How Do We Light a Way Forward?
Refined / Streamlined Shelf-Stocking Study Approach for Actionable Recommendations

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ABSTRACT

This research measured the availability and pricing of key light bulb types across a wide range of retailers to assess the remaining opportunity to promote residential lighting products and inform detailed strategies for program exit from these markets. A new shelf inventory approach was developed for this research which utilizes a rational selection process that mirrors consumer choice to identify an individual product SKU to represent each key product type under investigation. This new method leverages consumer purchase decision patterns to make actionable market intelligence available for key program design strategies at a fraction of the cost of typical shelf survey work. Moreover, although this method is demonstrated for lighting products in this study, the same method can be utilized wherever clear product characteristics delineate product types and where consumers make purchase decisions with a strong emphasis on first cost. This is particularly true with income qualified program purchases.

The key findings from this research were established by gathering and analyzing shelf stocking and program tracking data:

- First tier EISA compliant baseline halogen and incandescent bulbs for all shapes included in this study are widely available in the CT market.
- Nearly all LED product types are priced higher before program incentives than their first tier EISA compliant baseline counterparts.
- Program incentives are not sized according to the incremental first cost between LEDs and their corresponding baseline products.

A New Approach to Shelf-Stocking Studies

This research was designed to generate product availability and pricing information for key light bulb product types to inform market conditions and program planning to help the Energize CT program identify remaining opportunity in the residential lighting market and develop appropriate exit strategies from the market.

Data were collected in June 2020 in a sample of 33 retail locations throughout the state of Connecticut. The sample was stratified by retailer type (see Figure 1). The sample design leveraged the homogeneity within each national retailer (e.g. Home Depot, Lowe's, Target, Walmart) to represent over 60% of program activity with approximately one-third of the sample. For club stores and each national retailer, two locations were chosen within Eversource's service territory and one location within UI's service territory to ensure representation within both utility service territories. In all cases, sample store locations were selected randomly with probability proportional to size based on the YTD 2019 program activity.

A new approach was used in this shelf inventory compared to other studies within the region. It was not an exhaustive shelf inventory. Rather, it aimed to show a clear representation of the differences

between LED products and corresponding baseline products within key product types and retail channels primarily for program planning purposes. For each of 25 key product types (see Figure 2), a single model SKU was selected to be inventoried at each location.
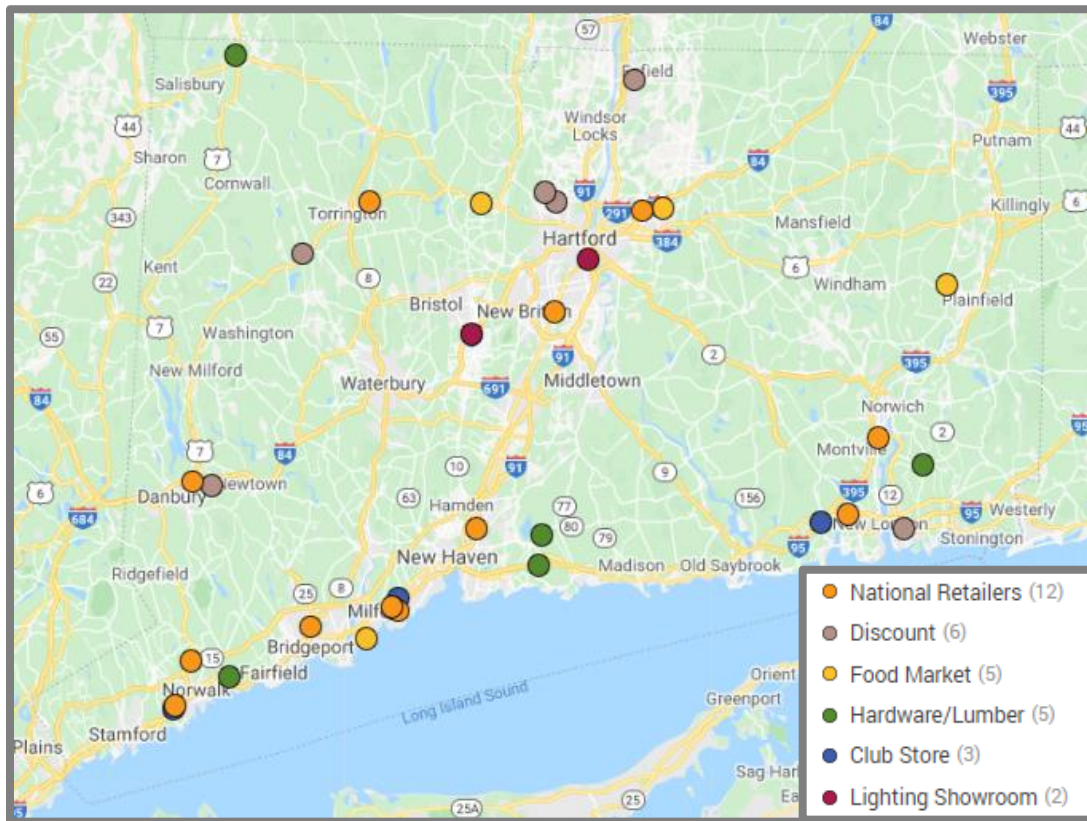

