

# **CFLs Here, There, Everywhere! What's Next for California Programs?**

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## **ABSTRACT**

California's investor-owned utilities (IOUs) will continue to promote CFLs via an upstream buy-down program. The goal is to ensure a smooth transition to a post-incandescent bulb world and also, improve the quality and performance of CFLs so that they can completely replace incandescent lighting in the home.

Over the past five years California IOU led CFL programs have significantly broken through the barriers to customer adoption of CFLs. Over 90 percent of Californians are aware of CFLs and at least ¾ of homes had at least one (and 17% had more than 15). Availability and accessibility of CFLs has increased as well, with a wide array of models and makes of thirteen manufacturers being offered by 640 retailers at over 2400 locations—from the mom & pop and discount stores to the big box retailers. CFLs have also become much more affordable, with un-discounted prices of about \$3 to \$10 per CFL being common. Given this, why would utility energy efficiency programs still want to promote CFL uptake by customers?

Many opportunities still remain for replacing inefficient incandescent lighting with CFLs. About ¼ of homes have yet to try their first CFL. About ½ to 2/3 of household sockets continue to use incandescent bulbs. The latest California energy efficiency potential study still found CFLs to have large untapped savings opportunities. Also, specialty CFLs are hard to find, of evolving quality and high prices. As the market has grown, CFL quality is very varied; making the introduction of high-quality, "super CFLs" important.

This paper will describe the changes being considered to California's CFL programs to capture as fast as possible remaining opportunities for CFLs. Future program offerings will continue to focus on upstream buy-downs and do selective targeting based on market and social/behavioral research. Product lines promoted by the programs will shift to "super" CFLs, to enhance participation by new customers or in sockets that still have incandescent lamps. Sales tracking is being looked at to help improve negotiations with market partners to ensure continued "lift" from these programs. For some CFL product lines the programs will start the process to wean these markets from further program support, given the maturity of these markets.

The paper will be of interest to both areas that have long standing CFL efforts as well as newcomers. It will enable the former to finesse their own efforts while providing the later ideas for leapfrogging and accelerating further the evolution of their CFL markets towards maturity.

## **Introduction**

One of the biggest success stories with the use of public funds to promote energy efficiency uptake by residential and small commercial electricity customers has been the recent upswing in purchases of compact fluorescent lamps (CFLs). California led the way for this accelerated market evolution that has become so evident since 2005. In California, CFLs are well known among customers, and are available in a variety of lighting outputs and configurations, as well as easily accessible at most

stores, at an affordable price. How this success story was achieved and what lessons it provides for the ongoing pursuit of efficient lighting uptake is the subject of this paper. We begin with a description of the various approaches undertaken in California to convince customers to use CFLs. Particular emphasis is put on describing the 2006-08 effort that centered on an upstream intervention; giving manufacturers and wholesalers' discounts that enabled them to get widespread distribution of CFLs across California stores at an easily affordable price. We end with a description of where the focus of the California lighting effort will be in the 2009-2011 period.

## **Background**

California utilities have been promoting CFLs since the 1980s. The approaches taken by the California IOUs to promote CFLs have varied over time; seeking to address the key market barriers perceived as most important at the time. Five major epochs of IOU intervention in the CFL markets in California come to mind:

1. CFLs? What are these?
2. Interesting, but they're way too expensive!
3. Interesting product, but performance and size are an issue.
4. Ok, the technology works, but I can't find them or prices are high and awareness still an issue
5. What about the stragglers? How do we get full changeout of incandescent bulbs?

### **CFLs? What are these?**

During this first phase (~ 1980 to 1994), the biggest issue was to simply make customers aware that there was this new technology that could save about 2/3 of the electricity used to light their homes. Most of the focus of this period was on making customers aware that CFLs existed. A variety of outreach methods was attempted to enhance customer knowledge about the potential benefits afforded by CFLs. At the same time, the main concern of the utilities promoting these was whether they would adversely affect the power grid, through technical issues such as power factor, recovery of lost sales in rates, etc.

