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California Upstream Lighting Program Evaluation: Charting the Next Evolution in Measuring Energy Savings Contributions

AESP Presentation
October 23, 2008

KEMA 

Background

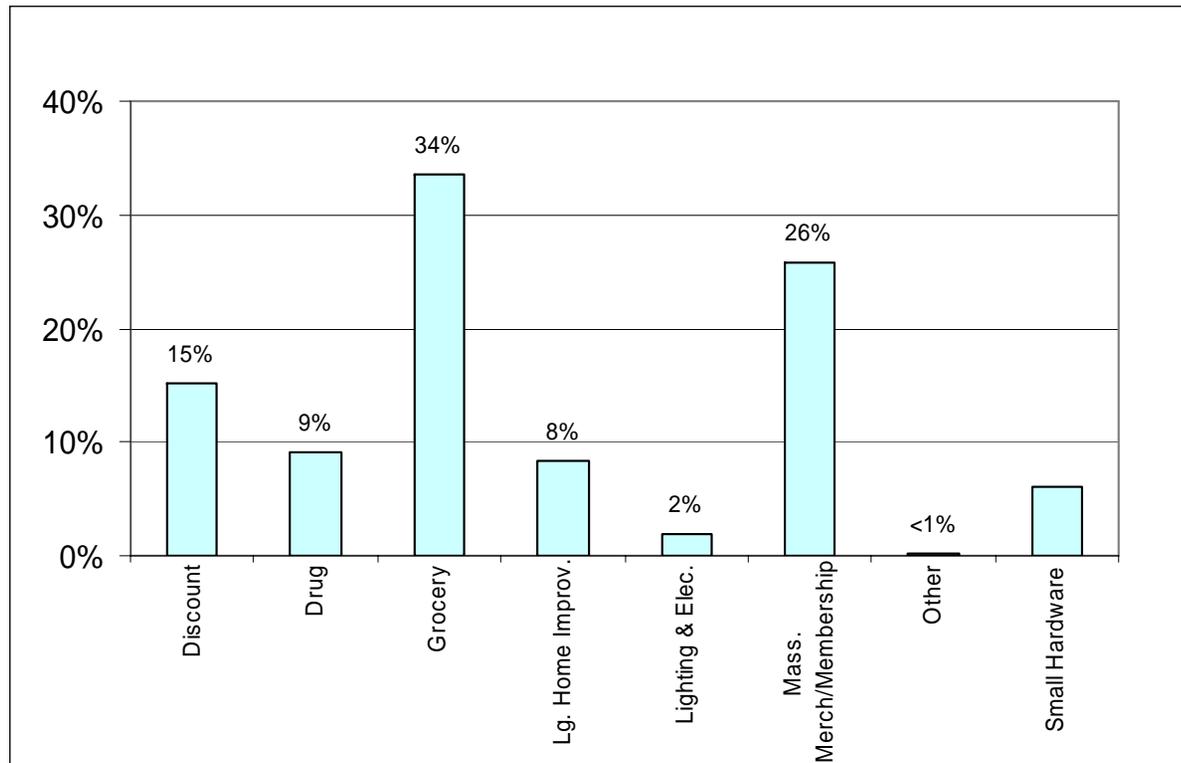
- California's Upstream Lighting Program accounts for more than half of the overall energy savings and peak demand reduction goals for 2006-2008
- Through June 2008, the utilities have provided incentives for over 85 million energy efficient lighting products
 - Nearly 75 million CFLs, only about 10-15% of these identified as "specialty CFLs" (e.g., A-lamps, globe, reflectors) and 85% are between 13 and 23 watts
 - About one million CF fixtures and over 2.5 million LED products rebated
- Over 4,000 annual GWH in energy savings and over 500 GW in peak demand reductions claimed by IOUs through June 2008

Reported Program Accomplishments

Product Type		Quantity Rebated <i>(Jan 2006 - Jun 2008)</i>
CFL	Average Wattage Screw-in CFL (13-23 watts)	62,676,427
	High Wattage Screw-in CFL (>23 watts)	7,796,360
	Low Wattage Screw-in CFL (<13 watts)	4,125,156
Fixture	Interior CF Fixture	617,883
	Exterior CF Fixture	400,144
LED	LED Holiday Lights	8,503,732
	LED Bulbs/Night Lights	2,374,262
	LED Task/Desk Lamp	260,180
	Other LED Products	2,771
All Lighting Products		86,756,915

Source: California IOU Quarterly Reports, 2nd Quarter 2008, EEGA website.