Figure 1. Sample Retail Locations Included in Study.

Technology	Shape	Equiv. Wattage	Dimmable?
LED	A-Line	60	
		75	Yes
		100	
		60	
		75	No
		100	
Incandescent/ Halogen	A-Line	60	
		75	Yes
		100	
LED	Globe	25	Yes
		40	
		60	
Incandescent/ Halogen	Globe	25	
		40	Yes
		60	

Technology	Shape	Equiv. Wattage	Dimmable?
LED	Candelabra	25	
		40	Yes
		60	
Incandescent/ Halogen	Candelabra	25	
		40	Yes
		60	
LED	BR30 Reflector	65	Yes
LED	BR30 Reflector	65	No
LED	5/6 Retrofit Kit	75	Yes
Incandescent/ Halogen	BR30 Reflector	65	Yes

Figure 2. Key Product Types for Light Bulbs.

The individual SKUs to be inventoried were selected on-site to represent the product type much in the same way that a consumer selects exactly which SKU to purchase within a certain set of parameters regarding the product that they need. In some cases (e.g. often in discount stores), there was only one SKU to select within each product type. In others (e.g. DIY, mass merchant), there were multiple options within product types – different brands, different package sizes, different color temperatures.

Certain consumer preference characteristics such as color temperature do not affect product efficiency or pricing. As such, these were chosen arbitrarily in this study. For example, wherever possible, soft white (≈2700K) products were inventoried. Other characteristics such as brand and package size DO have an impact on product pricing. Where choices needed to be made between competing SKUs with these price varying characteristics, a SKU was selected based on the price information available. Two guidelines were used in these cases to make the selection: 1) the availability of non-program pricing on the shelf at the time of data collection and 2) the lowest non-program price per bulb.

As an example, consider the selection process for a SKU to represent the dimmable 60W equivalent A-Line LEDs in a Lowe's location in Waterford, CT. Figure 3 shows the general-purpose lighting bay at the location. The baseline first tier EISA complaint halogen products were on the top shelf at this location. The basic, non-dimmable LEDs were on the bottom shelf. The dimmable LEDs of various wattage equivalencies, model type, and color temperature occupied the remainder of the bay. In this location, GE products were the dominant brand available.

Figure 3. Lighting Bay at DIY Retailer (Lowe's, Waterford, CT).

Within the dimmable 60W equivalent A-Line LED product type, there were three main decision points:

1) **Model Line**. There were 4 main model lines to choose from: Classic, Relax, Refresh, and Reveal. The Classic line was chosen because it is the least expensive before program incentives.

2) **Color Temperature**. As stated previously, soft white color temperature was chosen arbitrarily since it does not affect pricing or efficiency level.

3) **Package Size**. Here is where things get a little more complicated. There are 2 GE Classic, soft white packages on the shelf that contain the same product model. An 8-pack, non-program package (GE model: LED10DA19/827; 93122485) is selling for $18.98 ($2.3725/bulb) and a 4-pack program bulb (GE model: LED10DA19/827; 93122484) that has a non-program price of $9.98 ($2.495/bulb) and a program price of $4.98 ($1.245/bulb).

The 8-pack non-program bulb was selected for inventory because its non-program price was slightly lower than the 4-pack configuration of the same bulb ($2.3725/bulb compared to $2.495/bulb). This SKU most favorably represents the Dimmable 60W equivalent A-Line LED product type.