IOU program managers increasingly realized that the issues limiting CFL purchases were not just about awareness. Alas, the technology still had significant kinks such as flickering and weight (due to the use of magnetic ballasts), shape and size (bulbs were long tubes), quality of light (distinctly different from incandescent), as well as much higher cost and very limited accessibility in stores. This led to the next change in IOU programs.

### **Interesting, but they're way too expensive!**

IOU programs decided to try to entice customers to purchase CFLs by reducing their first cost differential with incandescent bulbs. Programs offered rebates and/or coupons to reduce the incremental cost of CFLs over incandescents. These were offered directly to customers. Yet it was not just about higher first cost.

### **Interesting product, but it simply does not perform like my incandescent bulbs nor does it fit everywhere!**

Programs then evolved to push for higher quality CFLs. Specifications for program participation sought to address technical issues such as power factor and harmonics, while also addressing customer

satisfaction issues of slow turn-on, dim initial light, flickering, useful life etc. Among the most well-known is Energy Star, which is periodically adjusted to require better quality product. Another important and more recent one is the Efficient Lighting Initiative (ELI), which began as a Global Environment Fund 15 M\$ project to promote efficient lighting in seven countries between 1998-2001. ELI now runs quality assurance laboratory tests in China and promotes high quality CFLs.

The results of these various pushes for better, more customer acceptable CFLs were significant. Early in this period a major shift from magnetically ballasted bulbs to electronically ballasted CFLs took place, improving significantly previous issues with flickering, slow turn-on, and weight. Over time we also saw other issues improve, such as color rendering with the introduction of tri-phosphor lamp coverings. The final major change was the design change from linear to squiggly tubes; making the CFLs look more like incandescent bulbs and allowing them to fit in more size-constrained sockets.

**Ok, the technology works...But they are hard to find, prices are high, and awareness is still low and/or significant misconceptions about product equivalency with incandescent light remain.**

After utility and other energy efficiency proponents were convinced that CFLs were a great technology for saving energy in the home, customers still needed to be convinced to purchase them. They were still hard to find in most stores, and even when you found them, they were significantly more expensive and only a few models were available and hard to find on the store shelves.

Utilities continued to promote CFLs with education campaigns and rebates. Initially rebates were given to customers. Rebates then moved upstream to manufacturers, wholesalers and distributors to take advantage of the mark-ups in the marketing chain and the much cheaper and easier to disburse rebating possible with upstream rebates.

In California, the energy crisis of 2000-2001 helped increase public awareness of CFLs significantly. The enhanced quality of the product also helped dispel many customers previous bad experiences or reticence to use fluorescent lighting.

**What about the stragglers? How do we get the stragglers and/or the last remaining fixtures to shift to CFLs?**

During the last five years we have seen an enormous growth in worldwide sales of CFLs. Estimates of current sales are of the order of a billion CFLs per year or more. Most of these are made in China and sold there. Large amounts also make it to European countries and Japan. The U.S.A. may have sold up to about 300 million in 2008. Major retailers such as Wal-Mart, Home Depot and Costco sell millions of these in the U.S.A. alone and use them to entice customers to come to their stores. The CFL has become the poster-child for anybody who wants to be environmentally conscious and “green”.

Yet as of early 2006, we still have significant amounts of the population, (about 1/3 of households in California), that have yet to try out their first CFL. Quality, cost, awareness, availability and increasing concerns about how to recycle CFLs and what to do about the mercury should one break are among the main reasons they are not being used in all possible sockets. Customers also still report a variety of issues that seem to be more a reflection of the CFL product characteristics of 15 years ago, than current technology. These issues are being addressed via mass media advertising by the utilities in addition to that by a variety of market actors who use CFLs as a symbol of how “green” they are.

