California Lamp Report 2001

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ABSTRACT

Historically, estimates made of the penetration of compact fluorescent lamps (CFLs) in the marketplace have relied on national shipment data, census data, self-reports, limited on-site data, and the willingness of distributors and manufacturers to supply critical data. These data lack the timeliness and level of detail needed to provide program planners and evaluators with the information needed to gauge the effectiveness of their lighting initiatives.

To improve this situation, a system was developed that collects line item detail on monthly unit sales data and reports results nationally and by California utility territory every six months. The data have been collected for three years now from five major sales channels through which lamps are sold: food, drug, mass merchandiser, home improvement, and hardware stores. The result is a timelier, detailed summary on California and national CFL sales. Recent findings from this process include identification of a surge in California's market share of CFL sales in 2001, identification of key retail channels through which CFLs are sold and how they change over time, and contrasts between California and national market share trends.

This work originated from the California Residential Efficiency Market Share Tracking study for the California investor-owned utilities (IOUs) to evaluate the success of their energy efficiency lighting programs. The intent was to collect point-of-sale data to support the IOUs' needs to measure program milestones for promoting CFLs in their respective service territories.

Introduction

Opportunities for energy savings in the residential sector with efficient lighting technologies have gathered momentum in recent years. One example of these increased opportunities is the ENERGY STAR® labeling programs for dedicated fluorescent fixtures and screw-based CFLs. Respectively, these programs began in 1997 and 1999. The ENERGY STAR program is conducted by both the Environmental Protection Agency and the Department of Energy. Additionally, throughout the U.S., utilities and organizations promoting market transformation have launched marketing and incentive programs to promote efficient lighting programs. Many of these types of programs have been in effect in California. To evaluate the potential impacts of the wide variety of these programs, the California Board for Energy Efficiency sought a Residential Efficiency Market Share Tracking (RMST) effort. Currently in its fourth year, the RMST analyzes residential market shares of high efficiency products, including lighting. The lighting effort includes detailed information about CFL sales throughout the state.

Much has been written and estimates have been made of the penetration of these technologies in the marketplace. Historically, estimates have relied on national shipments data, Department of Commerce data, census data, self-reports, telephone and mail-in surveys, limited on-site data, and the willingness of distributors and manufacturers to supply critical data. These data lack the timeliness and level of detail needed for program planners and evaluators to gauge the effectiveness of their lighting initiatives and to modify program implementation. This is especially true at the state or individual utility service territory level.

This paper looks at the lamp market in California and nationally using point-of-sale (POS) data from five major channels through which lamps are sold: food, drug, mass merchandiser, home improvement, and hardware stores. In particular, a computerized system was developed that collects line-item detail on monthly lamp sales, beginning in July 1998[1]. The California data are further subdivided into the service territories of each of the state's IOUs.

These data are processed and classified to garner information about overall lamp sales in the residential lighting market and provide information on lamp sales trends over time, geographic regions, and sales channels. More importantly, this paper provides details for all major lamp types used in residences, with comparisons and market shares developed for lamps that are interchangeable in form and function. The inclusion of a national comparison area provides a further context in which to evaluate the success of the California initiatives.

Additionally, during the development of the lighting component of the RMST, it became clear that, beyond California, there is a widespread need in the lighting community to understand and evaluate the penetration of CFLs and other lamp technologies in the residential marketplace. Other entities, such as the federal ENERGY STAR labeling program, Consortium for Energy Efficiency, Northwest Energy Efficiency Alliance, and a number of utilities, have expressed an interest in obtaining similar detailed data to measure the effectiveness of their national and/or regional lighting initiatives. By replicating this methodology in other regions, it would be possible to compare results for different program approaches, incentive levels, and demographic characteristics in the various regions.

This paper discusses lamp sales data and the results of the market share analysis.

Lamp Unit Sales Data

Point-of-Sale Data Sources

Most large retail stores today use barcode scanners and computers to automatically maintain product inventory, pricing, and sales data. Specialized market research firms sample and aggregate these data, which are available for a wide range of consumer products. RER identified the major research firms that supply POS data and evaluated their product for use in this study. Ultimately, POS data were purchased for the following retail channels: food stores, drug stores, mass merchandisers, and home/hardware stores. Although most lamps sold to the residential market are through these channels, it should be noted that the data analyzed do not include sales through other smaller channels, such as the Internet, small independent stores, and direct sales from the manufacturer to the consumer.[2]

The lighting data were purchased in an unprocessed spreadsheet format and then converted into a structured electronic database categorized by various levels of product

[1] The results presented in this paper include data from July 1998 through December 2001.

[2] Discussions with industry professionals estimate lamp sales outside of the major retail channels at 10 to 20%.

efficiency and performance. These data included universal product code (UPC), lamp-type indicator, location sold, retail sales channel, and monthly counts of units sold for nearly 10,000 different lamps.

Food Stores, Drug Stores, and Mass Merchandisers

ACNielsen provides consumer sales data for food, drug, and mass merchandisers.[3] These data are collected from a sample of food stores with revenue over $2 million, drug stores with revenue over $1 million, and mass merchandisers with revenue over $1 million from major metropolitan areas across the U.S. Data from grocery stores are collected in 51 regions and data from drug stores and mass merchandisers are collected from eight regions.

ACNielsen uses a stratified sample design to measure consumer sales across different geographic regions and retailers. ACNielsen 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 such as urban vs. rural, city vs. suburb, ethnic vs. non-ethnic, high income vs. low income, etc. This sampling strategy provides a complete picture of these retail channels, taking into account variances by retailer, geography, and other factors.

Some caveats should be noted. First, sales data for food stores, mass merchandisers, and drug stores cover only specific major metropolitan and regional areas. As such, U.S. Census Bureau[4] population data were used 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 all of California using population as the weighting factor. Total state sales were then proportioned to each IOU service territory and areas not covered by the IOUs using a combination of utility service area maps and population data. This approach requires certain assumptions about the demographic similarities of parts of California to the whole, and is likely not as accurate as the results that could be obtained by conducting customized (and costly) sampling in all parts of the state. This scaling process is reasonably accurate for grocery stores, where original sample sizes were substantial, but less precise for mass merchandisers and drug stores, because of the relatively small sample size.[5]

A second caveat is that the data cover only stores above a certain sales volume threshold that use computerized inventory control.

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[3] ACNielsen Company, Schaumburg, Illinois.

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

[5] Using population weighted expansion factors is a reasonable approach. However, we recognize that it assumes that lamp sales per household through these channels in areas outside the regions covered by the data are the same. To the extent that promotional and product offerings differ by mass merchandisers across regions, this assumption could lead to over- or under-reporting sales of certain lamp types.