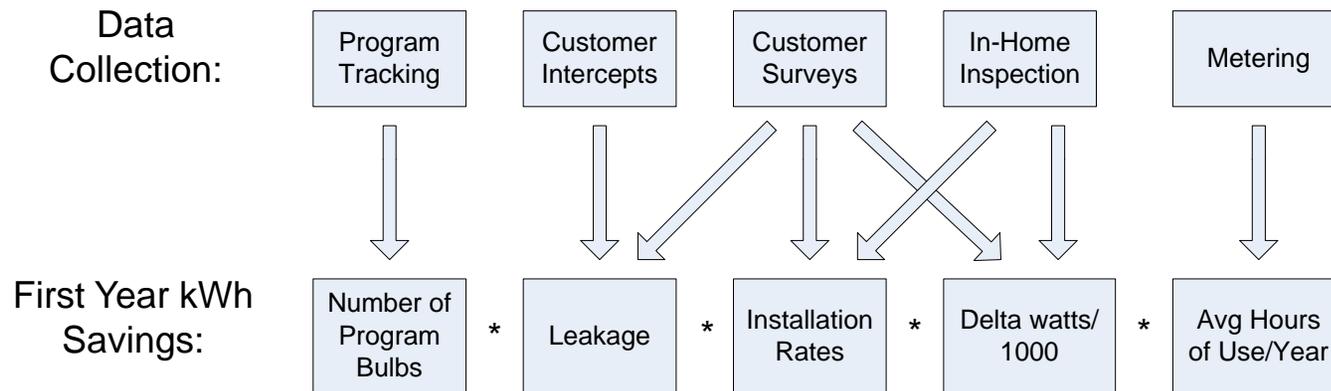
Reported Program Accomplishments



Evaluation Objectives

- Verify quantity of energy efficient lighting products rebated through the program that were:
 - Shipped by participating manufacturers to retailers within IOU service territories during 2006-2008
 - Installed by residential v. nonresidential IOU customers during 2006-2008
- Determine estimates of gross energy savings and peak demand reduction
- Determine level of program free ridership (i.e., net-to-gross ratio)

Determination of Savings: Mapping of Data Collection to Savings



Summary of Primary Data Collection Activities

CFL User Telephone Survey	1,500 CFL purchasers (4,000 total, quarterly)
In-Home Inspections	250 homes
Metering	7 meters/home
Customer Intercepts	1,200 surveys (240 stores)
Retailer/Manufacturer Interviews	50

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Verification of Quantities Shipped

- Approach
 - Review IOU documentation, including manufacturer invoices, application forms, and other relevant paperwork and match to program tracking database
 - Confirm product eligibility (SKUs), product quantities and product shipments to specific retailers
- Challenges
 - Thousands of transactions, many of which are unique to specific manufacturers and/or retailers
 - IOUs not entirely consistent in documenting transactions
 - Very little evidence of product sales (only shipments)

Leakage (Current approach)

- Retailer & manufacturer interviews
- Customer intercepts
- CFL user surveys

Installation Rates

- Primary method involves CFL User Survey
- Model will estimate time-to-installation distribution for CFLs and provide evidence of relationships between bulb acquisition, installation and storage

Delta Watts

- Asked during customer surveys
- Verified during in-home visits
 - Inspection of similar fixtures

Hours of Use

- Annual hours of use and peak usage
- Metering study to update 2005 study
 - Changes in saturation
 - Inclusion of exterior lights, incandescents

Residential vs. Nonresidential

- Need to verify number of bulbs sold to nonresidential customers
- Need to estimate similar measurements for nonresidential customers (leakage, installation, NTG rates)
- Coordinating closely with nonresidential EM&V contractor
 - Survey with nonresidential customers, property managers, contractors
 - Use of in-store intercepts

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Net-to-Gross

- Free ridership part of CA Residential Retrofit Evaluation
- CFL market effects study being conducted in parallel
 - Examines possible spillover (positive and negative)
- AESP Brown Bag on October 30, 2008

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Market Characterization Study CFL Buyer Actions and Opinions

A study to determine customer
actions regarding CFL Buyer
Installation Habits



Elements of the Study

Objective: Determine purchasing and installation habits of CFL purchasers

- Telephone Survey
 - Cannon Survey Center at UNLV
 - 1,250 households contacted representing a 90/10 Confidence Interval for SPR territories
- Intercept Survey
 - Paragon Consulting / Ecos Consulting
 - 27 Nevada Power customers and 29 Sierra Pacific Power customers

Findings

- The market is far from reaching saturation with 62% of responders in the telephone survey indicating that they have yet to purchase a CFL
- Purchasers are distributed with those purchasing 1-6 bulbs at a time being the largest segment followed by 7-12 bulbs
- 1st time buyers tend to be *investigating* and large purchasers are *using and inventorying*
- Telephone survey results - 83% / Intercept survey 82% CFLs replacing Incandescent lamp rate.
- CFLs replaced with new CFLs represents 17% Telephone survey and 18% Intercept survey.

Findings cont.