**Key to the Success in 2006-08: Focus on Customer Needs!**

In 2006-08 the utility CFL program built upon the early experience with upstream interventions of 2004-05, to address the issues confronting customers. By focusing on customer needs, the program

was able to succeed, resulting in CFL purchases that were several times larger than before. By this time most of the technical issues around CFLs had been resolved. The IOU and Energy Star requirements ensured a minimum life, quality of light, time-for-full warm up, savings that approached  $\frac{3}{4}$  of the incandescent energy use, weight (thanks to electronic ballasts) and size—with the advent of “squiggly” instead of tube formulations. Customers were mostly aware of the CFLs. Higher initial price, availability (variety of product) and accessibility (found at the store where normally purchased lightbulbs) were still important issues. By working directly with manufacturers and wholesale distributors, the many IOUs promoting CFLs were able to resolve these remaining barriers and entice many new manufacturers, distributors and vendors to produce and sell a much larger variety of CFLs across the service territory. In essence, CFLs became widely available to customers at the stores where they typically purchase lightbulbs, in a wide variety of options, at affordable prices. How this was achieved is described next.

To improve availability, accessibility and affordability of CFLs to customers, the IOUs provided the upstream trade allies with a ~ 2\$/CFL buy-down incentive. The IOUs required the upstream trade allies to distribute large amounts of product to areas that had not seen significant sales in the past. Concretely, in the manufacturer buy-down program, manufacturers receive the incentives and are required to build agreements with retailers to stock discounted CFLs on their store shelves. In the retailer point-of sale program, retailers receive the incentives and provide an instant discount to customers. There is no overlap between the manufacturer discount and the retail point of sale incentives. To date, the CFL program has over thirteen manufacturers, partnering with more than 640 retailers at over 2,400 locations. The CFL program managers distributed zip codes in the PG&E territories where CFL distribution agreements had not yet been made. This encouraged the availability of CFLs in outlying PG&E territories, generally where large chain store accounts do not exist.

To enhance customer awareness and interest in CFLs, IOUs did mass media campaigns to alert customers to the significantly enhanced quality of the CFLs and their benefits. The media campaign reminded customers that CFLs save money, save energy, and are good for the environment. More importantly, the campaign touted that “There’s a Better Bulb,” and shows customers that the light quality was good enough for any room in the house. The campaign showed that CFLs have improved in color quality, take less time to warm up and are smaller than CFLs of the past.

In 2007, PG&E partnered with Energy Star for the “Change a Light, Change the World Campaign”. PG&E took advantage of the Change a Light campaign to introduce customers to the new improved CFLs. In addition to hosting the Energy Star Change A Light bus tour, the PG&E team managed to hand out one million CFLs throughout the PG&E territory. PG&E and its partners held over 600 events involving over 1,000 volunteers. Many of these events were in areas where CFLs were not as widely distributed as in the San Francisco Bay Area region. The campaign was a resounding success and PG&E received award from Energy Star for “Excellence in Energy Star Promotion in 2008.”

Each recipient of the CFLs was required to fill out a pledge to “Change a Light.” This enabled evaluators to research the customers who participated in this program and get feedback on their experiences with the CFLs; something that was harder to do with customers purchasing CFLs via the upstream buy-down program. Key findings of this research were: 1. One quarter of the CFLs were given to customers that had never purchased a CFL before; and 2. A strong majority of the CFL recipients were satisfied with the quality of the bulb and installed it in their home.

An important lesson of this campaign is that there are probably about one quarter of customers that are still reluctant to purchase a CFL. This means that there is still a significant untapped energy savings opportunity to influence customers to adopt CFLs. The campaign also demonstrated that once customers install a CFL, they are generally satisfied with the quality of the bulb and likely to not only continue to use it but consider getting more.

Table 1 below shows how the evolution towards upstream incentives was able to capture the enhanced capabilities of wholesalers and retailers that had been developed over the many years of utility programs supporting CFL sales to customers. This capability came very handy and enabled the program to take advantage of the public’s interest in environmentally sound products. The CFL in essence became the poster child for efficiency and for “green” living!

