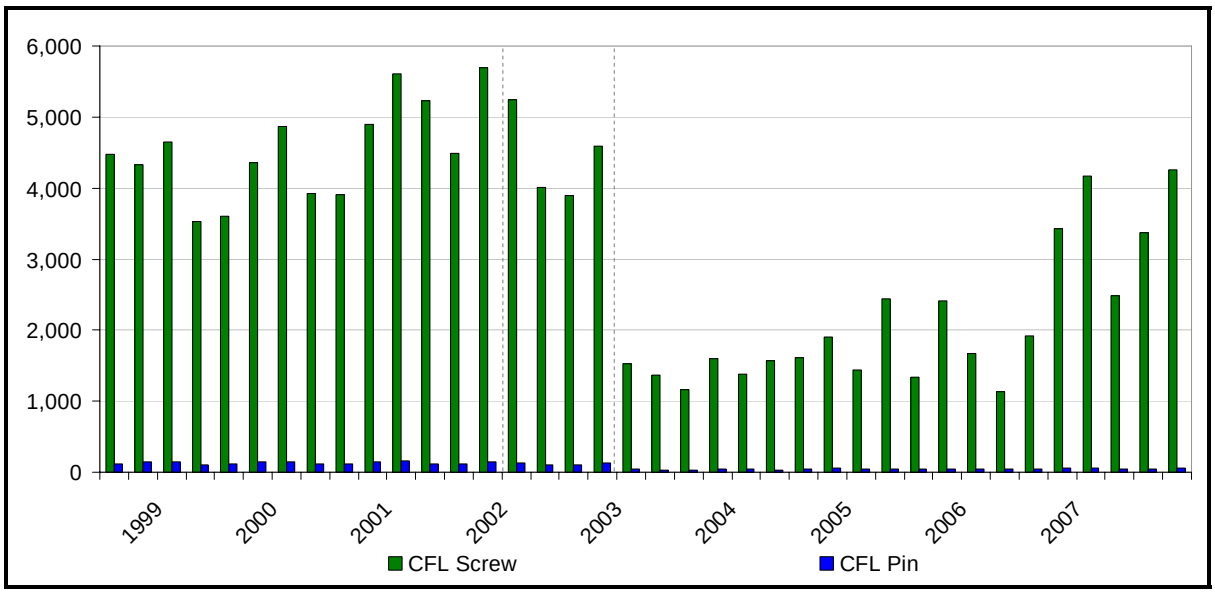

* After 2002, data from a large mass merchandise chain store are no longer included, and, after 2003, the data no longer include home improvement stores.

**Figure 24: Medium Screw-Based CFL Prices and Pin-Based CFL Prices – U.S.**



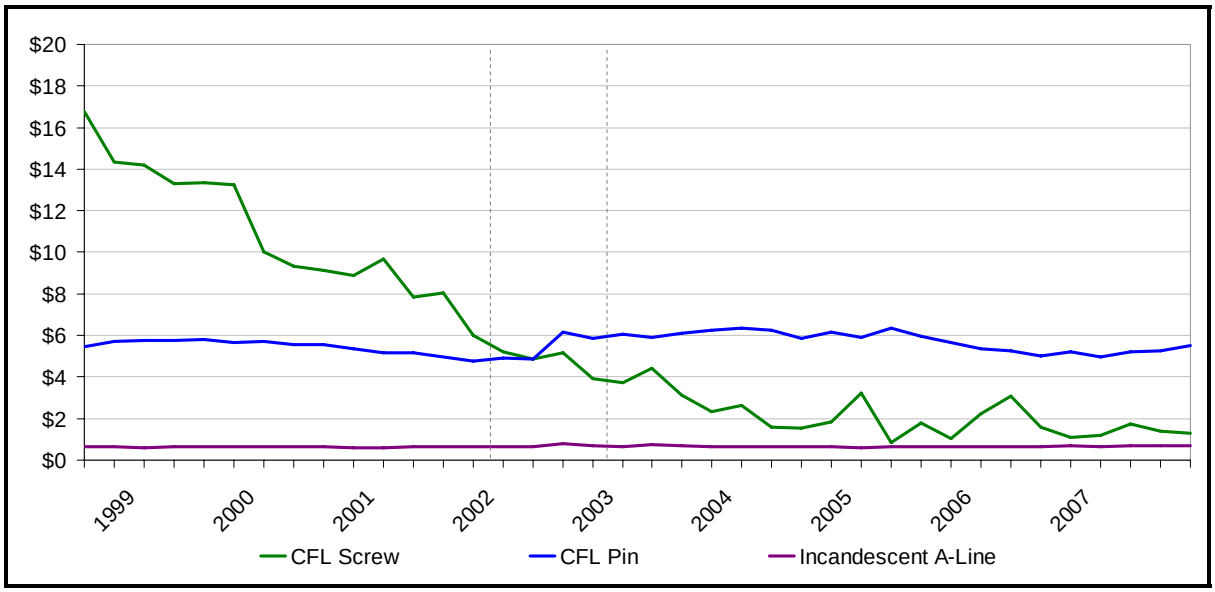

* After 2002, data from a large mass merchandise chain store are no longer included, and, after 2003, the data no longer include home improvement stores.

**Figure 25: Medium Screw-Based CFL Sales and Pin-Based CFL Sales – California (in Thousands)**




* After 2002, data from a large mass merchandise chain store are no longer included, and, after 2003, the data no longer include home improvement stores.

**Figure 26: Medium Screw-Based CFL Prices and Pin-Based CFL Prices – California**




* After 2002, data from a large mass merchandise chain store are no longer included, and, after 2003, the data no longer include home improvement stores.

## 4. Sales of Screw-Based Lamps by Equivalent Wattages

When replacing medium screw-based incandescent lamps with CFLs, it is important to maintain a comparable light level. Lumen output measures the amount of light produced by a lamp and is closely approximated by lamp wattage. Using information from lamp manufacturers and the Lighting Research Center,[15] lamps sold were sorted by equivalent lumen output, as shown in Table 2.[16]

### Table 2: Comparison of Equivalent Lamp Wattages

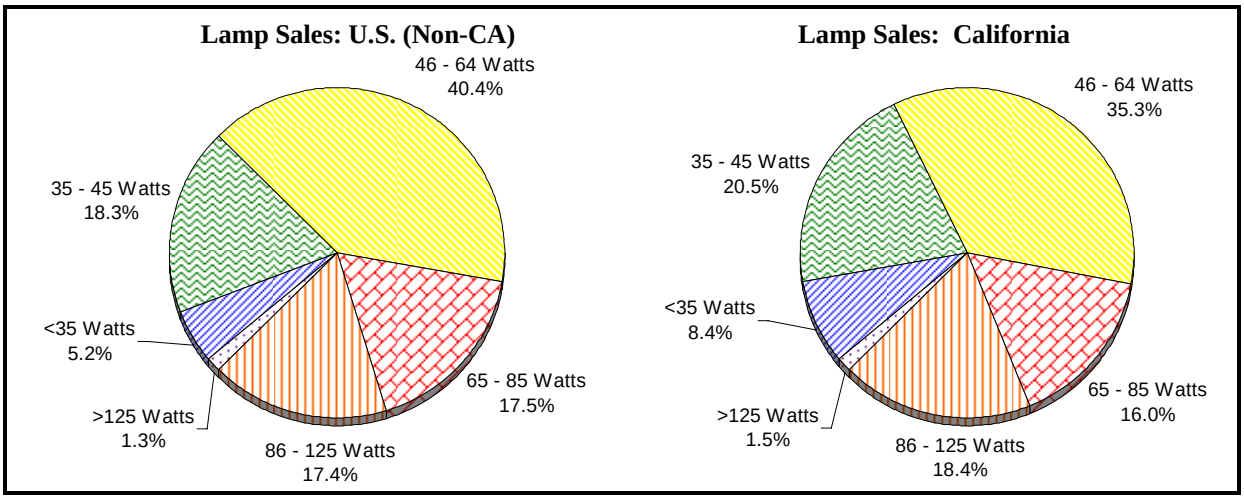
| CFL Wattage Range | Incandescent/Halogen Wattage Range | Typical Incandescent Wattage | Typical Lumen Output |
|---|---|---|---|
| 11-13 | 35-45 | 40 | 450 |
| 14-18 | 46-64 | 60 | 800 |
| 19-24 | 65-85 | 75 | 1,150 |
| 25-30 | 86-125 | 100 | 1,550 |
| 30+ | 125+ | 150 | 2,500 |

Figure 27, Figure 28, and Figure 29 present sales of medium screw-based compact fluorescent, incandescent, and halogen lamps by wattage in California and the rest of the U.S., respectively, by wattage group. Comparing these figures reveals that the most commonly purchased incandescent and halogen lamps are in the 46-64 watt range, typically 60-watt lamps. Correspondingly, CFLs that provide the equivalent light levels of the 60-watt incandescent lamps are the most commonly sold lamps, followed closely by CFLs that provide the equivalent light levels of the 75-watt incandescent. In California, the majority of CFLs sold were in the 19-24 watt range, which corresponds to the wattage of the high-selling, low-priced lamps that drove the increase in CFL sales since 2005. For the other lamp types, the distribution of wattage in California is similar to the rest of the U.S.