The result of this selection process was to inventory products that favorably represent the product type without the program adjusted pricing influence. This ensured that the research gathered market data that could accurately address the research goal of assessing the future opportunity to promote residential lighting products.

For each SKU inventoried, additional product characteristics: bulbs per package, wattage, light output, and color temperature were captured. Retailer specific information: shelf area, regular retail price (non-program price), and program adjusted price were captured (where available). Additionally, whether the SKU was ENERGY STAR labeled or labeled by the Energize CT program was captured.

Results

Product Availability Results

Table 1 provides a breakdown of where key product types are available in each retail channel. The values for each product type row in the table show the percent of individual locations where products of the given type were available. The values in the top row of the table show the total number of locations in the sample for that retail channel. Blank cells represent channels where the given product type is unavailable (for example, there were no 75W equivalent A-Line bulbs in any of the club stores that were visited).

National Retailers were categorized into DIY (Home Depot and Lowe's) and Mass Merchant (Target and Wal-Mart) to allow better comparison with other studies of retail programs. Food Market is represented alone since no Drug Store locations were selected into the sample. Also, there are no data on Lighting Showrooms since those locations could not be inventoried due to Covid-19 guidelines.

Table 1. Product Availability Results by Retail Channel

Shape	Tech	Dim	Equiv. Watts	Club Store	Discount Store	DIY	Food Market	Hardware/ Lumber	Mass Merch.
TOTAL LOCATIONS[+]:				3	6	6	5	4	6
A-Line	LED	Yes	60	100%[*]	100%	100%	100%	100%	100%
A-Line	LED	Yes	75	[#]	33%	100%	60%	100%	100%
A-Line	LED	Yes	100	100%	83%	100%	80%	100%	100%
A-Line	LED	No	60		33%	100%	60%	100%	67%
A-Line	LED	No	75				60%	100%	67%
A-Line	LED	No	100			100%	60%	100%	67%
A-Line	Halogen	Yes	60		33%	100%	80%	100%	100%
A-Line	Halogen	Yes	75			100%	80%	100%	100%
A-Line	Halogen	Yes	100		33%	100%	80%	100%	100%
Globe	LED	Yes	25				40%	50%	50%
Globe	LED	Yes	40		33%	100%	60%	100%	100%
Globe	LED	Yes	60			100%	40%	100%	100%
Globe	Incand	Yes	25			100%	40%	75%	33%
Globe	Incand	Yes	40		33%	100%	60%	75%	50%
Globe	Halogen	Yes	60		17%	67%	40%	75%	33%
Candelabra	LED	Yes	25			100%	20%	100%	50%
Candelabra	LED	Yes	40	100%	17%	100%	60%	100%	100%
Candelabra	LED	Yes	60		17%	100%	40%	75%	100%
Candelabra	Incand	Yes	25			100%	60%	100%	17%
Candelabra	Incand	Yes	40		33%	100%	80%	100%	50%
Candelabra	Incand	Yes	60		33%	100%	80%	100%	50%
BR30 Reflector	LED	Yes	65	100%	50%	100%	60%	100%	100%
BR30 Reflector	LED	No	65					75%	17%
5/6 Retrofit Kit	LED	Yes	75	100%	17%	100%		100%	17%
BR30 Reflector	Incand	Yes	65		33%	100%	80%	100%	50%

[+] Total number of sample locations for each retail channel.   [*]Values represent percent of locations with product type available.
[#] Blank cells = 0%.

Some key findings for product availability are:

- Baseline incandescent and halogen products are widely available in DIY, Food Markets, Hardware/Lumber, and Mass Merchants, especially for general purpose A-Line bulbs.

- LED products are widely available in all retail channels.

- Discount stores, except Dollar stores, do not carry baseline products and primarily only carry LED products that are "brought in" by the Energize CT program.

- Club stores sampled do not carry baseline products of any type.

- 25W equivalent LEDs and baseline specialty products (G25 Globes and Candelabra) are less commonly available across all retail channels than are brighter bulbs (esp. 40W equivalent).

- Dimmable LED BR30 directional products and their corresponding baseline incandescent bulbs are widely available across all retail channels. Non dimmable BR30 products are rarely available.