- Responders to the telephone survey reported a 28% shelving rate while the Intercept survey results were at 32%
- Results in an average 30% Shelving Rate
- In terms of the length of time on the shelf, the majority of responders to both surveys reported that they either *“didn’t know”* or that they *“replaced as bulbs burn out.”*

Assumptions

- The estimated life of an incandescent bulb is 1,000 hours or 334 days (*Source: EPA Energy Star Web site*)
- Currently installed incandescent bulbs have a remaining life of 167 days, hereafter referred to the half-life based upon the belief that bulbs currently in service span from “just installed” to “close to end of useful life” resulting in a median of 167 days remaining life.
- Similar assumption for CFLs based upon an 8,000 hour burn rate and an estimated three year shelf life
- Consumer knowledge regarding the proper use of CFLs in terms of appropriate fixtures and locations has sufficiently matured to assign bulb placement to those fixtures that represent the greatest average hourly usage per day. (*Source: EPA Energy Star Web site*)

Chart of Summary Statistics

Telephone Survey	Statistic	Percentage
# of Responders Telephone Survey	1250	100%
# of Responders - CFL Purchase within 90 days	472	38%
# of Responders - No CFL Purchase within 90 days	778	62%
# of CFLs Purchased by Responders	3954	100%
Average # of Lamps Purchased	8	
Most often selected size of CFL purchased	9-11 watt	49%
# Lamps most often purchased	2-6 lamps	53%
# of CFLs Installed immediately	2832	72%
# of Lamps Shelved	1122	28%
Average # of Lamps Shelved	4	NA
Responders installing CFLs immediately	202	43%
Responders shelving CFLs	270	57%
Most Reported Time from shelf to install	upon old bulb burn-out	67%
# Lamps reported as Replacing other Lamps*	3201	81%
Lamps purchased to replace Incandescents	2806	88%
Lamps purchased to replace existing CFLs	395	12%
# of Responders replacing Incandescents	406	83%
# of Responders replacing CFLs	84	17%
Intercept Survey		
# of Responders - Intercept Survey	56	100%
# of CFLs Purchased by Responders	835	100%
Average # of CFL Lamps Purchased	15	
Most often selected size of CFL purchased	13-15 watt	0.67
# Lamps most often purchased	13-24 lamps	0.32
# of CFLs Installed immediately	564	68%
# of Lamps Shelved**	271	32%
Average # of CFL Lamps Shelved**	10	
Responders installing CFLs immediately	29	52%
Responders shelving CFLs	27	48%
Most Reported Time from shelf to install	upon old bulb burn-out	88%
Lamps purchased to replace Incandescents	686	82%
Lamps purchased to replace existing CFLs	149	18%
* Difference between Total Purchased and Total Lamps Replacing other lamps represents "Don't Know" responses		
* Percentage heavily influenced by SPPC (72% of responses)		

Proposed Methodology

Objective: Determine a methodology by which energy savings credit can be assigned recognizing “shelving” as a buyer characteristic

- For purposes of assigning shelf life of Incandescent to CFL replacements (82% of all purchased CFLs), the assumption is that 100% of 30% shelved CFLs will be installed within Year One (within 334 days) post sale following a standard distribution bell curve (100% at 167 days).
- For those replacing CFLs with new CFLs (18% of purchased CFLs); the energy efficiency credit will be assigned over a three year shelf life based upon an 8,000 hour burn rating for currently available CFLs and will follow a standard distribution bell curve (100% in Year 2).

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Conclusions

- While purchases of CFLs are increasing, the utility's involvement in programs aimed at market transformation remains essential
- The majority of replacements (82%) are incandescent to CFL which supports the utility's reporting of significant energy savings impact
- There is some evidence that based upon CFL to CFL replacements (28%) that market maturity is occurring
- Respondent verbatims indicate that CFL EUL may not be as long as expected but those reports are, in most cases specific to manufacturers – *utilities caveat emptor on partnering*
- Residential customers are increasingly knowledgeable regarding placement of CFLs for maximum energy savings and achievement of Useful Life

Buyer Behavior Habits CFL Shelving/Storage Characteristics



Background

- NV Energy utilizes a Collaborative process to vet issues affecting the DSM Portfolio to best meet the collective needs of NV residents and the Utility.
- As a result of an NV Energy Collaborative meeting at which the original CFL market research was reviewed, the Companies requested additional research to:
 - Better understand consumer buyer behavior post-purchase regarding CFL shelving/storage.
 - The hoped for outcome would be supporting data that reflect how other utility's/state commissions/interest groups studied shelving/storage behaviors
 - How the entities incorporated those findings into formulae to more accurately account for energy savings.