Hardware and Home Improvement Center Stores

Consumer sales data for national and independent hardware and home improvement center stores were obtained from Triad Vista (Triad).[6] Triad collects hardware and home improvement center data from stores across four distinct regions: Northeast, Midwest, South, and West. A stratified sample design is used to develop the sample. The four main characteristics behind the sample selection process are retailer, geographic region, store type, and store size. Sample stores are chosen to be representative of all stores across these four characteristics. These sample data are scaled to the regional or national level by comparing individual store sales volumes and number of stores to overall sales for a given region.[7] RER and Triad also worked to develop a similar system to develop projections for California and each of the utility service areas.

Analysis and Findings

This section summarizes the POS data analysis and reports subsequent findings. An analysis was performed on the overall residential lighting market with an emphasis on interchangeable lamps. Findings are presented so that comparisons can be made based on different variables, including time, sales channel, wattage, and other variables of interest. This analysis provides insight on the shape of the residential lighting market nationally, in California, and in each IOU service territory. Results are presented below.

Sales by Market Channel

Comparing lamps by market channel reveals a shift in purchasing preferences for U.S. and California consumers. Figure 1 shows that hardware, home improvement centers, and drug stores account for a larger percentage of lamp sales in California than in the overall U.S. Correspondingly, mass market retailers contribute a smaller percentage of lamp sales in California than they do nationally.

Sales by Lamp Classification

Relative counts of each subcategory within incandescents, fluorescents, and halogens are presented below. This section details how sales in each of these lamp classes are distributed by specific lamp type.

Incandescents. Figure 2 presents sales of incandescent lamps by type for the U.S. and California and shows that medium screw-based lamps dominate incandescent lamp sales. The data presented here include both residential and nonresidential lamp sales. In both the U.S. and California, medium screw-based lamps account for approximately three-fourths of all incandescent unit sales, as shown in Figure 2.

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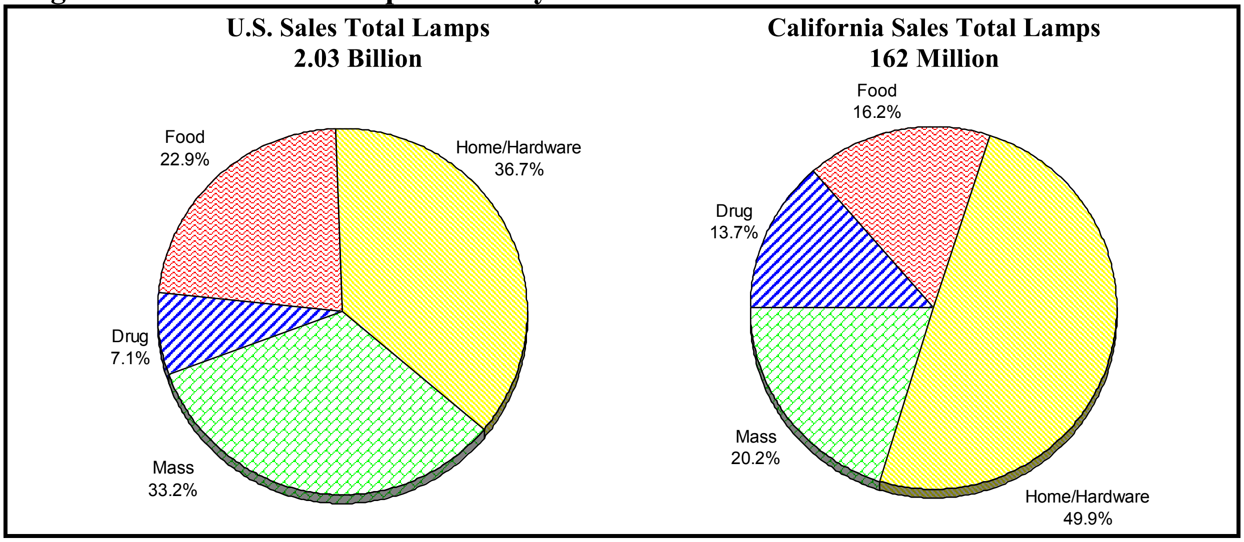
[6] Triad Vista, a division of CCITriad, Livermore, California.

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

Figure 1. Residential Lamp Sales – By Market Channel – California and U.S. – 2001



Fluorescents. Figure 3 presents residential fluorescent lamp sales by type for the U.S. and California. As shown in Figure 3, 4-foot lamps comprise the largest share, while linear lamps under four feet are a distant second. In addition, CFL screw-ins and CFL plug-ins contribute a larger percentage to overall fluorescent lamp sales in California than in the U.S.

Halogens. Figure 4 presents residential halogen lamp sales by type for the U.S. and California. Of the three major lamp classifications for residential settings, halogens contribute the smallest share to overall lamp sales. As shown in Figure 4, reflectors dominate halogen lamp sales. Only subtle differences exist between the distribution in U.S. halogen sales and California halogen sales.

Figure 2. Residential Incandescent Lamp Sales – by Type – California and U.S. – 2001

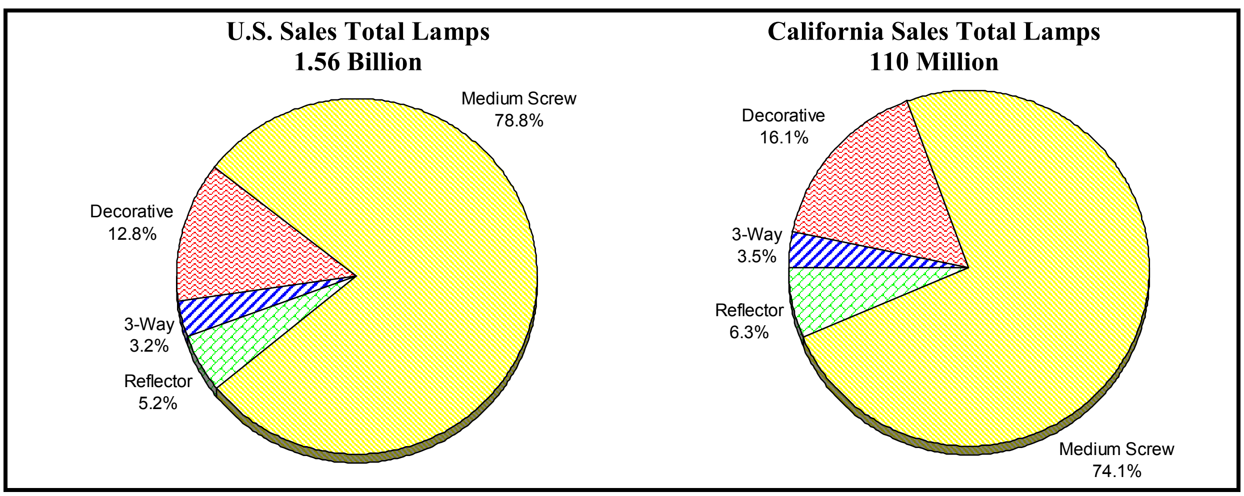


Figure 3. Residential Fluorescent Lamp Sales – by Type – California and U.S. – 2001

