

CFL Program Strategy Review: No Programmatic “Silver Bullet”

Dulane Moran and Jane S. Peters, Research Into Action, Inc.

Shahana Samiullah, Southern California Edison

Corina Jump, Itron, Inc.

James J. Hirsch, James J. Hirsch and Associates

ABSTRACT

The importance of residential lighting, generally—and CFLs specifically—in the portfolios of many program administrators warrants ongoing assessment of lessons learned in lighting program design and implementation to ensure the programs are adapting to a rapidly transforming marketplace. This paper presents findings from a review of evaluations of programs containing a CFL component, as well as in-depth interviews with program and policy experts in California and throughout the country. It describes the current thinking of 14 lighting program experts on design considerations for residential lighting programs, the benefits and risks associated with heavy reliance on upstream manufacturer buy-down approaches, and the need for market effects studies, given a rapidly transforming market for energy-efficient lighting. It concludes with program design considerations and information gaps that have the potential to influence the long-term effectiveness of residential lighting programs.

Introduction

The large volume of energy savings potential represented by converting residential lighting loads to more efficient technologies continues to make compact fluorescent lamp (CFL) programs extremely popular. CFLs represent between 80% to 90% of all residential program electricity savings claimed by California’s investor owned utilities (IOUs)—Southern California Edison (SCE), Pacific Gas & Electric (PG&E), and San Diego Gas & Electric (SDG&E)—according to their 2006-2007 filings with the California Public Utilities Commission (CPUC).

The Consortium for Energy Efficiency (CEE) reports that studies in all regions of the country have demonstrated that residential lighting continues to represent a valuable source of energy savings (CEE 2006). The CEE describes the substantial energy impacts and wide range of environmental benefits attainable through targeting savings in the residential lighting sector:

“Residential lighting accounts for approximately 17% of residential electricity use and approximately \$8 billion per year in consumer electricity bills. The environmental impact is also significant, representing 3% of all U.S. carbon dioxide emissions, 4% of SO_x and 2% of NO_x. It is estimated that the use of currently available energy-efficiency lighting technologies could reduce electricity use attributed to lighting by 50-75%” (CEE 2006, 1).

The importance of residential lighting, generally, and CFLs, specifically, warrants ongoing assessment of lessons learned in program design and implementation to ensure that current programs are adapting to a rapidly transforming marketplace.

This paper addresses one aspect of research conducted on behalf of Southern California Edison on two related topics: CFL program strategy; and CFL usage issues, necessary for an

accurate estimate of energy savings and CFL program cost effectiveness. This paper discusses program strategy, while a companion paper discusses the research into CFL usage issues.

The program strategy research involved two major activities. First, in March 2007, the research team reviewed evaluation reports for programs with CFL components. Most of the programs reviewed operated in California between 1999 and 2005, although three non-California programs were included; the majority of the programs targeted residential customers. The second research activity, conducted in May and June 2007, involved interviews with lighting program experts throughout the country. These contacts included program managers, policy experts, and other professionals focused on ensuring quality in both program design and CFL products.

The 2006 *California Energy Efficiency Potential Study* estimated that efficient residential lighting (including compact fluorescent lamps and hardwired fixtures, light emitting diode [LED] exit signs, occupancy sensors, photocells and torchieres) comprise 63% of the total electricity (GWh) savings potential in existing residential buildings (Itron 2006).

Given the encouraging signs in the CFL market (discussed below), and in light of the Potential Study and the electricity savings goals set by the CPUC, the CPUC-Energy Division (CPUC-ED) suggested a review and assessment of CFL program strategies that promise to help utilities meet higher, and likely escalating, goals. Our investigation focused on identifying ideas useful to policymakers and program administrators involved in the design of programs to acquire the residential lighting savings potential.

The Residential Lighting Market

The development, production, and promotion of CFL technology to residential electrical customers is the result of years of effort on the part of federal, state, and non-profit agencies, as well as sometimes aggressive promotion of CFL products on the part of utility and third-party efficiency programs. The Pacific Northwest National Laboratory (PNNL 2006) details the technological and programmatic challenges and advancements that occurred in the 1990s, as utilities sought to capture the efficiency represented by converting the residential lighting load from standard incandescent technologies to more efficient CFL products. With the launch of ENERGY STAR[®] product labeling in 1997, many efficiency programs tied their approved products to this recognizable national brand in what had been a fragmented marketplace (PNNL 2006). The continuing work of the ENERGY STAR[®] rating process and the further verification of third-party testing efforts have improved the overall quality of lamps and increased consumer confidence in CFL lighting products, while extensive program activities in some areas of the country have reduced prices to consumers. In recent years, the number and diversity of CFL products has exploded (KEMA 2007).