Process

- Literature Search using:
 - DataBases
 - State Commission Reports
- Personal Discussions
 - Utility Personnel
 - LISTserves

Executive Summary

- Confirmation of Previous Report Findings
 - 88% of CF Lamps purchased were to replace incandescent lamps/ 12% replacing other existing CFLs
 - 72% of CF Lamps purchased were installed immediately and 28% were shelved/stored for installation at a later date. *Actual search results indicated lower storage rates of 7% to 23%.*
 - The majority of respondents indicating storage offered that installation would take place, “upon burn out of other bulbs” which creates ambiguity regarding calculation of shelf time for energy saving determination

Caveats

There are many impacts that must be considered

- Storage of and the length of storage of CFLs were not the primary research goals of the majority, if not all of the studies reviewed.
- Questions about stored CFLs, when asked, were presented differently in different studies and therefore may not be comparable. For example, some of the research posed questions regarding lamps delivered to the consumer through the program (either purchase or distributed) and others surveys simply ask about CFLs in the home (not necessarily referencing immediately purchased lamps). In this instance, not every CFL in the home may be a result of a CFL utility-sponsored program.
- There were no surveys identified that specifically addressed length of time the stored CFLs remained on the shelf prior to installation.

Search Findings

- No conclusive study/studies accurately calculate the average length of time a CFL when placed in storage/shelved remains in inventory until replacing an incandescent or a CFL lamp.
- Validation of the assumption of “replaced when an existing bulb burns out” is a reasonable basis for calculating probable shelf/inventory length of time.
- Use of Estimated Useful Life (EUL) is a reasonable methodology for determining when a stored/shelved CFL will be placed into service.
- Only through a minimum year-long continuing survey of CFL Purchasers who report shelving/storage as a percent of purchased CFLs to replace incandescent lamps can a more definitive shelf life be determined.
- A study to accurately determine CFL shelf/storage life where the lamp is intended to replace another CFL could take as long as eight to ten years.

Recommendation

- CFLs replacing Incandescent Lamps
 - For purposes of assigning shelf life of Incandescent to CFL replacements (82% of all purchased CFLs), the assumption is
 - that 100% of the 30% shelved CFLs will be installed within Year One (within 334 days) post sale.
 - Energy savings will be attributed to the shelved bulbs following a standard distribution bell curve resulting in 100% of the savings accrued at 167 days following the purchase date.

Recommendation

- CFLs replacing CF Lamps
 - For those CFLs replacing currently installed CFLs (18% of purchased CFLs); the assumption is
 - that 100% of the 30% of shelved CFLs will be will be assigned energy efficiency credit based upon an 8,000 hour burn rating for currently available CFLs
 - an acknowledgement that even though EUL may exceed a half life of 6 years, 100% of the energy efficiency credit will be taken in Year 2.

The reason for the justification of this deviation is that customers rarely retain purchased goods intended for use for longer than a period of two years. Further, the administrative cost of carrying forward Portfolio Energy Credits for a period in excess of two years is onerous and burdensome.

Estimation of Impact

- The following represents an estimation of impact of this recommendation based upon the 2007 Energy Star Lighting and Appliance program results

# of CFLs reported as Accrued to 2007 Program	2,047,321
# of kWhrs reported as CFL energy savings to First Year of 2007 Program	36,568,569
Estimated Shelf Adjustment (30%) to 2007 Report (Lamps)	573,250
Estimated CFL to Incandescent Impact (82%)	470,065
Estimated CFL to CFL Impact (18%)	103,185

Est. Impact on Savings

- Assumptions

- Lamps are purchased with an equal distribution over the 4 quarters (i.e. 511,830 are purchased each quarter)
- Only lamps purchased and stored in the first and second quarter would represent savings for CFL to incandescent in that program year. Lamps purchased and stored in the third and fourth quarter would have energy savings accrued to next program year.
- Lamps purchased and stored in program year 2007 and representing CFL to CFL replacements would accrue energy savings in the program year 2009.

Est. Savings Impact

All NV Energy Companies	2007 Program Year Stats	PY 2007 kWh Impacts	PY 2008 kWh Impacts	PY 2009 kWh Impacts
2007 Total Program CFL Savings	36,568,569			
Annual Stored Savings (30%)	10,970,570			
Quarterly Savings	9,142,142			
Quarterly Stored Savings	2,742,642			
Incandescent to CFL Stored		(4,497,934)	4,497,934	
CFL to CFL Stored		(1,843,056)	0	1,843,056

Conclusions

Utilities need to determine with their Commissions if accounting for shelving is required and appropriate

- Is the assumption that someone purchasing a CFL does so with the intention of installing the lamp? If so, should the utility take the energy savings at the time of purchase or the time of install?
- If the use of the savings distribution to account for shelving is challenged, the only verifiable methodology is a full study at a specified Confidence Level – is this cost justified?
- If pressured by the Commission to account for shelving, should the utility simply accept a reduction in total program energy savings?