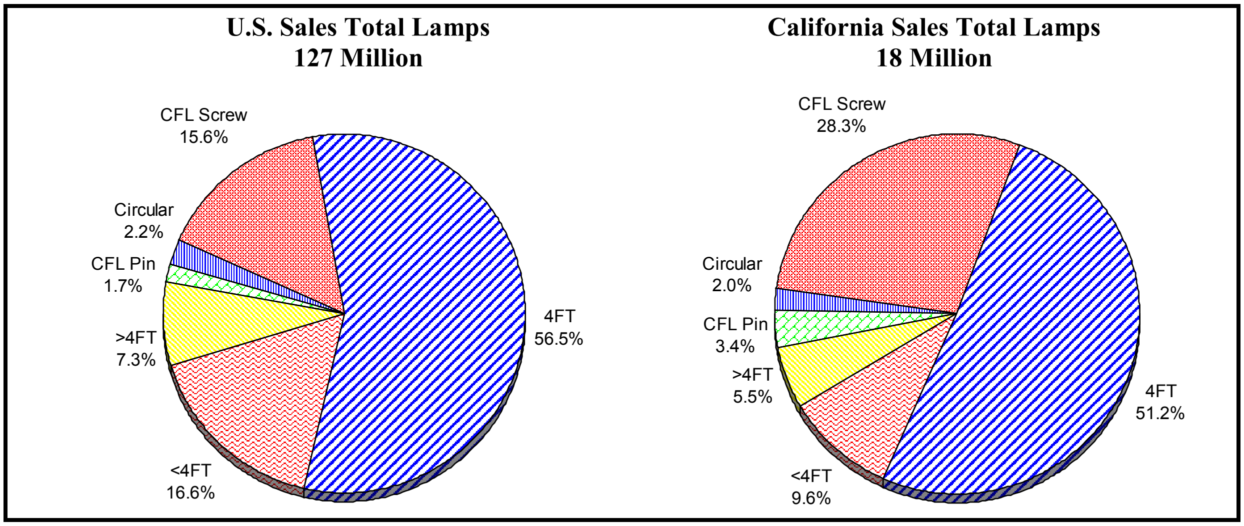
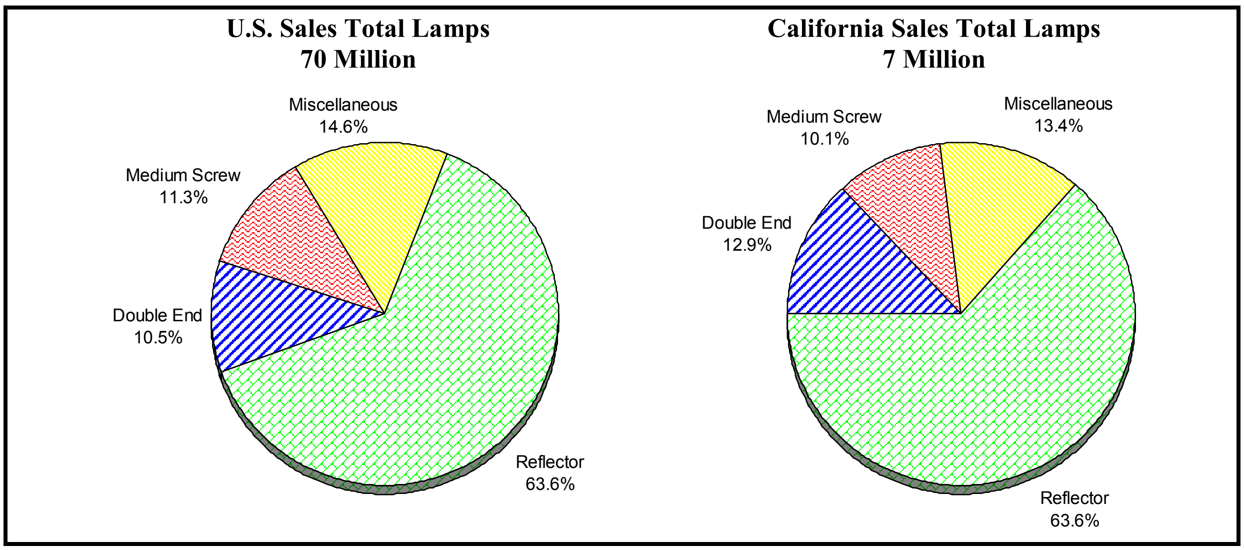


Figure 4. Residential Halogen Lamp Sales – by Type – California and U.S. – 2001



Total Unit Sales of Medium Screw-Based Lamps

Table 1 provides a snapshot of total unit sales of residential medium screw-based lighting for calendar years 1999, 2000, and 2001. This table provides some perspective on the number of light bulbs sold annually across the U.S. and the respective shares of California and the IOU service areas. Sales of medium screw-based bulbs in California accounted for approximately 7.0% of overall U.S. sales during 2001.

Total sales of medium screw-based bulbs decreased in both California and the U.S. between 2000 and 2001. Specifically, sales of medium screw-based incandescent bulbs decreased by approximately 22 million (21%) in California and 73 million (6%) in the U.S. CFLs sales increased by nearly 13 million in the U.S. and 3.7 million in California. This increase in CFL sales accounts for only 17% of the dramatic decrease in medium screw-based incandescent sales assuming a one-to-one replacement. However, CFLs are not a one-to-one replacement for incandescent bulbs. CFLs last approximately six years, which has reduced the need for replacement bulbs. The combination of the difference in life of CFLs and incandescent bulbs along with the number of CFLs bought over the last three years helps explain the decreased sales of incandescent bulbs.

Table 1. Residential Sales, Medium Screw-Based Lamps (in thousands)

Region	CFL			Halogen			Incandescent		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
U.S.	6,117	7,041	19,837	6,531	7,338	7,825	1,293,222	1,303,507	1,230,628
CA	973	1,257	4,974	648	827	740	104,322	104,289	81,959
SCE	239	334	1,428	186	244	216	32,637	32,588	26,614
SDGE	110	159	449	64	74	67	8,651	8,372	6,652
PG&E	391	431	2,144	248	305	277	43,934	43,345	33,046
Other	233	332	953	151	203	180	19,101	19,984	15,647

California Medium Screw-Based Lamp Sales over Time

Figure 5 illustrates sales of medium screw-based incandescent bulbs for both California and the rest of the U.S. As shown, incandescent lamp sales peak during periods of less daylight (autumn and winter) and dip during periods of more daylight (spring and summer). When comparing sales of medium screw-based incandescent bulbs between corresponding quarters of 2000 and 2001, sales were 21% lower in California and 4.5% lower in the rest of the U.S. There are several possible reasons for this decrease, including the following.