[15] Lighting Research Center. *Specifier Reports: Screw-base Compact Fluorescent Lamp Products, Volume 7, Number 1*. June 1999.

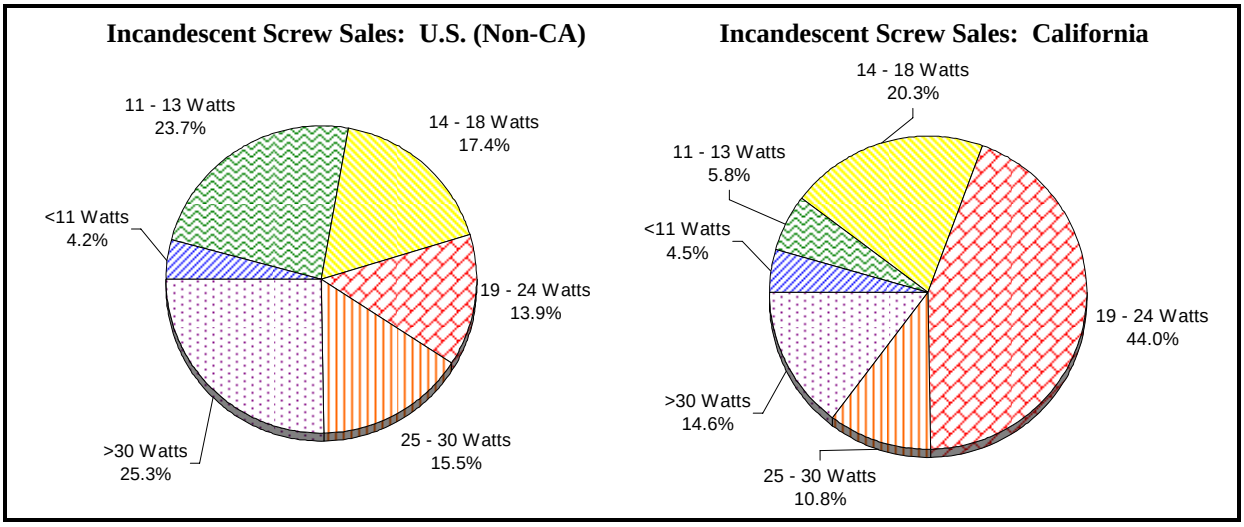
[16] Typical Incandescent Wattage is the most common incandescent lamp found for that wattage range, based on data from lamp manufacturers.

## Figure 27: Screw-Based CFL Sales by Wattage – 2007



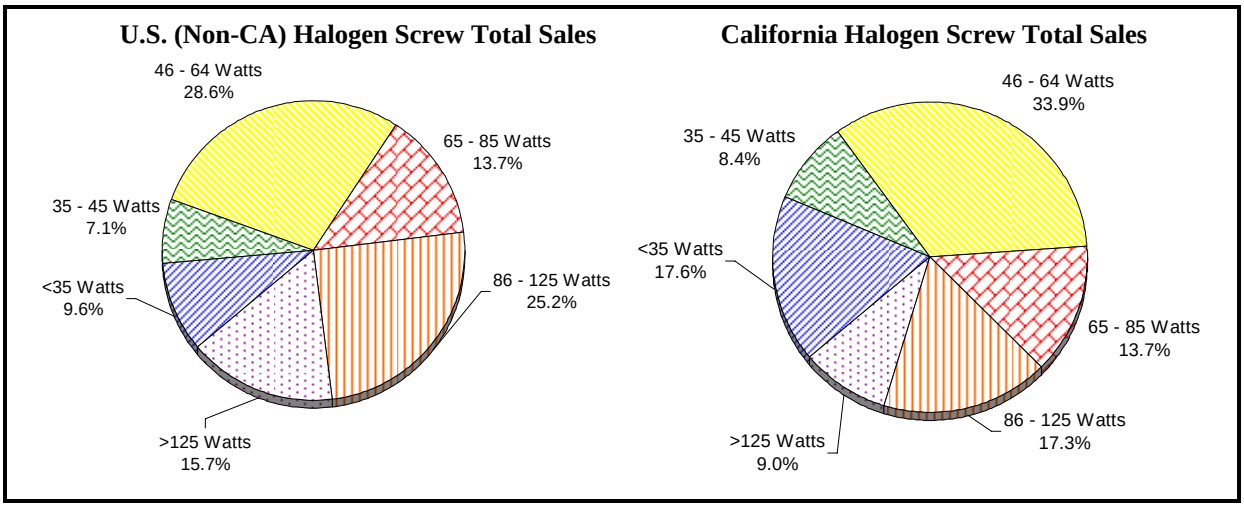

* POS data included in the figure above only includes sales through large food stores, drug stores, hardware stores, and some mass merchandisers.

## Figure 28: Screw-Based Incandescent Sales by Wattage – 2007




* POS data included in the figure above only includes sales through large food stores, drug stores, hardware stores, and some mass merchandisers.

**Figure 29: Screw-Based Halogen Sales by Wattage – 2006**

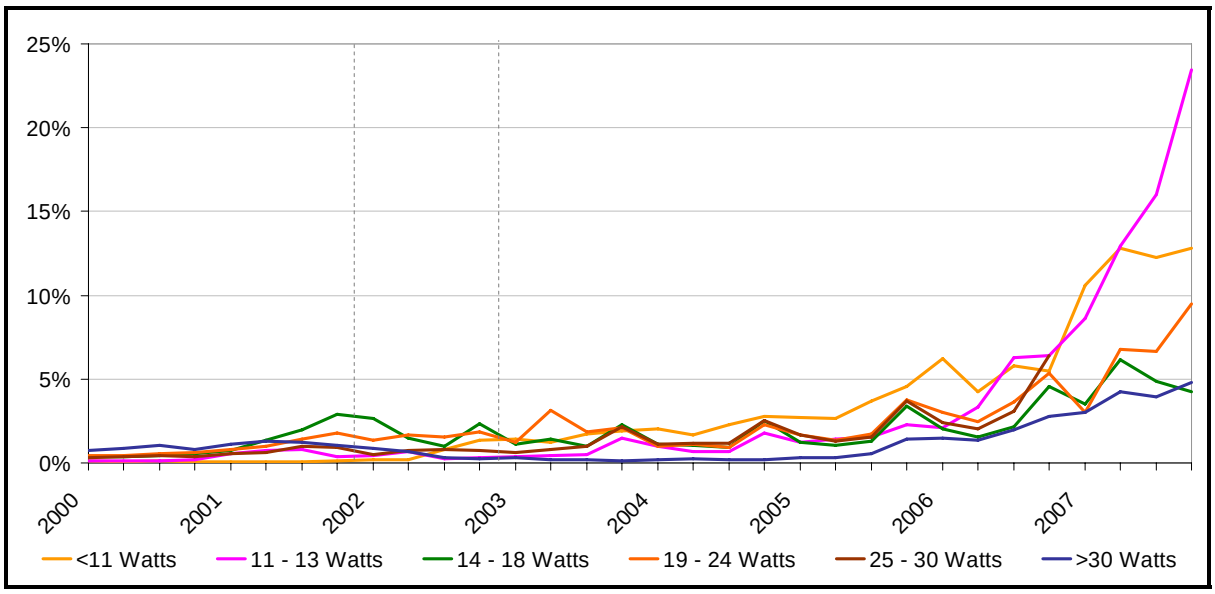



* POS data included in the figure above only includes sales through large food stores, drug stores, hardware stores, and some mass merchandisers.