Non-Program Pricing Results

Upstream lighting programs have promoted lighting products using incentives to reduce the first cost disadvantage of efficient products compared to baseline products. A key determination of the remaining opportunity to promote LEDs is whether an incremental first cost still exists between LEDs and baseline products, and if so, how large it is.

The figures below provide the non-program pricing information (the price before program incentives) for four key LED product types and their corresponding baseline products. In all cases, the average non-program price per bulb from varying package configurations (based on what was inventoried for the key product type in each location) is presented. In all cases, this pricing does not include program incentives. A reminder that pricing information in this research does NOT represent an average of all SKUs and all package configurations within each key product type. It is the average of the individual SKUs chosen to represent the key product type in each location. As such, this pricing information does not represent the full range of pricing available in the market, but rather shows a clear representation of the difference between key efficient and baseline products in the market for planning purposes.

For the figures below, the error bars reflect the 80% confidence intervals for the observations. Some product-retail channel combinations have extremely small sample sizes and correspondingly large confidence intervals, and in some other instances there is little price variation across the market leading to small or non-existent confidence intervals. Table 1 above provides the sample sizes for each product and retailer combination. The fraction of total program incentives processed through the individual retail channels are shown in the horizontal axis labels to show the volume of program activity. These fractions sum to 94%. The remaining program sales are through Drug Stores (2%), Miscellaneous (1%), and pop-up retailers and special event sales (3%). Although Drug Stores were grouped together with Food Markets in the sample selection, no Drug Stores were randomly selected into the sample, so results represent Food Markets alone. LED pricing is shown in green and baseline product pricing is shown in red for all figures.
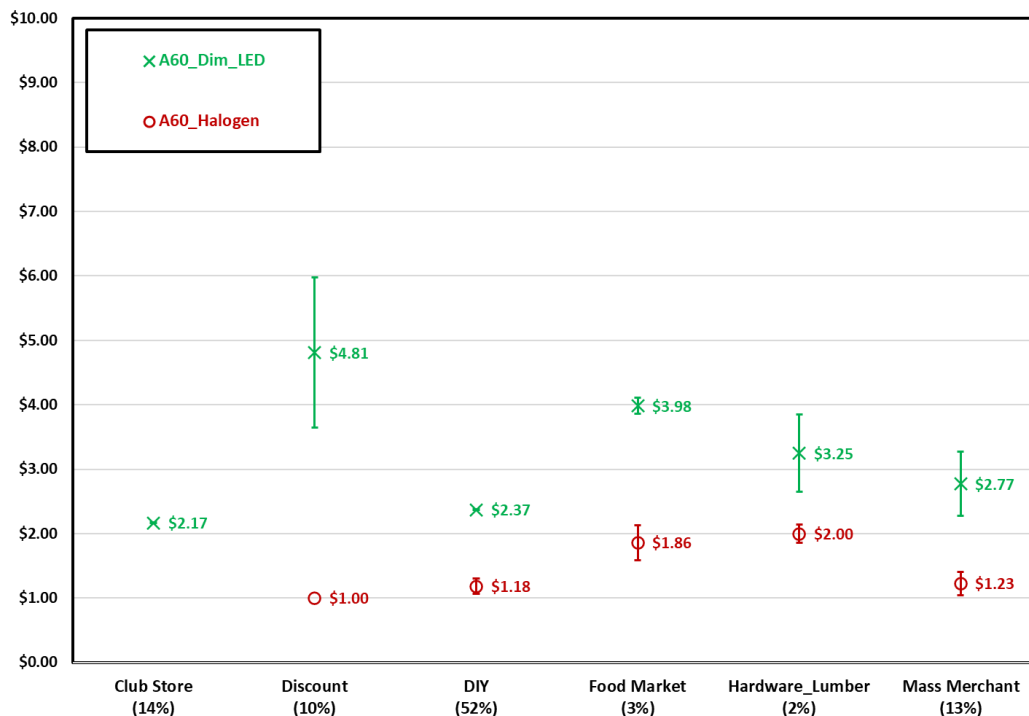