- There has been a tremendous increase in sales of CFLs. The combined increase in sales of these bulbs and their longer life[8] is one reason that the replacement market for medium screw-based incandescent bulbs has become smaller.
- CFLs tend to be purchased in packs of one or two, and consumers tend not to purchase spare replacement bulbs. On the other hand, incandescents tend to be purchased in packs of four, six, or eight. As such, the ramp up in CFL sales could cause a disproportionate decrease in incandescent sales. Interviews with industry experts suggest that a ratio of four to one would be reasonable.
- Due to the energy crisis in California, there has been a massive media campaign to inform Californians of ways to conserve energy. One of the least intrusive ways to save energy is to turn off lights when leaving a room. Other lighting energy saving measures include installing motion sensors and timers. These types of energy saving practices might have some effect on the number of bulbs needing to be purchased.

Figure 6 and Figure 7 illustrate California sales of medium screw-based CFLs and halogens, respectively. Similar to incandescent sales, halogen sales in California peak during periods of less daylight (autumn and winter) and dip during periods of more daylight (spring and summer). Over time, halogen sales have remained relatively constant. Incandescent

[8] See the section Impact of Lamp Life on Medium Screw-Based Lamp Shares.

lamp sales remained relatively constant until the second quarter of 2001 when bulb sales decreased by 22% compared to the second quarter of 2000. This drop off in incandescent sales coincides with a dramatic increase in CFL sales.

Figure 5. Incandescent Medium Screw-Based Lamp Sales by Quarter – California

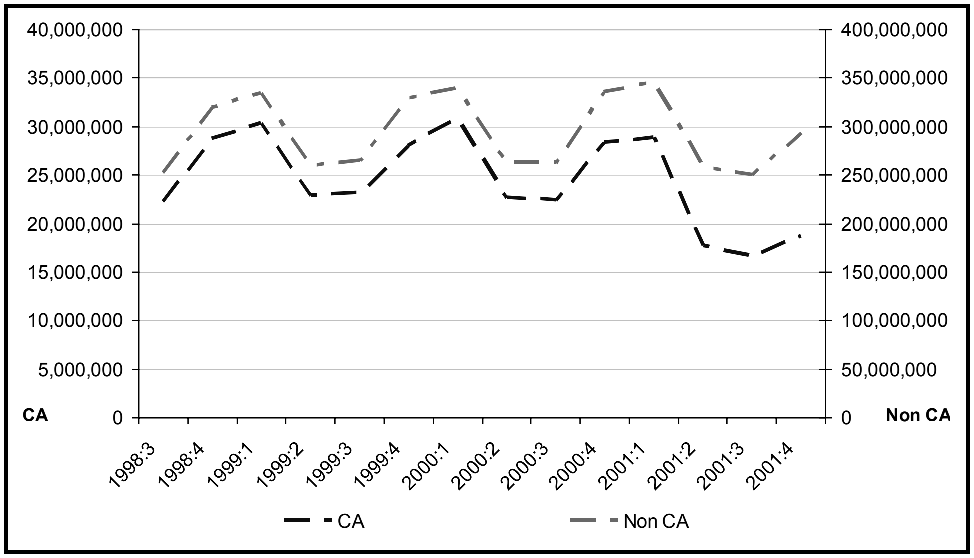
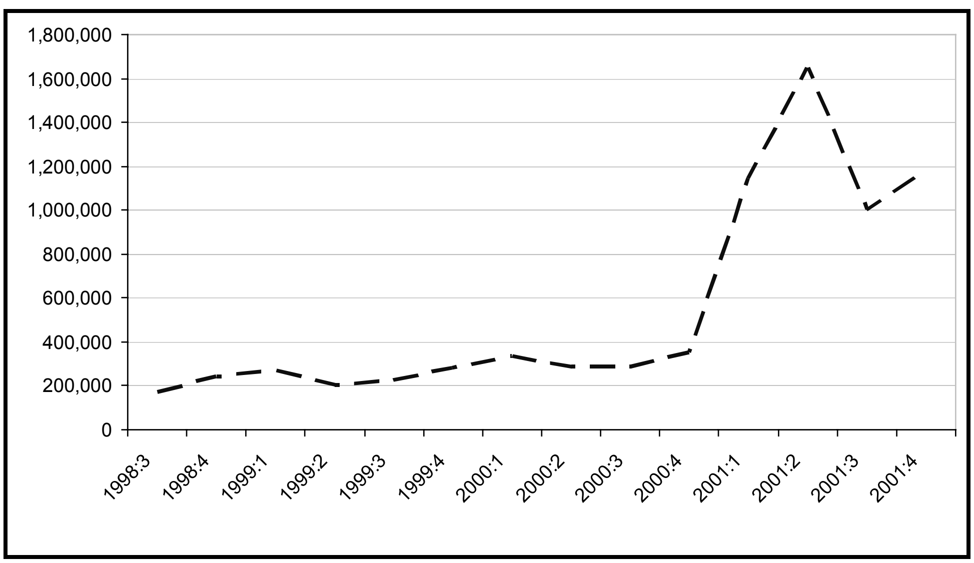


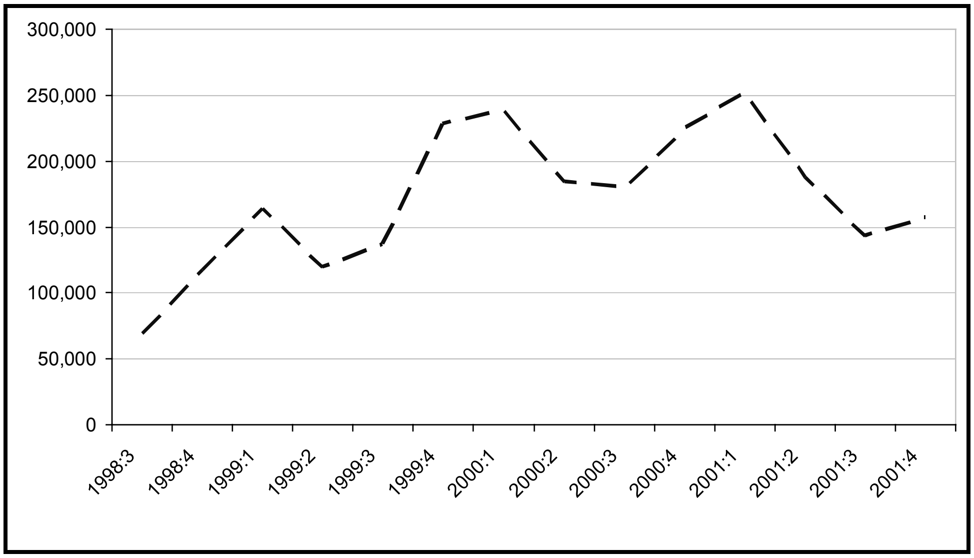
Figure 6. CFL Medium Screw-Based Lamp Sales by Quarter – California



Sales by Lamp Type as a Percentage of Total Sales for Medium Screw-Based Lamps

Analysis in this section focuses only on medium screw-based lamps, sold for use in residential buildings, because of their interchangeability. This section presents the shares of each medium screw-based lamp type as a percentage of all medium screw-based lamps.