### *Sales and Prices of Medium Screw-Based CFLs by Wattage*

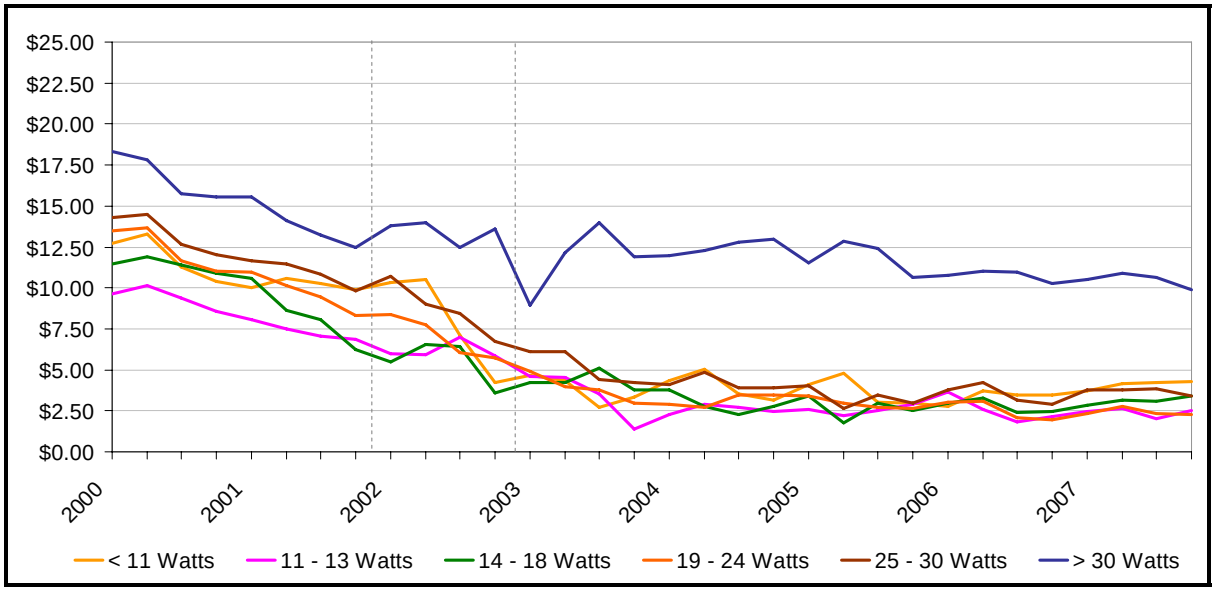
Figure 30 and Figure 32 illustrate quarterly medium screw-based CFL sales as a percentage of total medium-based lamp sales by wattage for the rest of the U.S. and California, respectively. These figures reveal that CFLs in the 14-18 watt range (60-watt equivalent) account for a large portion of the total increase in CFL MSBLs in 2001 and 2002 for the U.S. and California. In 2003, CFLs in the 19-24 watt ranges increased and temporarily overtook CFLs in the 14-18 watt range. However, the share of CFLs in the 14-18 watt range increased substantially in the latter part of the 2004, while the share of CFLs in the 19-24 watt range fell. In 2005, CFL sales in both wattage groups increased to nearly identical levels in the rest of the U.S., while in California the 14-18 watt range increased the most. Then, in 2006 and 2007 sales of bulbs in the 19-24 watt range increased again in California, while CFLs of 11 to 13 watts had the highest sales in the rest of the U.S, due to a large increase in the sales of "mini-twisters", or, smaller-sized twister shaped CFLs that fit into a larger number of lighting fixtures.

**Figure 30: Medium Screw-Based CFL Sales as a Percentage of Total Medium Screw-Based Sales, by Wattage – U.S. (non-California)**



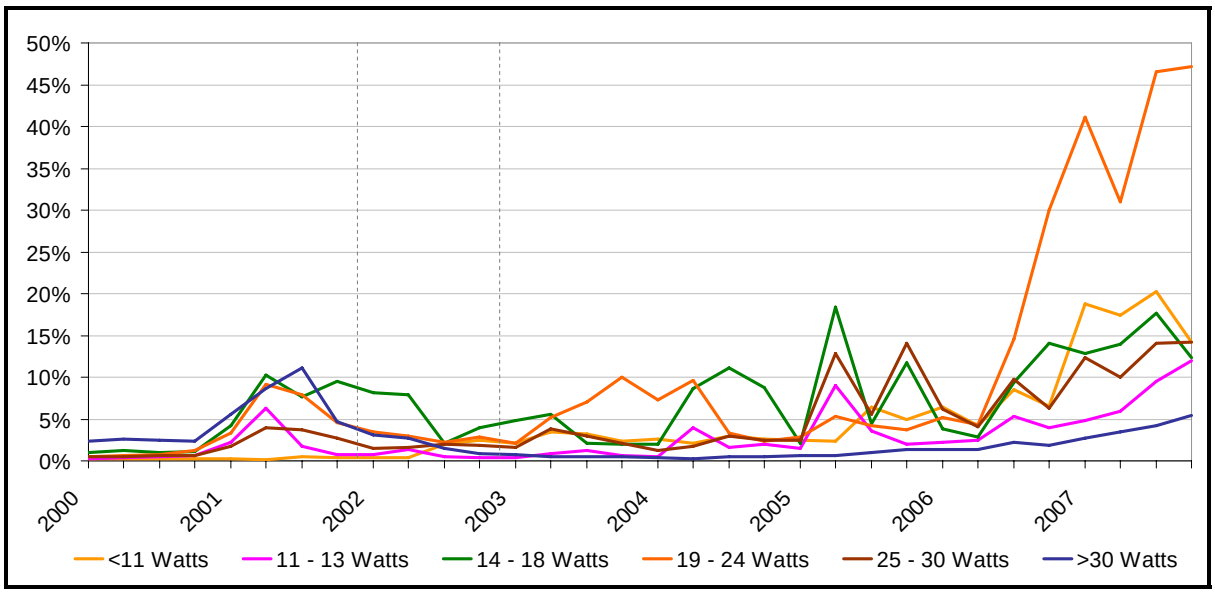

*After 2002, data from a large mass merchandise chain store are no longer included, and, after 2003, the data no longer include home improvement stores.

**Figure 31: Medium Screw-Based CFL Average Sales Price, by Wattage – U.S.**



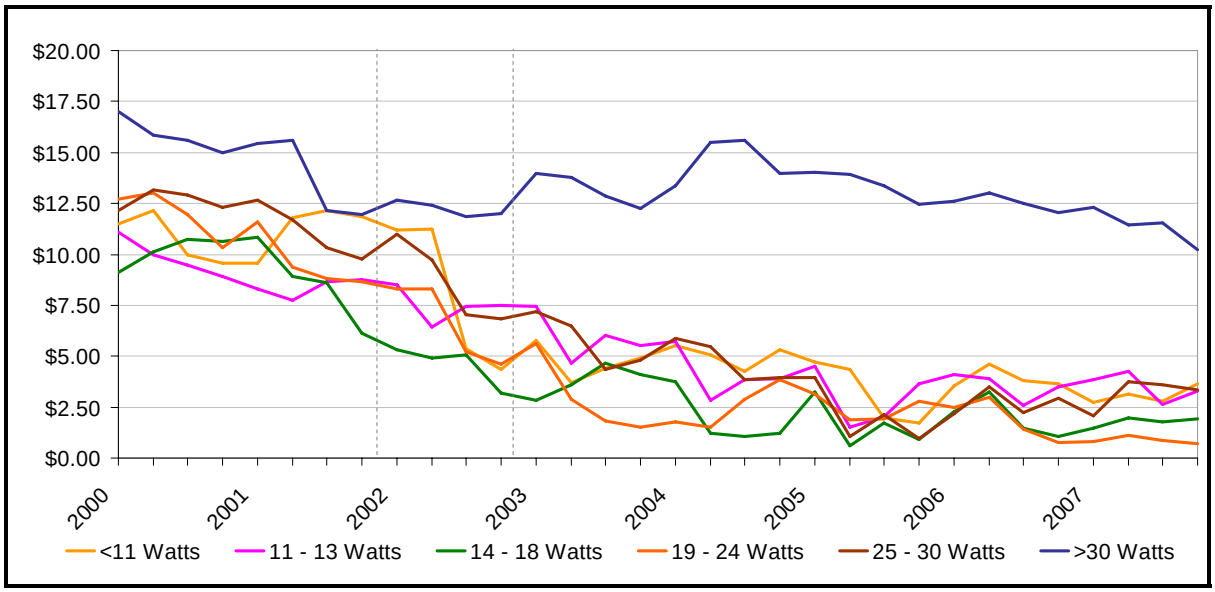

* After 2002, data from a large mass merchandise chain store are no longer included, and, after 2003, the data no longer include home improvement stores.