On the West Coast, CFL programs that addressed lamp quality and supply issues, promoted the lamps to customers, and encouraged stocking among retailers paid off during the disruption of energy markets in the 2000/2001 western energy crisis. Consumer familiarity with and purchasing of CFLs increased dramatically in 2001: national retail sales doubled, California sales increased more than four-fold, and sales in the Pacific Northwest increased by roughly ten times (PNNL 2006). Recent studies have found that, after a slight dip in 2002, sales of CFL products have steadily increased, as large retailers work with energy efficiency programs to stock and promote the lamps (Itron 2007; KEMA 2007).

Researchers are concluding that increases in CFL quality and decreases in price are encouraging recent purchases, and that consumers are generally satisfied with their CFLs. A

recent evaluation completed for the Northwest Energy Efficiency Alliance found sustained satisfaction ratings for CFLs in interviews conducted between 2001 and 2006 (KEMA 2007). According to the authors, these satisfaction ratings are noteworthy, given the large increase during that period in the numbers of purchasers and the likely increase in the proportion of purchasers who are “less motivated by environmental concerns and... more motivated by CFLs on sale and [by] saving energy on their bill.”

The evaluation of the 2004-2005 California Single-Family Energy Efficiency Rebate (SFEER) Program found that, as of 2006, 65% of California consumers had purchased a CFL, leaving only 35% as non-purchasers (Itron 2007). This 2006 percentage of 65% compares with 57% of 2005 consumers having purchased at least one CFL (found by the *2005 California Statewide Residential Lighting and Appliance Efficiency Saturation Survey* [CLASS]) and only 12% making a similar purchase in 2000 (RLW 2005). The SFEER evaluation found a moderately high average satisfaction among CFL purchasers—7.7 out of 10 (Itron 2007). The study also found satisfaction was higher among purchasers who bought CFLs more recently than among those who had not purchased a CFL for several years. These findings suggest increased satisfaction is related to the generally increasing quality of CFLs.

In spite of the improvements in CFL technology and reductions in CFL costs, CFLs continue to sell at a much lower rate compared to standard incandescent lamps, and this gap represents continuing potential for efficiency acquisition in the residential sector. The 2005 CLASS estimated that CFL use ranged from a high of 14.9% in table lamps to a low of 10.3% in both ceiling fixtures and recessed cans (RLW 2005). Stated otherwise, 85% to 90% of California residential lighting fixtures *do not* use CFLs. This finding is consistent with program experiences and research concluding that CFL’s low market share indicates significant potential remains for increasing residential lighting efficiency (Skumatz & Howlett 2006).

Review of Evaluation Studies

Study Review Methods

The research team reviewed 19 CFL-related reports, including 16 reports for California utility-sponsored or third party-operated programs, and 3 reports for programs in Wisconsin, New England, and the Pacific Northwest. The CPUC-ED provided the team with a list of California programs to review; we included other programs as evaluation reports were identified. The evaluations reviewed focused primarily on residential lighting applications.

The residential lighting chapter of the *National Energy Efficiency Best Practice Study* (Itron & RIA 2004) noted the difficulty of comparing different program approaches, due to differences in goals for the programs, target markets, et cetera. In light of this finding, we sought to establish a sound basis for comparing program outcomes. The team collected for each of the reviewed programs the following program elements: 1) program name, location, and administrator; 2) period of operation; 3) measures—CFL only or combinations of measures; 4) size and description of the target market; 5) strategies employed and tactics used; 6) number of customers served, number of lamps disbursed, and portion of the market reached; and 7) cost of the lamps and program cost effectiveness—specifically, for the CFL portion of the programs.

Evaluation Review Findings

A wide variety of program approaches have been employed in California and elsewhere in the quest to increase CFL installations. Although this variety makes program comparisons difficult, it was not unexpected and is consistent with the Best Practice Study conclusion that multiple tactics are necessary to fully reach the market (Itron & RIA 2004).

Program tactics include: targeted-event giveaways; door-to-door giveaways; reduced price programs (e.g., manufacturer buy-downs or point-of-sale rebates); direct install programs; and programs that target specific groups, such as hard-to-reach multifamily housing residents. Information or marketing-related tactics include: advertising; the distribution of product information; appropriate labeling; audits; and education and training (such as for retailers, distributors, manufacturers, schools, and community organizations).