Figure 7. Halogen Medium Screw-Based Lamp Sales by Quarter – California



CFLs. 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 defined to be the share of CFLs among lamps of similar type and application. Given this definition, the most logical comparisons are between the medium screw incandescents, medium screw halogens, and medium screw CFLs. It should be noted that although pin-based CFLs could be a replacement for incandescents, these CFLs require a special socket ballast or dedicated fixture to operate. For the comparisons presented in the following analysis, only screw-based CFLs (including modular CFLs) were included because these can directly replace a medium screw based incandescent or halogen lamp without changing or modifying the fixture. In addition, efforts in California to promote CFLs are focused on ENERGY STAR® compliant lamps, which are screw-based.

Figure 8 illustrates the share of medium screw-based CFLs as a percentage of total medium screw-based lamps sold by quarter for California and the rest of the U.S.[9] Figure 9 presents the same information for each of the California IOU service territories and for the remaining non-IOU areas in California. As shown, the market share of CFLs in California more than tripled from the fourth quarter of 2000 to the first quarter of 2001(1.2% to 3.8%). This trend continued in the second quarter of 2001 when the market share of CFLs rose to approximately 8.4%. These increases coincide with California's "energy crisis." During the energy crisis, the state saw rolling blackouts in January and March of 2001. In addition, most Californians saw their electricity bills increase dramatically beginning in April 2001 after the state's two largest utilities (PG&E and SCE) were allowed in increase their rates on March 27, 2001. Similarly, the increase in market shares of CFLs in SDG&E's service territory in the third quarter of 2000 coincides with the rate increases those residents saw during the summer of 2000 (see Figure 9). SDG&E was allowed to un-freeze their rates in June 1999, but their customers did not see their bills triple until the summer of the following year.

[9] "The rest of the U.S." includes all areas of the United States except California.

Figure 8. CFL Share of Medium Screw-Based Lamps – California and the U.S. (non-California)

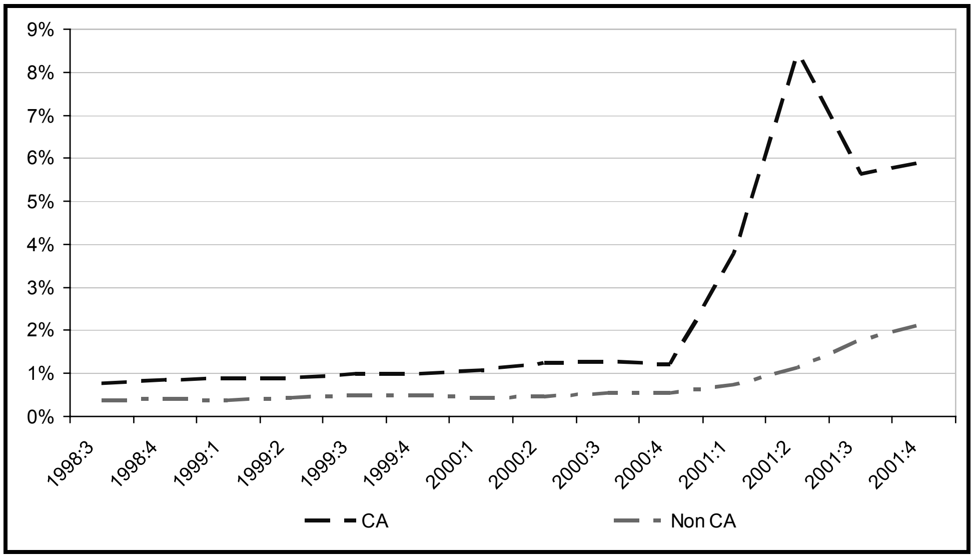
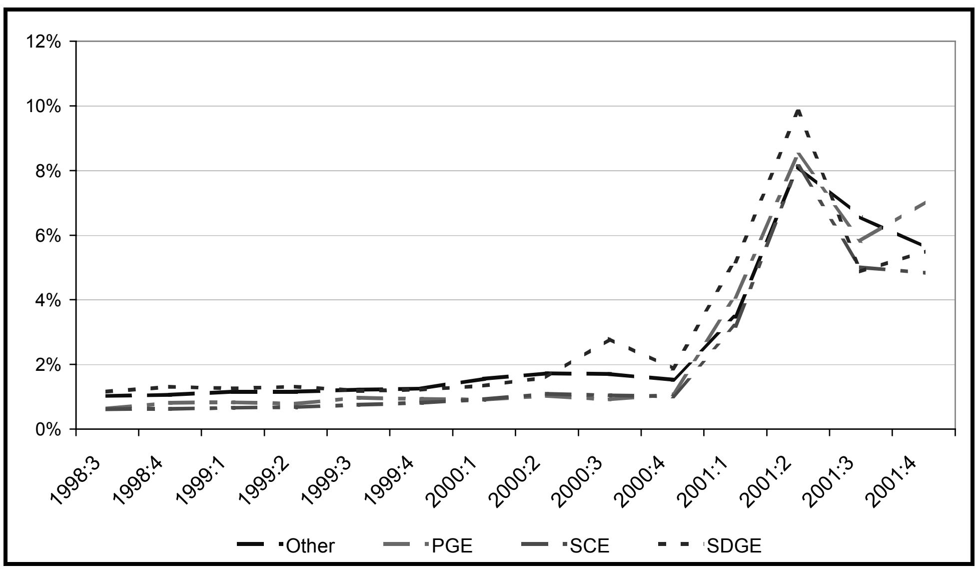