**Figure 32: Medium Screw-Based CFL Sales as a Percentage of Total Medium Screw-Based Lamp Sales, by Wattage – California**




* After 2002, data from a large mass merchandise chain store are no longer included, and, after 2003, the data no longer include home improvement stores.

**Figure 33: Medium Screw-Based CFL Average Sales Price, by Wattage – California**




* After 2002, data from a large mass merchandise chain store are no longer included, and, after 2003, the data no longer include home improvement stores.

Figure 31 and Figure 33 presents the average sales price of a medium screw-based CFL in California and the U.S. by wattage group. (Because of the method used to calculate average sales price, the national sales prices include California.) Prices for all wattage groups have fallen, especially the 14 to 18 and the 19 to 24 wattage groups. Prices for the highest watt group, those over 30 watts, have not decreased as much a the other groups, and remain above $10.00. National prices have shown some of the same trends as California, though the average national price is usually higher than California's average price. The lowest national price of $1.85 occurred in the 11 to 13 watt range in 2006.

## 5. Comparison of the RMST and other Estimates of CFL Sales

### *Other National Data Sources*

As mentioned in Section 1, aside from the RMST data there are currently two known data sources that attempt to estimate national CFL sales through retail channels in 2007:

- ***ENERGY STAR.*** CFL sales data is currently collected by The Cadmus Group in support of the EPA's ENERGY STAR program. This data includes ENERGY STAR qualified CFLs from five major national retailers. As of the writing of this report, data is only available for the first and second quarters of 2007.[17]
- ***18Seconds.org.*** CFL sales data presented on this website is collected by AC Nielsen in conjunction with Yahoo! and Wal-Mart. These data overlap the RMST data in that they include many of the same market channels.

Table 3 presents both the 2007 California and U.S. total CFL sales by data source. (These data are <u>not</u> additive.) The 18Seconds.org data overlaps with both the RMST and ENERGY STAR data. However, neither the RMST data or the ENERGY STAR overlap, nor do they represent all retail channels selling CFLs. The following sections describe other known sources of CFL sales in California in an attempt to illustrate the likely retail channels that could also have a sizable market share in the U.S.

[17] Where annual numbers are presented in the tables below, we have assumed that the CFLs sold in the third and fourth quarters of 2007, through the channels represented by the ES data, would increase at approximately the same rate as the CFLs sold nationally through the RMST channels and those rebated through the CA IOU upstream programs. When comparing the data from both datasets, the third and fourth quarters are approximately 140% of the first and second quarters.

**Table 3: Estimates of CFL Sales in 2007 by Data Source**

| Data Source | U.S. | CA |
|---|---|---|
| 18Seconds.org – 2007 | 124,685,587 | 10,370,472 |
| 18Seconds.org – thru 2008Q1[18] | 152,770,402 | 13,061,218 |
| ENERGY STAR – 2007Q1&Q2 | 94,038,253 | 8,637,032 |
| ENERGY STAR – Estimated 2007 | 225,691,807 | 20,728,878 |
| RMST – 2007 | 48,376,369 | 11,047,139 |

***Strengths and Weaknesses of Various National Data Sources***

Below is a brief overview of the three national data sources described above. These are the opinion of the project team and we are currently in communications with both The Cadmus Group and Yahoo!/Nielsen to ensure that they agree or have a chance to respond. As of April 25, 2008, this should be viewed as a draft and may change prior to the publication of this report.

### A. ENERGY STAR CFL tracking system maintained by The Cadmus Group

Strengths

1. Collects point-of-sales from the same six large national (one regional) chains and publishes quarterly data.
2. Data collected by state.

Weaknesses

1. Sales totals do not include sales from hardware (non-large home improvement stores), food and drug chains, regional chains, internet channels, or small independent store fronts.
2. The data collection system makes no attempt to collect data for CFLs that do not qualify for ENERGY STAR label.
3. The data is currently only available starting in 2007.

### B. RMST Lighting Tracking Study - for the California IOUs, managed by SCE and conducted by Itron

Strengths

1. Uses of a consistent set of data based on point–of-sale information at both the state and national levels. The data allows for high quality time-series analysis. Data is available since 1999.
2. Includes UPC-level data including wattage, bulb type and shape, and price.

[18] As of the writing of this report, we are waiting for clarity from Yahoo!/Nielsen regarding the lag time between sales and reporting.

3. Data represents California and the U.S. from the same channels
4. Obtained from well respected market research firms, AC Nielsen and Activant, which brings high level of credibility and confidence to data collected.

Weaknesses

1. The data do not include sales through other channels, such as club warehouse stores, large home improvement stores, the Internet, small independent stores, and direct sales from the manufacturer to the consumer. (This has become a bigger problem over time as customers spend more time purchasing goods at a lower cost through Sam's Club and Costco and well as small food store and discount store channels.)

### C. 18Seconds.org – produced by Yahoo! and Nielsen – various sponsors

Strengths

1. Collects point-of-sales information in **every state** from a consistent from food, drug, and mass merchandiser channels and publishes data daily.

Weaknesses

1. It is not transparent how daily data is estimated.[19]
2. Data currently only available since January 2007.
3. The data do not include sales through other channels, such as club warehouse stores, the Internet, small independent stores, large home improvement stores, and direct sales from the manufacturer to the consumer.

## *2001 and 2005 California Lighting and Appliance Saturation Study (CLASS)*

Table 4 presents estimates of CFL sales extrapolated from the California Lighting and Appliance Saturation Study database.[20] As part of the CLASS Study RLW estimated the percentage of household fixtures with CFLs in both 2000 and 2005. Weighting these up to the population and subtracting the 2005 results from the 2000 results in and increase of approximately 24 million CFLs in CA residences. Of these, a small percent could have been installed by builders or provided to the residence through IOU giveaways.

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[19] Itron is currently working with the developers of the 18seconds.org website to resolve discrepancies between data published online, Wal-Mart/Sam's Club press releases, and data from Nielsen for this study. If the issues are resolved prior the publication of this report, changes will be made to this draft.

[20] www.calresest.com: RLW was the Prime Contractor in completing the CLASS Study. "The California Lighting and Appliance Saturation Study database provides baseline information on residential appliance, equipment and lighting saturations and efficiencies. The original study was completed in 2000. An update was completed in 2005. The overarching goal for the studies is to provide an accurate baseline in order to understand future energy savings potential and past accomplishments in the residential sector."

**Table 4: 2000-2005 CFL Sales in California by IOU – in Thousands**

| IOU | % Fixtures w/ CFL | | # Households | | Est. ScrewBased Fixtures/Household | | Est. # CFLs Sold 2000-2004 | |
|---|---|---|---|---|---|---|---|---|
| | CLASS 2000 | CLASS 2005 | 2000 (000's) | 2005 (000's) | 2000 | 2005 | CLASS | RMST* |
| PG&E | 1.3% | 11.7% | 4,072 | 4,560 | 21 | 25 | 12,236 | 9,331 |
| SCE | 0.3% | 11.4% | 3,817 | 4,275 | 20 | 20 | 9,517 | 6,029 |
| SDG&E | 0.3% | 7.6% | 1,138 | 1,274 | 16 | 26 | 2,469 | 1,999 |
| **Total IOUs** | | | **9,026** | **10,109** | | | **24,222** | **17,359** |

* Assumes that Home Centers slowly decreased their share of total CFLs purchased in CA between 2003 and 2006 (2002 = 62% and 2006 = Confidential but quite a bit less than 62%).