In the table we see a very large increase in sales as a result of the California energy crisis of 2000-2001. Interest waned in 2002 as the crisis was averted. Sales started to pick up again in 2003, and really took off in 2006 onwards reaching over 30 million in 2008.

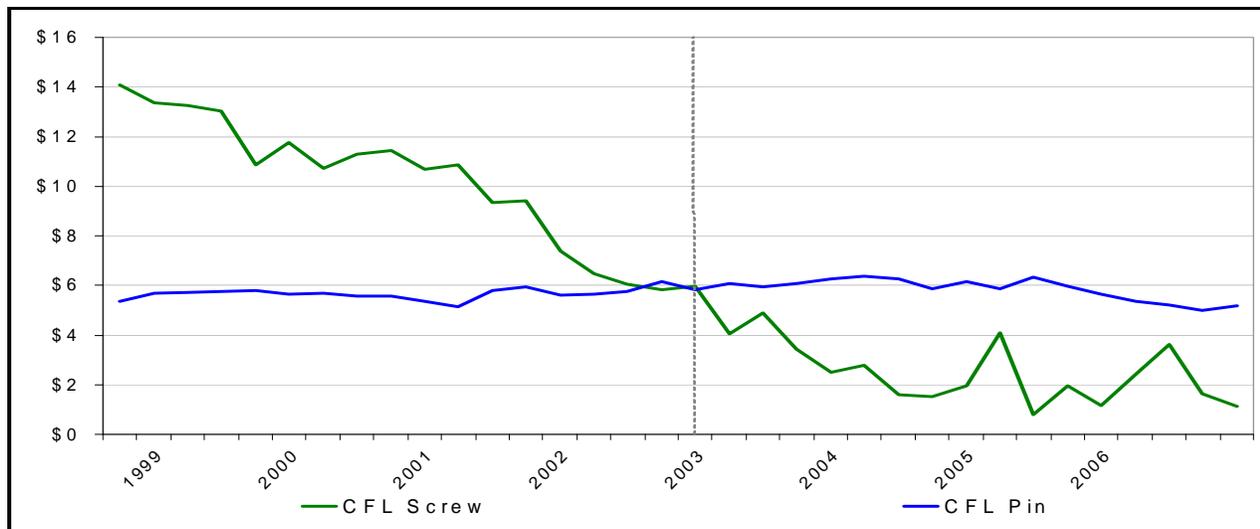
**Table 1. CFLs Incented by PG&E in Program Years 2000-2007**

PROGRAM YEAR	UNITS (Screw-In '000 bulbs)
2000	142
2001	7,649
2002	1,683
2003	5,342
2004	3,508
2005	4,125
2006	7,736
2007	19,431
2008 (as of 10/31)	30,496
<b>TOTAL</b>	<b>80,111</b>

Source: PG&E tracking data.

A similarly impressive change can be seen in the evolution of the price of CFLs over this time period. Figure 1 below shows how the price of screw-in CFLs (the main product rebated in the IOU programs) has come down, especially since 2004. These prices reflect the IOU programs buy-down incentive. Non incented CFLs typically cost at least \$3 per bulb.

**Figure 1: California CFL Prices**



\* After 2003, the data no longer include home improvement stores.

Source: Itron 2008

This enormous increase in CFLs participating in the buy-down program and decrease in prices being faced by consumers would seem to indicate that the residential CFL market has been “transformed” and that further IOU support is unwarranted. In the opinion of the program managers, this is a misperception and stopping support for CFLs could be followed by a sharp decline in sales. For example, sales data from some vendors show precipitous sales drops when the buy-down incentives are unavailable. Customer surveys show a significant portion of customers who have yet to purchase their first CFL and/or who continue to have serious misgivings about using them. Residential lighting inventories work shows a significant portion of sockets still using incandescent bulbs. Finally, to ensure a smooth transition to a post-incandescent residential lighting world (in essence to capture the full intent of the Huffman Bill), the program managers believe continued support is needed to allow manufacturers and vendors to take the final step to make CFLs usable in all residential sockets. This is the “super” CFL effort that is described next.