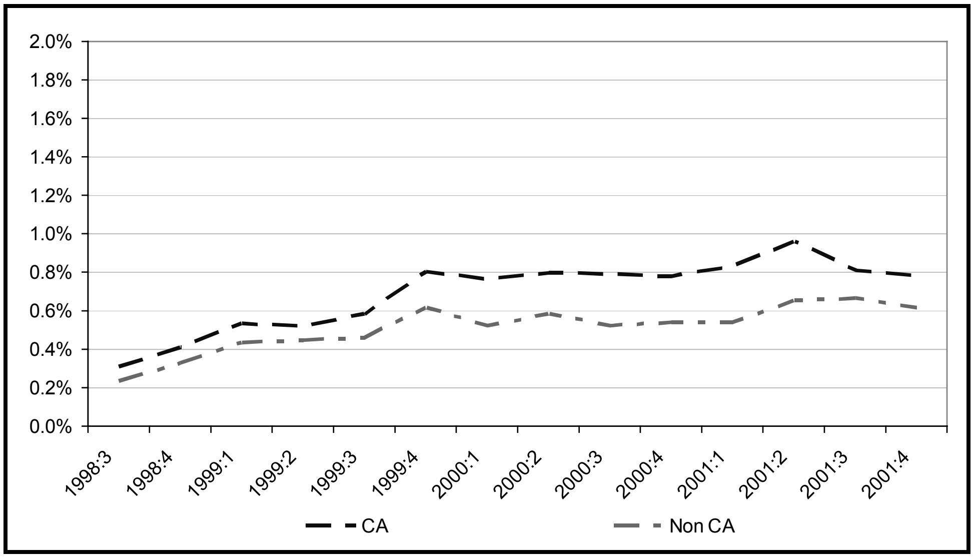
Figure 9. CFL Share of Medium Screw-Based Lamps – California IOUs and Other[10]



10 "Other" includes territories in California not served by the three electric IOUs.

Halogens. Figure 10 illustrates the share of medium screw-based halogens as a percentage of screw-based lamps sold by quarter for California and the rest of the U.S. With the development of new technologies and active promotion by manufacturers, the shares of halogen screw-based lamps have been increasing since 1998. Halogen shares in California have increased from 0.3% to nearly 1.0%. In the rest of the U.S., shares have increased from 0.2% to 0.7%.

Figure 10. Halogen Share of Medium Screw-Based Lamps – California and U.S. (non-California)



Sales of Medium Screw-Based Lamps by Market Channel

This section breaks down medium screw-based lamps by type and by market channel. This analysis provides insight on where consumers typically purchase light bulbs.

CFLs. Figure 11 illustrates sales of medium screw-based CFLs by market channel. In the U.S. and California, sales are dominated by hardware/home improvement stores. However, in California, hardware/home improvement stores comprise a larger percentage of CFL sales than in the rest of the U.S. Mass merchandisers play a more significant role in overall U.S. lamp sales than in California.

Incandescents. Figure 12 shows incandescent lamp sales by market channel in the U.S and California. As shown, incandescent lamp sales are more evenly distributed between sales channels than are CFLs. However, the California trend of more lamp purchases hardware/home improvement stores continues.

Halogens. Figure 13 presents sales of medium screw-based halogens by market channel in the U.S. and California. Sales of medium screw-based halogens are sold primarily through hardware stores and home improvement centers.

Figure 11. Medium Screw-Based CFL Sales by Retail Channel – California and U.S. (non-California) – 2001

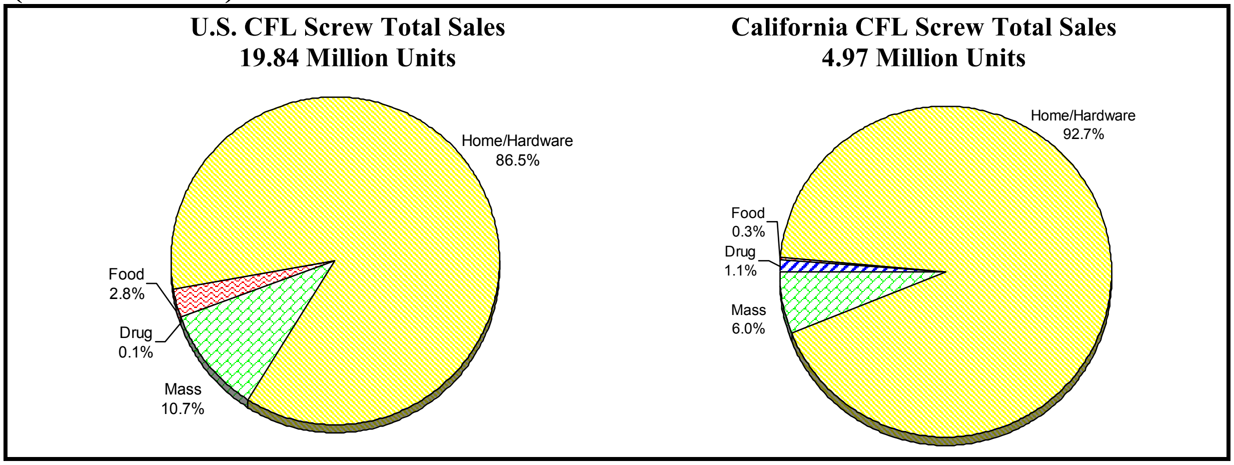
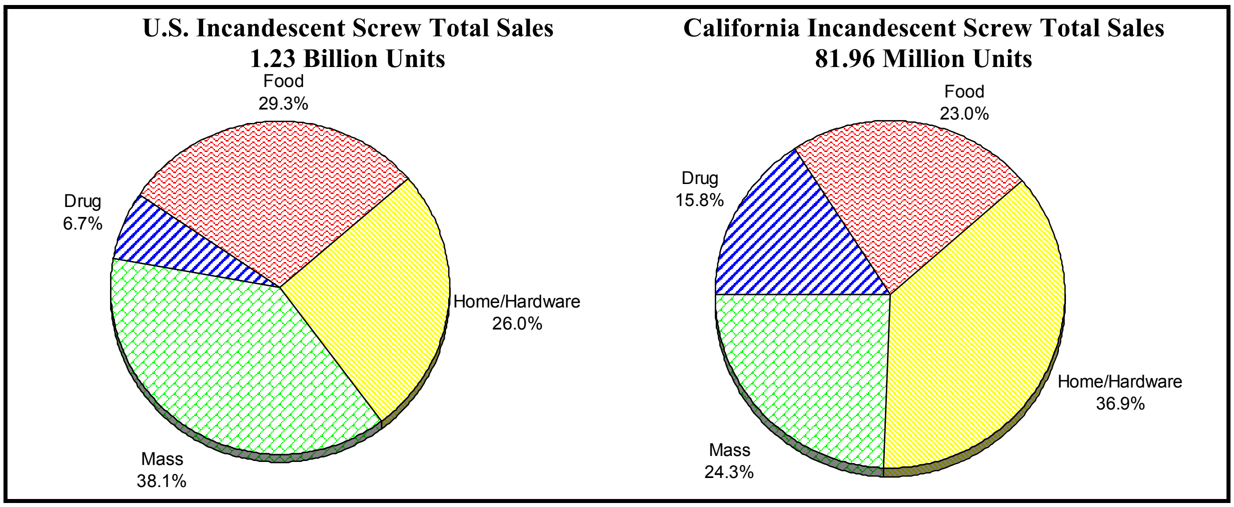


Figure 12. Medium Screw-Based Incandescent Sales by Retail Channel – California and U.S. (non-California) – 2001



Sales of Medium Screw-Based CFLs versus Pin-Based CFLs

Figure 14 and Figure 15 present sales of screw-based CFLs versus sales of pin-based CFLs by quarter for California and the U.S., respectively. These graphs show that while medium screw-based CFL sales have increased significantly over the last year, pin-based CFL sales have remained relatively constant.