Comparing CLASS with the 2000-2004 RMST data shows that the total RMST CFL sales (estimating large home improvement and mass merchandisers in 2004) shows that approximately 72% of the estimated 24 million installed are accounted for through the RMST channels originally supplying data. Depending on the assumptions made regarding lamps obtained through non-retail sources, and regarding how many lamps were sold prior to 2003 (prior to the Upstream Programs), the original assumption that the RMST channels account for 80% of retail CFL sales prior to 2004 was a decent estimate.

However, since the inception of the CA IOU Upstream CFL programs, the CFL share of the RMST channels compared to all medium screw-based lamps sold in CA has decreased rapidly. The following sections attempts to provide examples of which channels have increased sales of CFLs over the last four years.

### *Upstream Lighting Programs (ULP)*

Table 5 includes the number of CFLs the CA IOUs rebated during the 2004-2005 and 2006-2007 Upstream Lighting Program (ULP).[21] The ULP issues rebates directly to manufactures of energy efficiency compact fluorescent lamps and fixtures which are then sold to consumers at discounted prices. The CFLs included in the Upstream Lighting Program were incentivized these time periods, but because the rebates are paid to the manufacturer, there is a lag between the time when the lamps are incentivized and the time when the consumer makes their purchases. Therefore, a lamp included in the Upstream Lighting Program in 2005 may not be counted in the RMST until first quarter of 2006. Likewise, lamps rebated prior to 2004 may be included in the 2004/2005 RMST results.

[21] ULP portion of the 04/05 SFRP Evaluation was conducted by KEMA. Further, data for 2006 and 2007 were provided by CADMUS. The number of rebated bulbs in 2006 and 2007 are draft numbers and should not be viewed as official or verified. These numbers will be updated in future versions of this report as available.

**Table 5: Upstream Rebated CFL in California by Market Channel**

| Market Channel | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Big Box | 2,512,953 | 2,317,819 | 2,320,706 | 9,863,872 |
| Large Home Improvement | 1,194,658 | 1,080,150 | 1,656,480 | 2,951,916 |
| Small Hardware | 240,646 | 401,388 | 367,342 | 2,537,440 |
| Food (Large Chains) | 1,916,251 | 3,679,851 | 2,463,816 | 5,975,444 |
| Food (Small) | 876,854 | 1,683,857 | 2,124,806 | 7,457,138 |
| Drug | 1,249,964 | 1,231,030 | 2,164,356 | 2,497,907 |
| Discount | 671,623 | 776,846 | 1,731,026 | 6,443,976 |
| Other Retail | 71,724 | 243,198 | 244,986 | 723,158 |
| **Grand Total** | **8,734,673** | **11,414,139** | **13,073,518** | **38,450,851** |

Data provided by CADMUS.

Due to issues in the CFL manufacturing industry, many of the IOUs got a late start in 2006 incentivizing CFLs. While this caused some issues for the IOUs, it has provided insight into a possible lag between the rebate and the sale of a CFL. One indicator that a one quarter lag may be appropriate is that there were still sizeable CFL sales in the first quarter of 2006 with fairly low prices. The average price increased and sales continued to decrease in the second quarter of 2006 indicating less rebated lamps were being sold.

Figure 34 presents the total CA IOU rebated CFLs compared to the RMST point-of-sales data. Also provided are the RMST data lagged by one quarter (i.e. the "RMST – Lagged" data shown for 2005 includes sales between 2005 Q2 and 2006 Q1. Figure 35 and Figure 36 show similar data for large food and drug stores.

As shown, in some years for some channels, the data lines up nicely with the lagged RMST data somewhat higher than the rebated CFL data. However, there are noticeable differences with the CFLs sold in hardware stores in 2007 the most noticeable. There could be many reasons for this. The POS data providers have good coverage for most channels. However, there is at least one case where a retailer who is very active in the IOU programs (accounting for approximately 25% of the total rebated CFLs through its channel in 2006 and 2007) is not included in the data provided by our data sources. Another reason for the differences is that it is possible that not all rebated lamps are sold in CA. There have been reports of lamps being sold in both Nevada and Arizona. While this is likely a small percentage, this claim has been reported by several independent sources. However, the purpose of this report is not to make claims about how many program bulbs were sold in CA, instead these graphs are simply meant to provide a comparison to the total number of CFL sales reported between the RMST data and the IOU Program filings.