## **The Future: Building on the Past – Super CFLs in 2009-2011**

According to the recent energy efficiency potential study done for California, in the period 2004-2016, IOU programs could achieve the introduction of about 100 million CFLs in homes. During 2006-08, the three California IOUs were enormously successful in supporting CFL sales, incentivizing close to this amount. This success corroborated the appropriateness of providing upstream buy-downs and leveraging the “greening” of America. Unpublished, preliminary research being conducted as part of the impact evaluation of 2006-07 residential retrofit programs shows a variety of sockets that have yet to be switched from incandescent to CFLs. Many of these are specialty bulbs (candelabra, dimmers or other controls). This means that there are still significant opportunities for CFLs in California homes; especially in sockets with dimmers, three-way, and/or occupancy controls. Customer surveys also show a significant segment that still has strong misconceptions and/or concerns about the quality and comparability of CFLs to incandescent bulbs. During 2009-2011, the IOUs are seeking to address these opportunities via support for the manufacture and retailing of the “Super CFL”.

Under the “Super CFL” program, the IOUs propose to provide incentives to upstream trade allies that focus on CFLs that can work in a variety of specialty situations (controls and/or candelabra) and continue to improve on other issues such as color rendering, time for full “on”, reducing mercury levels to less than 3 mg per CFL, etc. Incentives for non “Super” CFLs will be reduced and eventually stopped, unless a significant downfall in sales occurs. Mass media advertising will continue, but focused on the “Super CFLs”. As with the previous CFLs, the intent of the program is to make these “Super CFLs” as ubiquitous to customers as their current incandescent lightbulbs to help CFLs enter all appropriate lighting sockets in the home.

To ensure that trade allies continue to provide “lift” in the marketplace, the IOUs will conduct ongoing review of sales data for CFLs. Programs will be modified as needed after review of this market data and consultations with trade allies and the CPUC.

The ultimate goal of the “Super CFL” 2009-2011 program is to have a product that can completely replace incandescent lights and is widely accepted by customers. After 2012, California’s Huffman Bill will require lighting in California to be more efficient; basically making it impossible to continue to sell current incandescent bulbs. Nevertheless, higher efficiency incandescent bulbs will be able to comply with the Huffman bill. By then, the IOU programs hope to make customers prefer CFLs to incandescent bulbs (even higher efficiency models). The utilities are also supporting the rapid maturation of LED lighting so that it becomes more efficient than CFL technology and can lead to further energy savings in lighting. The experiences gained with CFLs will definitely help accelerate LEDs technological improvements and market acceptance and maturation. Also, with the change in

customers' cognitive maps that lighting can be more efficient, it should be easier to get them to adopt the LEDs and other efficient equipment.

## Conclusions

California has used public money to successfully support the evolution of the CFL marketplace. At this juncture, what is still needed is to get the ~ 1/3 of households who have yet to try this technology to adopt it. Furthermore, at most about 1/2 of the lighting sockets in homes have CFLs. A large amount of these are specialty bulb fixtures (candelabra, dimmable, three-way, occupancy sensor, etc). These will be the targets of the publicly funded programs in the near future.

Thanks to the many years of public support, California is now able to leverage the significant efforts of major retailers, wholesalers, manufacturers, and a variety of public and private actors who see the CFL as a way to highlight how "green" they are. This will enable the utility programs to move from being the "machinery" to just being the "oil" of the CFL marketplace. More and more the main efforts will be carried out by market actors who traditionally sell lighting products. This will be among the biggest market transformation successes of the energy efficiency efforts of the past 30 years.

The evolution of the marketplace towards maturity observed with CFLs provides a model to follow for a variety of other mass market energy efficiency products and services.

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