In California, particularly during the 2000/2001 western energy crisis, many programs distributed free CFLs through direct install efforts, at special events, or through door-to-door campaigns. These programs were able to tap into the tremendous awareness generated by the threat of rolling blackouts and the spikes in energy costs. For many California consumers, giveaway programs likely represented their first experience with a CFL. Indeed, prior to 2000, the CFL market share in California was minimal—less than 1% of the market for medium screw-based lamps (Itron 2004).

While the reports identified these tactics and strategies, the majority of reports did not specify the size of the target markets; in most cases, we found only the number of CFLs distributed, rebated, or bought-down. Relative program costs, measure costs, and cost effectiveness outcomes can provide another option for comparing program effectiveness. We sought to compare the program cost per CFL, but found only three of the reviewed reports provided such information.

The cost effectiveness test values (Total Resource Cost, or TRC) were not typically included in the evaluation documents; the documents typically provided the ex post savings estimates used subsequently to calculate program TRC values. For SCE's programs, we were able to obtain TRC values from filing documents and program contacts. In no cases, could we identify the TRC value associated with the CFL program component only, making it impossible to assess the cost effectiveness of this measure, as implemented, in isolation from other program measures.

To the extent any data were found, it was additionally difficult to directly compare program and measure cost effectiveness, given the different assumptions and mix of measures in each program. The reported program TRC values, when available, ranged from 0.31 to 3.2, with the lowest value associated with low-income programs, which are driven by equity concerns, and the highest with a commercial program, which benefits from economies-of-scale due to larger applications.

We recorded in a matrix whatever information the evaluation studies provided on program strategies, tactics, impacts, target population, and cost effectiveness indices, yet—due to data limitations, combined with the complexity of cross-program issues—the resulting comparative data did not reveal whether there were any relative advantages of different program strategies and tactics.

Evaluation Gaps and Recommendations

Inconsistently reported data and differences in data tracked made a direct comparison of the program tactics and strategies impossible. To the extent that an assessment of a program was provided, it was because the evaluation described the effectiveness of the specific program in a qualitative manner, but not in a way that allowed for comparison along common metrics, such as TRC or standardized market share metrics for CFLs.

The U.S. Department of Energy is currently working on collecting market share information by state for ENERGY STAR[®]-qualified CFLs. These data are expected to be available by the end of 2008. When the market share data become available, it will be possible for researchers to confidently compare market share accomplishments across program areas, but it is likely to still be difficult to draw conclusions about the relative effectiveness of specific tactics and strategies due to the perceived strength of mixed-method approaches.

An evaluation conducted in 2002 by Xenergy concluded that the cost effectiveness and resulting program impacts associated with each delivery strategy varied with the number of CFLs distributed and whether or not the CFLs were fully or partially subsidized. The evaluation further revealed multiple designs and diverse strategies, each of which had its own set of advantages and limitations, all delivered CFLs to consumers. Applicability of a given strategy or tactic appeared to vary with the maturity of the market, market acceptance of the measure, and the importance of other program goals, such as equity, market transformation, or resource acquisition. For example, programs in California, the Northwest, and Massachusetts all used manufacturer buy-down strategies in 2003 and 2004, and documented large increases in sales of CFLs. However, all three of these program areas had already engaged in years of steady market preparation work prior to 2001, including extensive work with retailers, mass market and promotional activities, and participation in third-party testing that confirmed the quality of the rebated product. Disentangling the effects of these many factors was not possible through comparison of evaluation documents.

The research team presented summary results from the evaluation study review to the project sponsors in May 2007. The team recommended that additional work should focus on expert interviews with program contacts, rather than further investigation using the program evaluation data.

Expert Interviews

Expert Interview Methods

The program sponsors supported the recommendation to conduct in-depth interviews with 14 program contacts from 11 organizations in California and across the country. Since the review and comparison of past CFL program-related reports could not clearly identify best program designs or strategies for meeting CPUC and utility-defined goals, SCE and the CPUC requested that the research team try to assess whether changes or additions to the current lighting program portfolio were indicated.

To address these questions, the research team sought to elicit expert advice about CFL program design and implementation, and to obtain a detailed understanding of program contacts' experiences with and opinions of the best strategies for increasing the sales of CFLs, engaging

manufacturers and retailers, increasing CFL socket penetration, and delivering effective future programs.

It is important to note that the knowledge of experts is limited by their own experiences and, occasionally, by the limitations of their programs or the organizations with which they work. They are also limited by the same the lack of broad-based national market share data and the near impossibility of comparing program features using standard metrics of energy efficiency program success (such as cost effectiveness, portion of market reached, level of influence, program cost, etc.) described in the previous section. Nevertheless, program administrators and national or regional policy experts are often on the front lines of discussion about program trade-offs, political considerations, and the pressure to meet specific program goals. Further, many of the experts interviewed had experience that spanned multiple geographical locations, as well as many years of program implementation.