**Figure 34: Total CA Rebated CFLs compared to RMST – Hardware Stores**

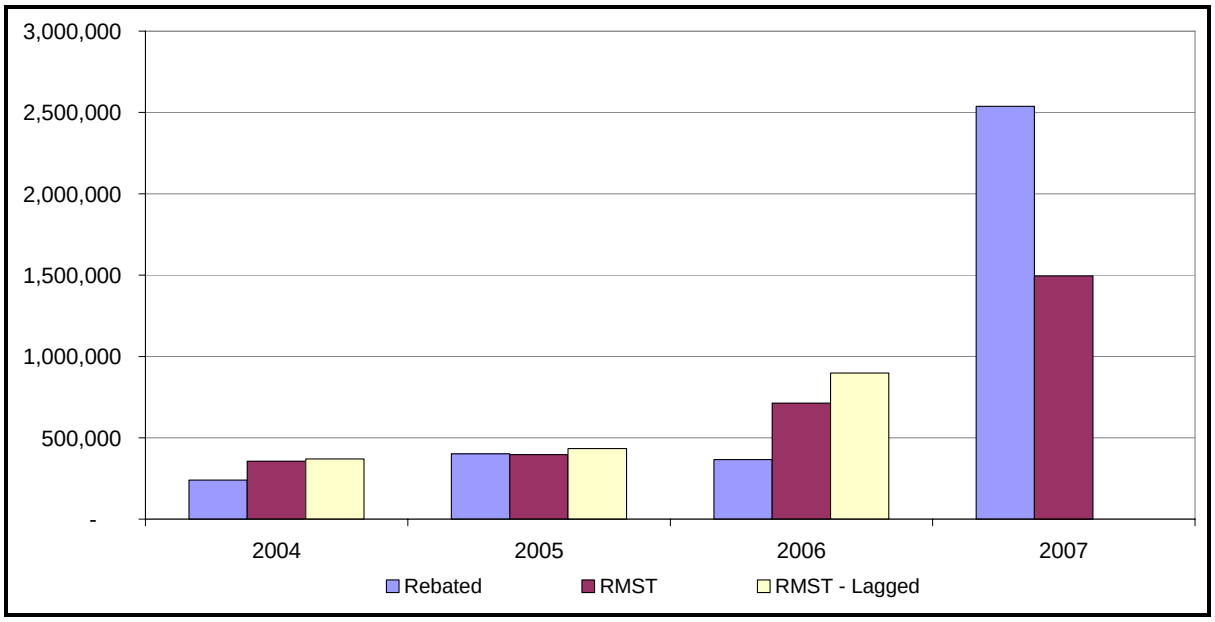



**Figure 35: Total CA Rebated CFLs compared to RMST – Large Food Stores**

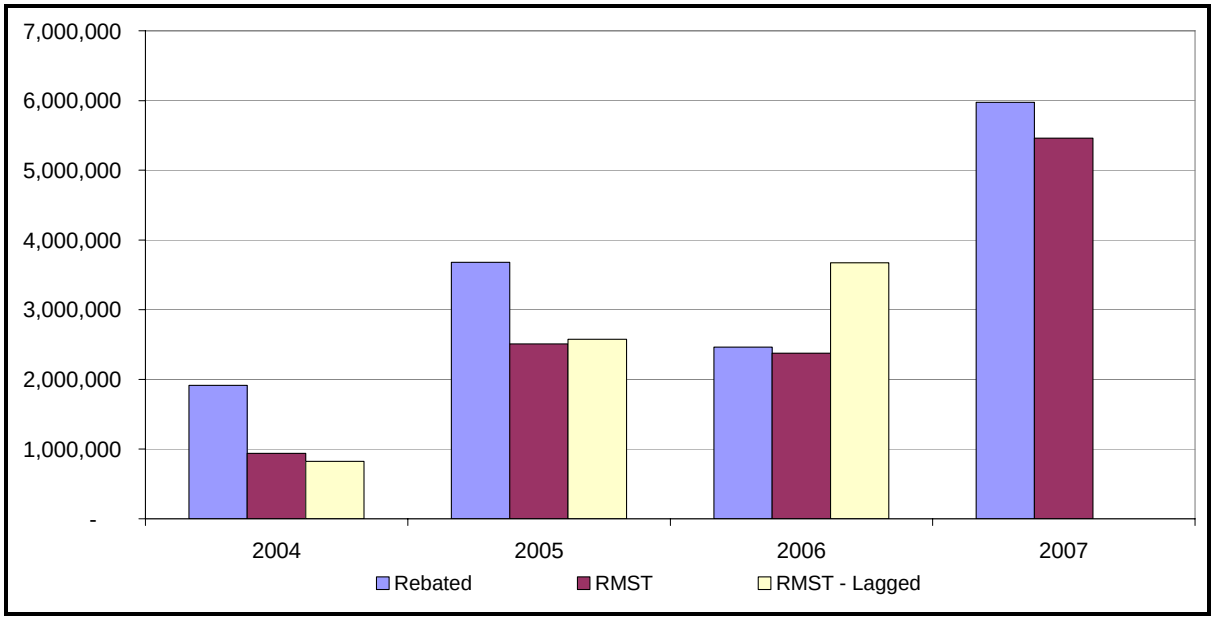
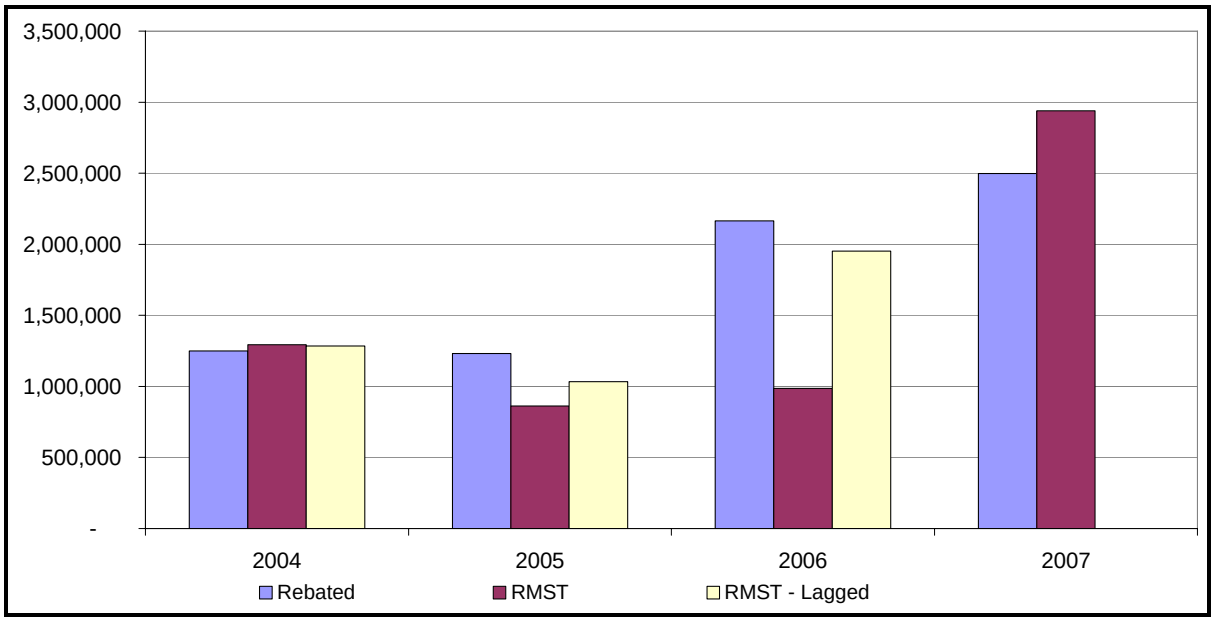


**Figure 36: Total CA Rebated CFLs compared to RMST – Drug Stores**




### *Estimates of Total CFL Sales*

Using the national data sources explained above along with the ULP data and the RMST results, Itron's current estimates of the trends in CFL sales for California are shown in Table 6 below.[22] The total sales estimates in this table were developed using two major primary sources: the RMST and ENERGY STAR data provided by CADMUS. This synthesis of data sources is the probably the best that can be done now because there is no single data source that simultaneously covers all CFL sales channels. Further details on the strength and weaknesses of each data source are detailed above.

[22] Readers should note there is considerable uncertainty in the estimates of nationwide and state level CFL sales due to different data sources, extrapolation errors and the unknown size of the Wal-Mart effect. A detailed discussion of the existing uncertainties in the state and national sales estimates can be found in Appendix below.

**Table 6: Estimates of CFL Sales in 2007 by Data Source**

| Data Source | US (non-CA) | CA |
|---|---|---|
| CADMUS | 257,395,813 | 28,790,643 |
| RMST | 37,329,230 | 11,047,139 |
| CA IOU ULP – Small Food | | 7,457,138 |
| CA IOU ULP – Discount Stores | | 6,443,976 |
| CA IOU ULP – Other Channels | | 723,158 |
| Estimated Total thru Retail Channels* | 294,725,043 | 54,462,054 |

* This total has many caveats, including not including rebated CFLs in other program states sold through small food stores and discount stores. It also does not make any assumption on the percentage of non-ENERGY STAR qualified CFLs sold through the large national chains included in the ENERGY STAR data to represent all CFLs sold.

The U.S. total sales estimate of 350 million (294M Non-CA plus 54M CA) was cross-referenced against estimates of CFL shipments from the U.S. Department of Commerce and on the channel level with estimates from private retailers and 18seconds.org. The shipment data from the Department of Commerce reports total shipments of over 400 million CFL in 2007 but it is not clear if some portion of these CFLs are subsequently reshipped to Mexico or Canada. Also, as mentioned above, the 290 million estimate does not include any expansion to include non-ENERGY STAR qualified CFLs. The Non CA sales is simply our best estimate of U.S. sales minus the best estimate of CA sales for each year. We note that it is still possible that direct sales from distributors to utilities or via the internet to customers are not captured by either of these sources.

***MBSL Shares and Prices of CFLs by Region Using CADMUS and RMST Data***

For Figure 37 and Figure 38, CFL data from RMST and CADMUS were combined to present an estimate of CFL sales by geographical region. (Please see Figure 13 for geographical region breakout.) Combining the two data sets for 2007 was possible because the RMST and CADMUS data do not overlap, but instead track CFL sales from different retailers. By combining this data, it is possible to present results for approximately 80% to 95% of the CFL market. These data do not include several retail channels, e.g., regional chains, Internet retailers, small independent stores, and direct sales from the manufacturer to the consumer. Unfortunately, sales of incandescent lamps are not available for the data covered by CADMUS, so comparisons of CFL sales to total lamps sales are not possible.