Figure 13. Medium Screw-Based Halogen Sales by Retail Channel – California and U.S. (non-California) – 2001

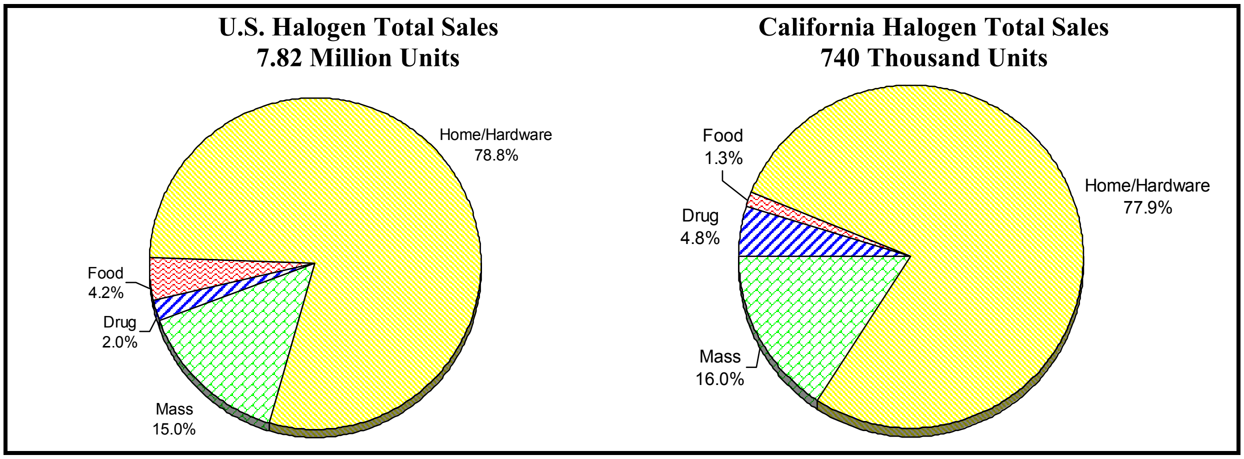
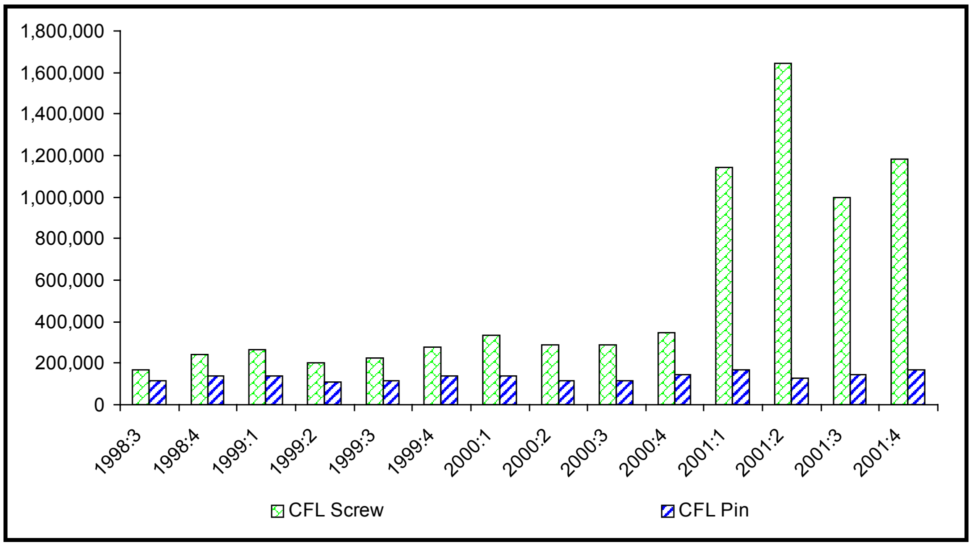


Figure 14. Medium Screw-Based CFL Sales and Pin-Based CFL Sales – California



Sales of Medium 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 this measure is closely approximated by lamp wattage. Using information from lamp manufacturers and the Lighting Research Center (Lighting Research Center 1999), lamps were sorted by equivalent lumen output, as shown in Table 2.

Figure 16 presents sales of medium screw-based CFLs by wattage for California and the rest of the U.S. CFLs that provide the equivalent light levels of the 60-watt incandescents are the most commonly sold lamps.

Figure 15. Medium Screw-Based CFL Sales and Pin-Based CFL Sales – U.S.

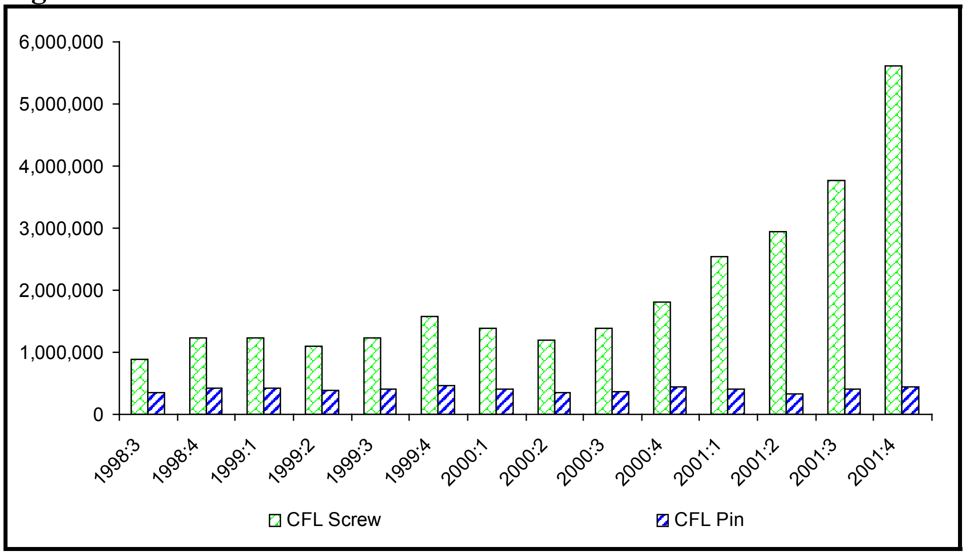


Table 2. Equivalent Wattages[11]