Reports from Experts

While CFL programs and promotions have resulted in significant increases in familiarity and market share in many parts of the country, barriers remain. Many programs seek to overcome what is frequently perceived as the most powerful barrier to purchasing a CFL: higher upfront cost. However, our research revealed some key considerations for a holistic CFL program portfolio focused on reducing lost opportunities. These fall into three primary areas: general program design considerations; marketing and consumer education; and quality assurance.

Analysis of Expert Opinions

General Program Design

Program evaluations, market effects studies, and anecdotal reports from every region indicate that some retail outlets or retailers are more “transformed” than others. Free-ridership rates vary between big box stores and grocery stores, and some retailers (most recently and notably, Wal-Mart) have made public or corporate commitments to stocking and selling CFLs. Future evaluations will need to continue to assess the relative benefit of discounting lamps destined for retail outlets likely to sell and stock lamps regardless of the availability of incentives. Suggestions in this area include:

- **Engage the market.** Buy-down strategies were widely viewed as an effective way to engage upstream market actors. These strategies work within the existing market structure and within the relationships that form the lighting market. These strategies also help energy efficiency program staff to build relationships with key manufacturers and retailers. It is therefore important to solicit input from the latter before designing the program. Contacts also noted that manufacturers continue to seek rebates via buy-down programs and express a desire for more.
- **Prioritize consistent, measured expansion in a buy-down approach.** It is dangerous to ramp up too quickly in an effort to avoid all lost opportunities. Capturing all cost-effective energy savings can require spending levels that contort the market, or cause gaming by manufacturers, distributors, or retailers.

- **Prioritize stocking choices.** When engaging retailers and manufacturers, it remains important to consider how the products are stocked and displayed. Are CFLs stocked in the lighting section with incandescent lamps? Are they prominently displayed? As one contact put it: “Aim for a world where incandescent lamps are at the ankle and CFLs are at eye level.”
- **Create synergies.** Look for opportunities to integrate lighting with other programs. This could include using CFLs as a program driver or “teaser” measure that encourages people to call for an audit or participate in some other assessment. CFLs are seen as an introduction to energy efficiency for many people—a tested measure that can be easily purchased and installed, and that is relatively inexpensive.
- **Occasionally expose consumers to the true price.** Contacts focused on market transformation were more likely to note the limitations of relying solely on upstream approaches that create continual price reductions. Long-term, continual price reductions in specific areas of the country can eventually get in the way of normal market development and may not be necessary. Shifts in consumer purchasing behavior that might result from the end of an upstream promotional period could help program implementers discern the effects of the rebate.

Marketing and Consumer Education

Programs also seek to overcome information barriers at the point of purchase. Regardless of the expanding consumer awareness of CFLs and the increasing market saturation, purchasing a CFL remains more difficult than purchasing an incandescent lamp, because it requires thought on the part of consumers in a transaction most consumers are not used to thinking about. Deciphering the incandescent equivalency, understanding lumens, and assessing the appropriateness of a particular lamp for a particular fixture are all complicating aspects of the CFL purchase. There are also issues related to safe disposal, customers must choose among less familiar brands and colors of light, and the lamps continue to face a higher initial price-point. Buy-down programs address only one of these barriers: the higher initial price-point. Many of the remaining barriers could be addressed with targeted marketing and consumer education capable of communicating specific information about the CFL features, including:

- **Offer an educational component.** Customers still need facts, figures, and in-store demonstrations of CFLs to explain why they are important and what benefits consumers can expect. Marketing and educational challenges remain for implementers faced with the need to continually remind customers of the benefits of CFLs while simultaneously educating them about inappropriate applications or fixtures.
- **Maintain awareness of the customer perspective.** Identifying and targeting customers (especially those who have never bought a CFL) are needed. Customer identification and segmentation of CFL purchasers will be important in crafting education and marketing strategies likely to increase participation. Different messages may be appropriate in targeting men versus women, first-time purchaser versus repeat purchaser, do-it-yourselfer or the mass-merchandise shopper versus grocery and drug-store purchasers, and those moved by economic messages versus those moved by environmental concerns.
- **Mass-marketing can still affect consumer perceptions of CFLs.** While consumer education activities may occur through retail channels or via word-of-mouth networks,

reaching customers that have not purchased or considered purchasing a CFL will likely require the broad reach of mass-marketing efforts.