**Figure 37: CFL Sales by Region – RMST and CADMUS Data Combined**

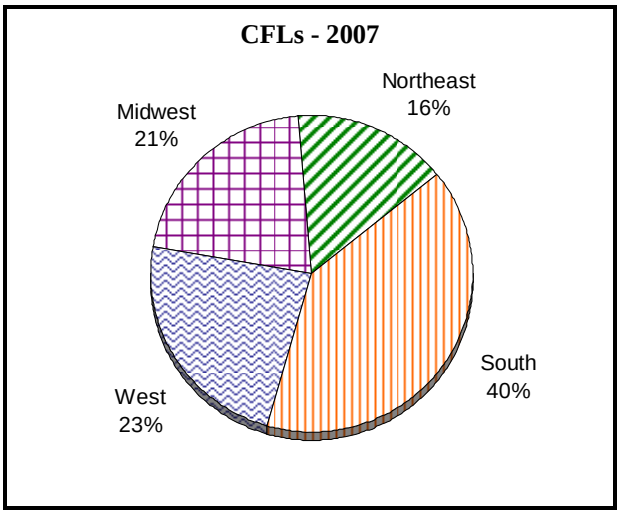



**Figure 38: 2007 CFL Sales per Household – CADMUS and RMST Data Combined**

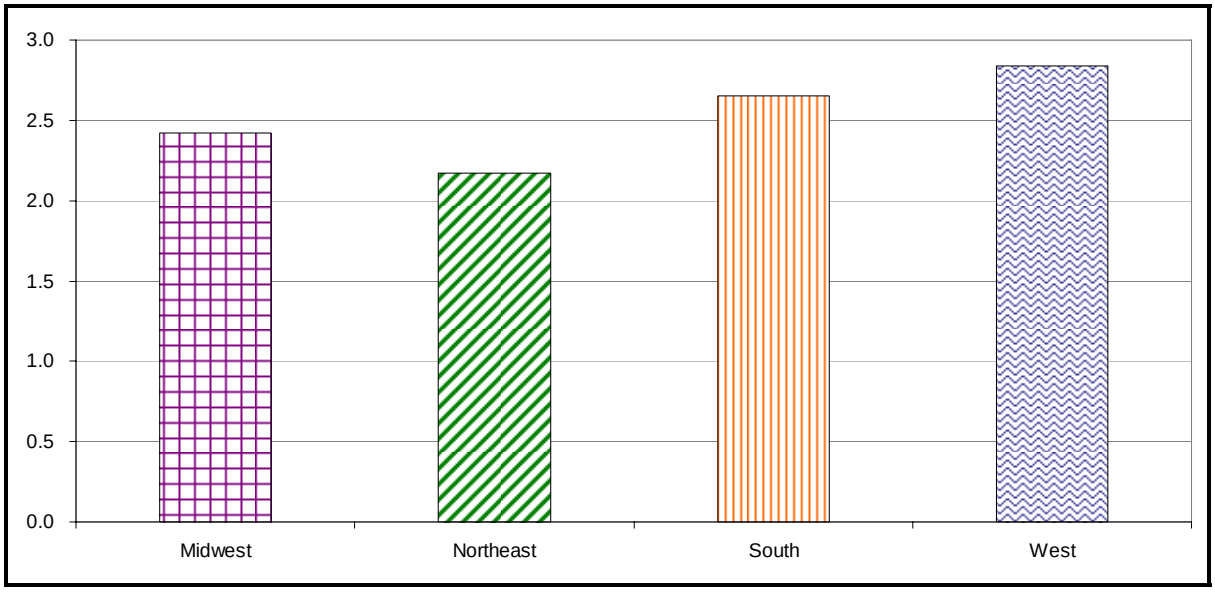
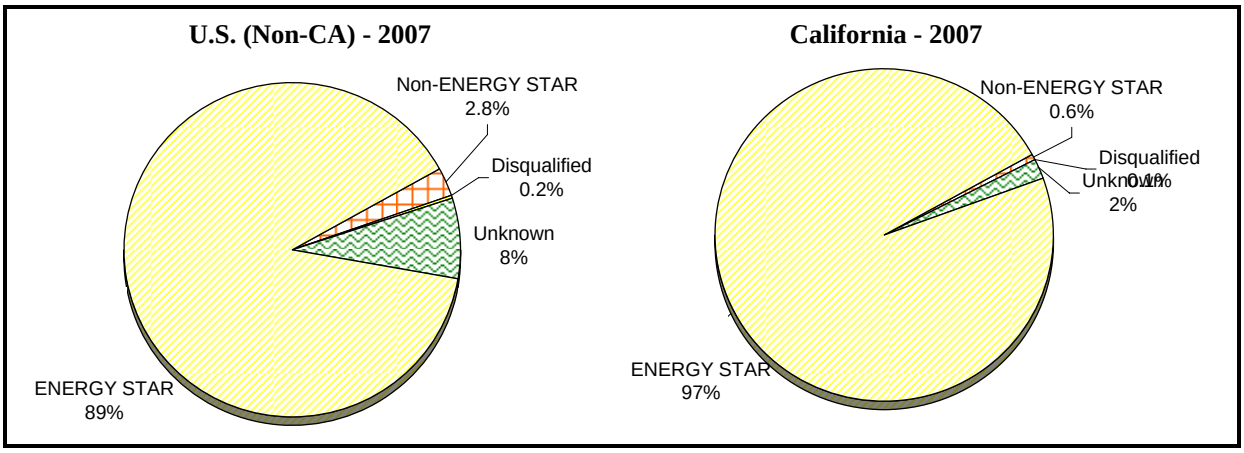



Figure 39 shows the percentage of CFLs in the RMST data that are ENERGY STAR rated. As can be seen, the percentage of non-ENERGY STAR rated bulbs is higher nationally then it is in California. Lamps that are included in the California rebate programs are required to be ENERGY STAR rated. Since it is likely that a large portion of the lamps purchased in California are rebated lamps, this may account for the difference between California and the rest of the country.

**Figure 39: RMST CFL Sales – ENERGY STAR Status**




# 6. Price Elasticity

## *Background*

This analysis focuses on lamps that were purchased through the food, drug, and hardware channels, from 2000-2007. Food, drug, and hardware were the three channels through which lamps were sold and data collected that were the most complete. Unlike other market channels which lost participants providing data, the food, drug, and hardware remained relatively unchanged during the time period, resulting in 8 years of quarterly data allowing 32 observations for each category of light bulb.

Initially, the lamps were separated into five different categories, based on wattage. Substitution patterns were expected to only occur within watt group. For example, CFLs with a wattage of 19-24 were only considered to be substitutes for incandescent light bulbs in the range of 65-85 watts (or an average 75 watt incandescent bulb).[23] However, the results from estimating the model and price elasticity by wattage group were not of the expected sign and were not statistically significant and are not included within this report.

## *Analysis of Market Share*

Market share was calculated based on the percentage of budget share spent on each type of light bulb. Total expenditures was the sum of the expenditures spent on CFLs plus the expenditures spent on incandescent light bulbs. The budget amount spent on each lamp type was calculated by multiplying the price per lamp by the quantity of lamps sold.

When the lighting data is aggregated up to the market channel level, there are notable similarities shared by the three market channels analyzed within the pricing study. The Food

[23] Please see Table 2 for more detail on the wattage groups.

and Drug channels have CFL market shares that are approximately zero in 2000, while the share in the hardware channel is less than 2%. In 2001, the market share in each channel rises substantially, but this share is still in the range of 2 to 6%. It is likely that the energy crisis increased the publics' awareness of the energy savings benefits of CFLs. All three market channels underwent increased growth in market share starting in the 2004-2005 time period. Overall market share was highest in the Drug market channel with an increase from less than 9% in 2004 to approximately 29% in 2007. Hardware started with a slightly higher market share, but not seen the growth in market share exhibit by the Drug market channel. Hardware's market share increased from approximately 2-3% in 2004 to about 10% in 2007. The Food market channel's CFL market share increased from about 4% in 2004 to 26% in 2007.

### *Almost Ideal Demand System Model*

For each watt group, with the exception of Watt Group 1, which had no CFLs recorded, an Almost Ideal Demand System (AIDS) Model was estimated, using both the linear approximation and non-linear estimation methods.

Seasonality and a time trend were added to the models. To incorporate the seasonality of lamp purchases, the AIDS model was modified to include trigonometric variables and also a time trend variable. The share equations were estimated subject to homogeneity and symmetry constraints. The estimated parameters from the AIDS model were then used to calculate the price and income elasticities for each type of lamp.

The equation for the AIDS model is shown below:

$$\omega_i = \alpha_i + \Sigma\, \gamma_{ij} \ln p_j + \beta_i \ln(X/P) + \alpha^c_i \cos(2\pi t/4) + \alpha^s_i \sin(2\pi t/4) + \alpha^t_i t$$

where $\omega_i$ is the share associated with the *i*th good, $\alpha_i$ is the constant coefficient in the *i*th share equation, $\gamma_{ij}$ is the slope coefficient associated with the *j*th good in the *i*th share equation, $p_i$ is the price on the *j*th good. $a^c_i$ and $a^s_i$ represent parameters on the trigonometric variables to capture seasonality and $a^t_i$ is the parameter on the time trend, *t*. X is the total expenditure on all types of light bulbs given by:

$$X = \Sigma p_i q_i$$

in which $q_i$ is the quantity demanded for the ith good. P is the price index defined by

$$\ln P = \alpha_0 + \Sigma \ln p_i + \tfrac{1}{2} \Sigma\Sigma\, \gamma_{ij} \ln p_i \ln p_j$$

The nonlinear AIDS model was estimated using the RMST Lighting data. The data consists of aggregate quarterly retail price and number of light bulbs sold for each general category, CFLs and incandescent light bulbs with a medium base and includes both A-lines and

twisters. The data period covers the first quarter of 2000 through the fourth quarter of 2007 for a total of 32 quarters of price and quantity data. As described above, the only market channels analyzed were food, drug, and hardware.