Figure 4. Non-Program Pricing Information for Dimmable 60W Equivalent A-Line Bulbs.
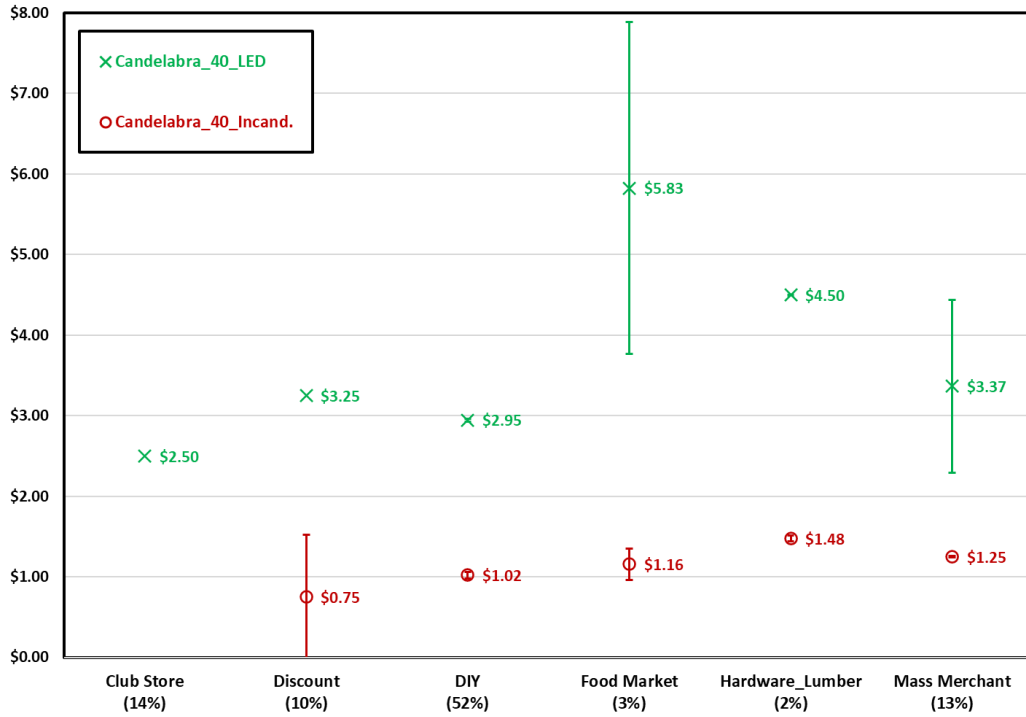
Figure 5. Non-Program Pricing Information for Dimmable 40W Equivalent Candelabra Bulbs.
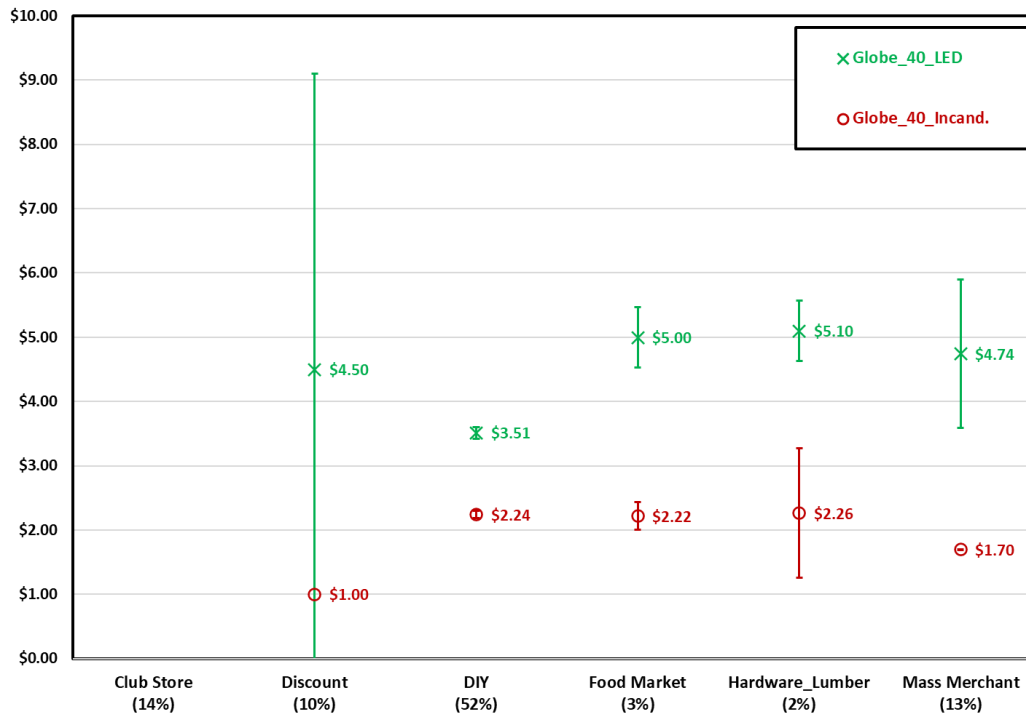