- **Consider non-traditional marketing and messaging strategies.** Community groups, church groups, universities, informal communication networks, list serves, and other interest groups are effective in getting the word out about CFLs to otherwise uninformed groups. It is important to develop connections with these networks.

Quality Assurance

All contacts advocated for reliance on ENERGY STAR[®] certification to establish the minimum quality standards for program-discounted lamps, as well as additional quality assurance through activities like PEARL.¹ While overall quality has improved through these testing and certification activities, quality still emerged as an issue when contacts discussed prospects for future expansion, likelihood of out-of-program purchases, and concern over whether pressure to lower prices and acquire savings is undermining the overall quality of available lamps. Realistic measure-life estimates, standardization of lumen output, and standardized light colors all emerged in discussions about remaining barriers. Suggestions in this area include:

- **Maintain quality.** Don't over-promise. Establish minimum quality specifications and clear guidelines for product packaging and labeling. Consider establishing a maximum allowable mercury level.
- **Push for consistency in color rendering.** Manufacturers offer lighting in different "flavors" (warm, bright, white, yellow), yet there is a lack of standardization across manufacturers that makes it difficult for consumers to choose the lighting product that best meets their needs.

Codes and Standards

While there have been highly publicized discussions of outlawing incandescent lamps, few of the contacts we interviewed advocated or even mentioned this strategy as a realistic approach for increasing the market for CFLs.² However, there may be room for using codes and standards to address quality concerns among program implementers worried that low cost, imported lamps from unknown manufacturers might undermine the quality standard reinforced through years of promoting ENERGY STAR[®]-labeled lamps. Establishing the ENERGY STAR[®] label as the minimum quality standard for any CFL sold in the United States could eliminate the poorest quality lamps and offer consumers some assurance of quality regardless of price. Suggestions included:

- **Only add new products or technologies after specifications and testing is in place.** ENERGY STAR[®], CEE, and other emerging technology groups are watching for emerging new lighting technologies, but it remains important to ensure that minimum

¹ Program for the Evaluation and Analysis of Residential Lighting (PEARL).

² These interviews occurred prior to approval of the 2007 Energy Bill, which will phase out incandescent lamps by 2012.

specifications and quality control protocols are established before the product is pushed into the market.

Issues of Lighting Markets

The expert interviews revealed several overarching themes or concerns about residential lighting, generally, and CFLs specifically. In some cases, contacts directed us to studies or other reports that supported their opinions. The results of this research are presented below.

Upstream approaches are effective. The interviews revealed that experts value the manufacturer buy-down for its ability to obtain a large amount of energy savings cost effectively. California has applied the upstream approach widely and found it an effective strategy that has influenced millions of CFL purchases in California since 2002. A similar story can be told in Massachusetts, where the residential lighting program shifted toward a buy-down approach in 2002, and experienced dramatic increases in sales and decreases in program costs for CFLs in the state (Kates & Bonanno 2005).

A manufacturer buy-down program offers many advantages: it can be expanded and contracted easily; the barrier of high first-cost is directly addressed; it can reach a variety of retail outlets and get the attention of multiple CFL manufacturers; and the strategy engages large numbers of consumers, yet requires interactions with only a small number of market actors (retailers and manufacturers) on the part of program managers. This strategy also allows the program manager to maintain a high degree of product quality control through specifying eligibility and product quality requirements, packaging, and bulb configurations. Finally, the relationships established by program staffs with manufacturers and retailers help increase program administrators' understanding and awareness of how lamps are distributed and sold.

Market effects are likely larger than one program. Expert contacts continue to need broad-based saturation or market progress reports to assess the movement of the CFL market in their respective program areas, but frequently have only evaluations of their own programs on which to base decisions. The expert interview findings indicated occasional broad-based market effects studies are needed to provide a clear picture of the consumer market for CFLs—supply, pricing, and the factors driving demand—and the overall impact of program activities, including spillover effects (program-induced adoption of CFLs beyond that occurring as a direct result of program activities).

Program goals drive program design. Upstream lighting programs are viewed as the “workhorse” of many utilities’ residential portfolios, capable of quickly acquiring a large volume of kWh savings at a low cost. Given this short-term focus and the fact that, in California, currently neither participant nor non-participant spillover can be counted towards the attainment of efficiency goals, program administrators reap little benefit from investing in other approaches that might drive participants to non-rebated bulbs (spillover purchases).³ These other approaches include marketing and outreach activities not associated with directly-measurable savings, and require taking a broad market view that encompasses factors other than price that affect consumer demand.