Homogeneity and symmetry are imposed within the model. Homogeneity is satisfied only if for all i, the gammas sum to zero and symmetry is satisfied if:

$$\gamma_{ij} = \gamma_{ji}$$

### *Estimation Results*

The results from estimating the model and price elasticity by wattage group were not of the expected sign and were not statistically significant and are not included within this report. External factors beyond price are likely influencing the unexpected results. Exploring the external factors is outside the current scope and budget of this particular project. The project team are certain that given more time and additional funds, the data provide a great wealth of information which could be explored more fully and could provide more meaningful results.

For the aggregated model, the estimation was done for each market channels separately: food, drug, and hardware. The results for all three market channels are shown below in Table 7 thru 10. The results from the hardware market channel fit the theoretical expectations better than in food and drug. The price elasticities for both CFLs and incandescent light bulbs sold in hardware stores are statistically significant at the 99% confidence interval.

**Table 7: Hardware Nonlinear AIDS Model Estimates**

| Own-Price Elasticities | | | | | |
|---|---|---|---|---|---|
| **Variable** | **Estimate** | **Std Err** | **t Value** | **Pr > \|t\|** | **Adj $R^2$** |
| elasticity Inc | -0.986 | 0.073 | -13.47 | <.0001 | 0.3030 |
| elasticity Flo | -1.334 | 0.222 | -6.02 | <.0001 | 0.3030 |
| **Cross-Price Elasticities** | | | | | |
| **Variable** | **Estimate** | **Std Err** | **t Value** | **Pr > \|t\|** | **Adj $R^2$** |
| elasticity Inc to Flo | 0.103 | 0.069 | 1.51 | 0.1437 | 0.3030 |
| elasticity Flo to Inc | -0.046 | 0.236 | -0.19 | 0.8489 | 0.3030 |

### Table 8: Food Nonlinear AIDS Model Estimates

| Own-Price Elasticities | | | | | |
|---|---|---|---|---|---|
| **Variable** | **Estimate** | **Std Err** | **t Value** | **Pr > \|t\|** | **Adj $R^2$** |
| elasticity Inc | -0.539 | 0.089 | -6.04 | <.0001 | 0.4454 |
| elasticity Flo | 0.088 | 0.306 | 0.29 | 0.7762 | 0.4454 |
| **Cross-Price Elasticities** | | | | | |
| **Variable** | **Estimate** | **Std Err** | **t Value** | **Pr > \|t\|** | **Adj $R^2$** |
| elasticity Inc to Flo | -0.228 | 0.064 | -3.55 | 0.0018 | 0.4454 |
| elasticity Flo to Inc | -2.203 | 0.426 | -5.17 | <.0001 | 0.4454 |

### Table 9: Drug Nonlinear AIDS Model Estimates

| Own-Price Elasticities | | | | | |
|---|---|---|---|---|---|
| **Variable** | **Estimate** | **Std Err** | **t Value** | **Pr > \|t\|** | **Adj $R^2$** |
| elasticity Inc | -0.591 | 0.157 | -3.77 | 0.0009 | 0.6379 |
| elasticity Flo | -0.395 | 0.352 | -1.12 | 0.2724 | 0.6379 |
| **Cross-Price Elasticities** | | | | | |
| **Variable** | **Estimate** | **Std Err** | **t Value** | **Pr > \|t\|** | **Adj $R^2$** |
| elasticity Inc to Flo | -0.182 | 0.106 | -1.72 | 0.0987 | 0.6379 |
| elasticity Flo to Inc | -1.362 | 0.522 | -2.61 | 0.0154 | 0.6379 |

The tables above provide the estimated own-price and cross-price elasticities from the Almost Ideal Demand System Model. The results vary by market channel. **In all three of the market channels, the own-price elasticity for incandescent light bulbs was negative and statistically significant.** However, for CFLs, the own-price elasticity was positive for the food channel, though not significant, contrary to economic theory which expects a negative own-price elasticity so that when price increases, the quantity demanded decreases. In both the Food and Drug market channels, the own-price elasticity for CFLs was not statistically significant.

The **cross-price elasticities also were contrary to expectations in both the Food and the Drug** market channel. As can be seen in Table 8, in the Food market channel, the cross-price elasticity from Flo to Inc is -2.203 and statistically significant. In Table 9, the Drug market channel, the cross-price elasticity from Flo to Inc was -1.362 and statistically significant as well. For the Hardware market channel, the cross-price elasticity was also negative, but not statistically significant.

**The results suggest that further research is needed to understand why the results are not reflecting the expected substitution patterns between CFLs and incandescent light bulbs.** One possible theory is the difference in the amount of shelf-spacing dedicated to light bulbs at the stores represented by the different market channels. Hardware stores typically

have more space dedicated to light bulbs, whereas food and drug have many other products competing for limited shelf space. The introduction of rebates in 2005 could have led to an increase in the stock of CFLs available as food and drug stores decreasing the shelf space available for other light bulbs. With the rebates, the food and drug would not be charging as much for CFLs and may receive less revenue for the sale of CFLs.[24]

**The results from this study imply that further research is needed to discern what other factors are impacting the food and drug market channels. One possible solution would be to lag some of the variables such as prices and sales, or to study the amount of shelving space dedicated to light bulbs at the various market channels.**

## 7. Continued Efforts to Identify Data Sources and Coordinate with Stakeholders

As explained in this report, this analysis utilizes data from four major retail channels through which lamps are sold (**food, drug, mass merchandiser, and hardware stores**). The analysis of sales prior to 2003 also includes the home center and mass merchandiser market channels, and represents approximately 80% to 90% of all lamps sold. The remaining 10% to 20% of lamps were sold through the Internet, small independent food stores, club warehouse stores, and direct sales from the manufacturer to the consumer, which were smaller market channels in the pre-2003 time period. The post-2003 analyses, however, no longer accounts for sales through the home-center market channel. This loss of home center data, lack of representation of sales through club warehouses, coupled with a growing interest in market penetration tracking by energy efficiency organizations outside of California, has facilitated efforts to expand data sources for this project.

## Appendix A

Below is a discussion by wattage group that was completed prior to the model being run by channel and not wattage group.

For Watt Group 2 the market share was relatively low until 2003 and then varied with a few spikes until in 2005 there was a steady increase in the market share of CFLs. The minimum market share for CFLs in Watt Group 2 was less than 1% in 2000 and increased to a maximum of 36% in the fourth quarter of 2007.

The market share for CFLs in Watt Group 3 was more volatile with a slight upward trend beginning in the first quarter of 2006. However, the market share drops significantly in the

[24] This is just a possibility and research is being conducted by KEMA as part of another study.

last quarter of 2007. The sudden decrease is a product of both a decrease in the demand for CFLs and an increase in demand for incandescent. The minimum market share for CFLs was 4%, with a maximum market share of 36% in the third quarter of 2007.

Watt Group 4 shows a significantly different trend with CFLs having less than 1% of the market at the beginning of 2001 and then increasing to a maximum of 74% in the third quarter of 2007. It appears from the data that the rebates, in part, led to a relative decline in the price of CFLs beginning in the latter part of 2006 and continuing through 2007.

The market share for Watt Group 5 is variable until the beginning of 2004, when an upward trend begins and continues through 2007. Similar to the other watt groups, with the exception of watt Group 4, the maximum percentage of market share for CFLs was in the mid to high 30s at 38%. The minimum market share for Watt Group 5 was 3%, in the first quarter of 2001. Unlike for the other watt groups, Watt Group 5 did not experience a converging price between CFLs and incandescent. CFLs are still more expensive than incandescent light bulbs, by about 70%.

In general, over most of the watt groups, as the price differential between the two categories of light bulbs neared zero, then market share of CFLs began to increase.