CFL Wattage Range	Incandescent/Halogen 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

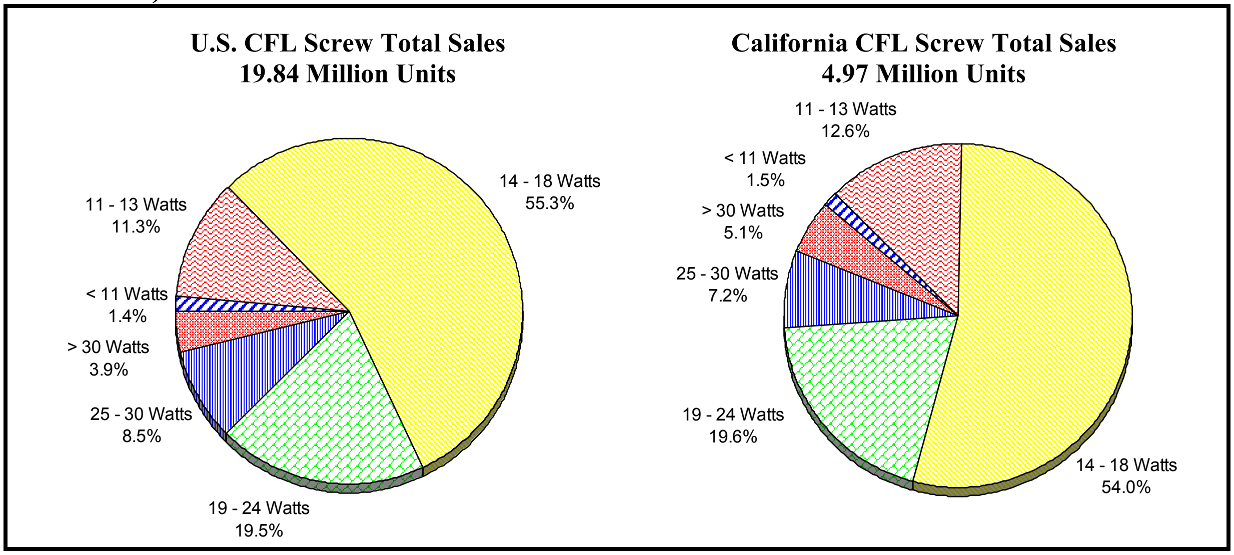
Impact of Lamp Life on Medium Screw-Based Lamp Shares

The percentage of medium screw-based CFL and halogen sales as a percentage of total medium screw-based bulbs sold does not entirely capture their impact in the market. The sale of one CFL is not equivalent to the sale of one incandescent, because, on average, a CFL will last 11 times longer than an incandescent bulb.[12] Therefore, the sale of one CFL is equal to selling 11 incandescent bulbs. Likewise, the sale of one medium screw-based halogen bulb is the equivalent of selling three incandescent bulbs. The technologies of CFLs and halogens require fewer replacements and fewer subsequent purchases by the consumer.

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

[12] Lamp life estimates are based on average data from lamp manufacturer catalogs.

Figure 16. Medium Screw-Based CFL Sales by Wattage – California and U.S. (non-California) – 2001



To capture a better estimate of the impact of CFL and halogen sales, first the relative life of each lamp type was calculated by using the average lamp life, in hours, for each lamp type. Then, by using the share of sales for each bulb type in 2000, a lamp life normalized market share was calculated. Table 3 shows the results of this analysis. As shown, by weighting the lamp counts by relative lamp life, the impact of CFLs and halogens in the marketplace are higher than when simply looking at their shares of sales. In 2000, the CFL share of sales was approximately 1.2% in California. However, when considering that the life of each CFL is much longer than that of an incandescent bulb, the estimated market share is nearly 12%. Similarly, the lamp life normalized market share for halogen bulbs is higher than its share of sales—2.1% compared to 0.8%, in California.

Table 3. Medium Screw-Based Lamp Shares Based on Normalized Lamp Life – 2001

Lamp Type	Average Lamp Life (hours)	Relative Life of Lamp*	Raw Sales		Lamp Life Normalized	
			U.S. Share	California Share	U.S. Share	California Share
Incandescent	875	1.00	98.1%	93.5%	85.7%	58.1%
Compact Fluorescent	10,000	11.43	1.3%	5.7%	12.7%	40.3%
Halogen	2,750	3.14	0.6%	0.8%	1.7%	1.6%

* Relative Life of Lamp is Average Lamp Life divided by Average Incandescent Lamp Life

Summary of Key Findings

A number of key findings were identified from the analysis of the lamp tracking data. Some general observations include the following:

- The data from the five market channels reveal that U.S. sales decreased from 2.14 to 2.03 billion bulbs, while California sales decreased from 197 to 162 million bulbs. A possible reason for this is that the increased shares of CFLs, which last approximately six years, have reduced the need for replacement bulbs.

- Incandescent lamps dominate the unit sales of lamps with over three-fourths of the U.S. market. Other lamp types with significant market shares of unit sales include specialty (13%), fluorescent (6%), and halogen (3%) lamps.
- CFL market shares in California increased to nearly 9% in the second quarter of 2001 and then dropped to 6% during the last two quarters.
- In the second quarter of 2001, CFLs have more than eight times the market share of medium screw-based lamps in California than they do nationwide.
- Growth in unit sales of CFLs has not been uniform across all types of CFLs, but has been strongly concentrated in 14-18 watt bulbs (60-watt equivalent incandescent).
- Home improvement stores play a dominant role in efficient lighting sales in California. This is not surprising given the heavy focus on these stores by the state's lighting programs. However, grocery stores still sell a substantial percentage of incandescent bulbs and might be a useful channel in which to explore more CFL sales opportunities.
- CFL market shares in California increased nearly five-fold between 2000 and 2001. Between the fourth quarter of 2000 and the second quarter of 2001, CFL market shares jumped from 1.2% to 3.8% and then to 8.4%. This coincides with California's "energy crisis," which included rolling blackouts in early 2001. Most California residents saw significant increases in electricity bills in April 2001, while SDG&E customers saw their bills triple during the summer of 2000. Towards the end of the blackouts, California launched a marketing campaign to reduce peak load that included CFLs and turning off appliances not in use.

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