³ The California Protocols assign participant spillover to impact evaluations and non-participant spillover to market effects evaluations. However, spillover effects are not currently allowed to be counted towards goal attainment.

Marketing and consumer education are (still) needed. While upstream approaches were clearly popular among the experts we interviewed, many experts continue to value consumer education and marketing strategies launched in association with buy-down programs, or even in lieu of these programs.

The Northwest Energy Efficiency Alliance (NEEA), operating with a market transformation perspective, anticipates continuing only consumer marketing and education activities in support of CFL purchases because of signs of market transformation. The Northwest CFL market share of total residential lamp sales was estimated at 19% (KEMA 2007). However, contacts in the Northwest anticipate that utilities and other organizations in the Pacific Northwest seeking resource acquisition savings will likely continue some type of incentives for CFLs.

Other jurisdictions report substantial CFL purchasing as a result of marketing and consumer education, coupled with incentives, although the previously noted inconsistencies among reported evaluation data make it difficult to confidently compare market accomplishments across programs.

The current programs in California lack a dedicated budget for marketing and consumer education; instead, marketing is conducted at a high level through *Flex Your Power* and the programs rely on manufacturers to provide marketing materials to their retail partners.

Maintain progress on quality. Lighting experts believe secondary testing programs like the Program for the Evaluation and Assessment of Residential Lighting (PEARL) will continue to be valued for providing independent verification of ENERGY STAR[®]-rated products. If these efforts fail to identify issues with product quality and measure life, program administrators may want to consider additional checks on product quality. Requiring warranties or excluding products may be necessary.

Information Gaps

Our analysis of the expert interviews and the associated literature review revealed several gaps in the information required to assess the specific and cumulative effects of long-running efficiency programs targeting CFLs.

How Important Is It To Isolate the Effects of the Upstream Buy-Down Strategies?

Manufacturer buy-down efforts have clearly succeeded in moving a large volume of CFLs; what is less clear is: 1) how critical were the years of market preparation work; and, 2) whether or not years of buy-downs have resulted in any lasting change in the market for energy-efficient lighting.

An evaluation of the 2004 Massachusetts buy-down program noted that the de facto objectives of the program appeared to have shifted from market transformation to resource acquisition, while the official program theory was still focused on market transformation (Megdal 2005). Megdal reported that several administrators in Massachusetts expressed concerns about the messages reaching customers. She summarized their concerns:

“While the current program is effective in getting the price down, as one sponsor put it, ‘then you want customers to want to use these things, not get the price to be so low that they don’t care if the quality is bad.’ The basic calculation of the utility cost index, however, does not encourage investment in consumer education” (Medgal 2005, 10).

A similar tension exists in California, where a transition from market transformation to rapid resource acquisition occurred in the early 2000s. The 2005 CLASS evaluation (RLW 2005) and the 2004-2005 SFEER evaluation (Itron 2007) both found substantial increases in the saturation and availability of CFLs in California since 2000. However, neither study directly addressed the market effects question, nor has it been assessed in California since the early 2000s. A market effects study currently underway should provide some insight into permanent changes in the energy efficiency lighting market in California.

According to interviewed lighting program experts, buy-down approaches have sought to get the cost of rebated CFLs to zero, or near zero, for retailers. This point is important to consider carefully. Many utilities have decided not to pursue consumer giveaway programs because giveaways are thought to undermine the value of the product and the strength of other market delivery channels. Further, the success of the buy-down programs has proven many consumers will pay for bulbs at a discounted price and so should not be given free bulbs.

A looming question, then, is whether or not near give-away pricing to retailers similarly undermines the market and devalues the lamps to retailers. Steep discounts to retailers, which are common in buy-down programs, may ultimately distort retailer perceptions of cost or profit and reduce overall willingness to stock lamps once the subsidy ends. Long-term discounts may also obscure the true price of CFLs to purchasers and ultimately undermine consumer willingness to pay once the subsidy ends.

What Will Broad-Based Market Effects Studies Show?

Given that protecting retailers and consumers from the true price of CFLs may ultimately distort the market and reduce willingness to pay, it will remain important for programs to continually assess the importance of the price reduction in the minds of retailers and consumers. Evaluation activities should include efforts to assess the importance of the price reduction by using motivation and willingness to pay measures. If consumers are buying CFLs primarily because the price is low, this indicates a continued need to participate in the upstream market in order to continue the low price. However, if surveys indicate consumers are buying CFLs for reasons such as longer life, brighter light, energy savings, and concerns about climate change, then any price increases that occur when the buy-down programs are terminated may not substantially reduce CFL purchases.

Research designs need to take into account:

- the fact that upstream approaches provide discounted products to customers seamlessly, making it difficult for consumers themselves to know whether or not they are purchasing a bulb at an artificially low price;
- the retail price of CFLs in comparable buy-down and non-buy-down areas constitutes another important market research activity, necessary to ensure over time that the reduced CFL prices are passed on to consumers and not retained as retailer incentives; and
- the level of free-ridership occurring in the program areas, because utilities do not know the identities of participants in upstream buy-down programs.

Achieving market-related goals will require relationships with all types of market actors, and will require that market actors provide feedback to program staff in a timely manner—providing market intelligence critical to real-time adjustments to program messages and activities. Years of steady investment and program operation in California and elsewhere make it highly likely that program staff have the relationships required to stay informed about shifts in the market. Prioritizing and receiving this feedback may require only minor changes.

Should Administrators Also Focus on Market Segmentation Studies?

As barriers related to price and familiarity decrease, it will be important for program staff to know precisely which barriers continue to prevent additional purchases. This information is often part of evaluation efforts, but can also be developed through targeted market research using focus groups and survey data.

For CFL programs to maximize penetration and saturation, segmentation studies will be needed to identify how to market to the variety of consumer types. Identifying and segmenting CFL purchasers may be important in targeting specific populations needing an extra marketing nudge. Program administrators should continue to explore messages and tactics likely to reach the remaining non-participating households. While 100% participation is unlikely, lighting experts believe additional information, targeted marketing, effective retail displays, and the availability of low cost, high quality lamps will continue to expand the proportion of households using CFLs.

Program administrators will also need program efforts designed to encourage additional installations in homes with one or more CFLs. These efforts could include keeping the price-point as low as possible, experimenting with multipack products, and developing marketing messages and product placement efforts that normalize CFL installation in a variety of fixtures and rooms. Future programs may need to explore different marketing messages; these messages could be informed by segmentation studies.

How Do Program Goals Affect Design Choices?

Policymakers should consider expanding program goals to encourage and reward increased market share and market penetration in terms of both residential participation and socket penetration, as well as reductions in perceived barriers.

If market effects studies and program feedback loops provide ample evidence of widespread spillover and market movement *that can be attributed to ratepayer investments*,

programs could begin prioritizing out-of-program purchases and consider new ways to expand participation beyond the purchase of a discounted lamp.

What Is the Appropriate Level of Marketing and Consumer Education Activities?

Program-specific marketing resources could help ensure that retail displays are visible and attractive, and that program-specific or targeted messages are developed to communicate concepts to specific consumers or to address specific barriers. For example, encouraging additional purchases among previous purchasers may require a different marketing message than encouraging the first purchase among new participants.

All CFL programs will want to continue to communicate the importance of installing the lamps in the most-used rooms or fixtures.

Are the Current Quality Assurance Activities Adequate?

CFL quality remains a concern among consumers, retailers, and program administrators. Many of the initial CFL product complaints have been addressed (noise, insufficient light output, green skin tones, slow to illuminate); however, others remain. Program implementers continue to guard against exaggerated lamp-life claims, premature failure of bulbs, and dissatisfaction with light output or color.⁴ A 2005 paper reviewing international testing procedures found a wide range of quality in the universe of available products and noted these differences are not easy for the consumer to discern based on product packaging or price (Granda & Conway 2005).

ENERGY STAR[®] designation means that lamps meet standards related to lumen maintenance, lamp efficacy (lumens/Watt), and rated lifetime, as well as other characteristics like color rendering, color temperature, and startup time. Relying on an ENERGY STAR[®] platform provides a basic level of quality assurance, but it may not be enough. For example, Granda and Conway explain that the high failure rate (8% to 9%) prior to 40% of rated life means that manufacturers are:

“...essentially asking consumers to gamble—the consumer who pays a premium for a CFL as an alternative to an incandescent bulb has a 92% chance of getting a more efficient and longer-lived lighting product, but an eight percent chance of probably losing money on the investment. This level of risk seems inconsistent with long-term market transformation from incandescent to fluorescent lighting.” (Granda and Conway 2005, 9).

As new lighting products are considered or introduced (including new LED applications, fixtures, and/or dimmable CFLs), program administrators need to establish minimum performance requirements. If performance cannot be guaranteed, administrators should delay program inclusion rather than introduce inferior products.

⁴ See the companion paper to this research: “Welcome to the Dark Side: The Effect of Switching on CFL Measure Life,” also scheduled to be presented at the 2008 ACEEE Summer Study (Jump & Hirsch 2008).

Conclusions

We began this effort with an attempt to gather tactic and strategy-specific numeric data, which could be used to compare the efficacy of one strategy or tactic deployed between 2000 and 2008 to capture residential and small commercial energy savings through more efficient lighting technologies. Such data were not available. And certainly holding all other factors equal—such as the effects of previous program efforts, the demographics of target markets, the presence of news coverage associated with energy shortages or price increases, and the effects of Al Gore’s *An Inconvenient Truth*—was impossible.

Without comparable data on measure cost, cost effectiveness, and market effects, we turned to lighting program experts to elicit their advice and insight as to how to best capture the energy efficiency associated with conversion to CFLs. Experts discussed with us their perceptions of effective program designs and the remaining barriers to purchasing energy-efficient lighting. While many contacts noted the large increases in CFL purchases associated with transitioning to an upstream buy-down approach, it should be noted that these approaches are primarily occurring in areas of high visibility and/or ongoing program activity. Teasing out the importance of the extensive market preparation work that occurred in the late 1990s and early 2000s has yet to be done.

Further complications loom, including the passage of the 2007 Energy Bill and the prospect of phasing out incandescent lamps entirely beginning in 2012. Market effects studies, saturation studies, marketing campaigns, and direct CFL promotions that appear critical to program accomplishments today may soon be moot as the rapidly transforming marketplace for efficient lighting becomes the only option.

References

- [CEE] Consortium for Energy Efficiency. 2006. *Consortium for Energy Efficiency Residential Lighting Initiative, Revised June 2006*. http://www.cee1.org/resid/rs-lt/rs-lt_init_descr.pdf. Boston, Mass.: Consortium for Energy Efficiency.
- Granda, C. and K. Conway. 2005. “Compact Lessons Learned from International Lamp Testing Programs.” In *Proceedings from Right Light 6*. http://www.rightlight6.org/english/proceedings/Session_8/International_Lamp_Testing_Programs/f030granda.doc. Shanghai, China: 6th International Conference for Energy-Efficient Lighting.
- Itron, Inc. 2004. *California Lamp Trends, The Residential Market Share Tracking Project*. Rosemead, Calif.: Southern California Edison.
- Itron, Inc. 2006. *California Energy Efficiency Potential Study, Volume 1*. CALMAC: PGE0211.01. San Francisco, Calif.: Pacific Gas & Electric.
- Itron, Inc. 2007. *2004-2005 Statewide Residential Retrofit Single-Family Energy Efficiency Rebate Evaluation*. CPUC-ID# 1115-04. San Francisco, Calif.: California Public Utilities Commission.

- Itron, Inc. [formerly Quantum Consulting, Inc.] and [RIA] Research Into Action, Inc. 2004. *Residential Lighting Best Practices Report*. Vol. R1 of *National Energy Efficiency Best Practice Study*. www.eebestpractices.com. San Francisco, Calif.: Pacific Gas & Electric.
- Jump, C. and J. Hirsch. 2008. "Welcome to the Dark Side: The Effect of Switching on CFL Measure Life." Paper to be presented at the 2008 ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, Calif., August 17-22.
- Kates, B. and S. Bonanno. 2005. "Energy Efficient Lighting in the Residential Market." PowerPoint presentation at the 2005 ENERGY STAR Lighting Partner Meeting, Las Vegas, Nev., April 4-5.
- KEMA, Inc. 2007. *ENERGY STAR® Consumer Products Program Market Progress Evaluation Report*. Portland, Oreg.: Northwest Energy Efficiency Alliance.
- Megdal & Associates. 2005. *Evaluation of the Massachusetts ENERGY STAR® Residential Lighting Program PY 2004 Integrated Report*.
- Pacific Northwest National Laboratory. 2006. *Compact Fluorescent Lighting in America: Lessons Learned on the Way to Market*. Richland, Wash.: United States Department of Energy.
- [RLW] RLW Analytics, Inc. 2005. *2005 California Statewide Residential Lighting and Appliance Efficiency Saturation Study. Final Report*. San Francisco, Calif.: California Public Utilities Commission.
- Skumatz, L. and O. Howlett. 2006. "Findings and 'Gaps' in CFL Evaluation Research: Review of the Existing Literature." In *Proceedings of the Fourth International Conference Energy Efficiency in Domestic Appliances and Lighting (EEDAL)*. 2:803-14. London, England: Energy Efficiency in Domestic Appliances and Lighting.
- Xenergy, Inc. 2002. *Phase 4 Market Effects Study of California Residential Lighting and Appliance Programs*. San Diego, Calif.: San Diego Gas and Electric Company.