Figure 6. Non-Program Pricing Information for Dimmable 40W Equivalent G25 Globe Bulbs.
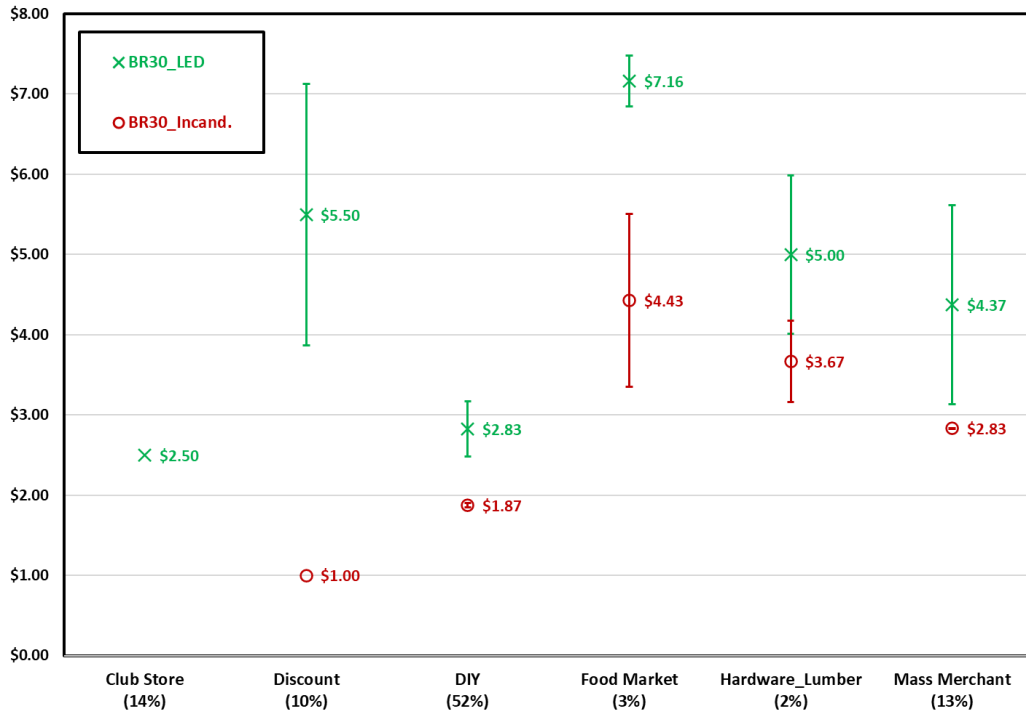
Figure 7. Non-Program Pricing Information for Dimmable 65W Equivalent BR30 Directional Bulbs.

Some key findings for non-program pricing are:

- In nearly all combinations of product type and retail channel, LED are statistically more expensive in first cost to the customer than their baseline counterparts.

- Baseline products tend to be more similarly priced across retail channels than LEDs – especially A-Lines, Candelabras, and Globes.

- This new approach generates incremental first costs between LEDs and baseline products that are statistically significant and can be compared to average incentive levels to yield actionable program design changes (see next section).

Incremental First Costs Compared to Program Incentives Results

The incremental first cost pricing information generated in this research compared to program incentive levels generates additional insight regarding the effectiveness of program design. This comparison particularly addresses the question of whether incentives are sized to cover the first cost disadvantage for LEDs. Program tracking data were used to calculate the sales weighted average incentive levels for the key product types in the study.

Tables 2 and 3 below show the Incremental first cost (IC) between LEDs and baseline products and Average Program Incentives (AI) for each of the product type and retail channel combinations. In product type/retail channel combinations where the % AI/IC is far from 100%, program designs could be altered to improve overall program effectiveness and cost efficiency.

Table 2. Incremental First Cost and Program Incentives by Retail Channel: DIY & Mass Merchant

LED Product	DIY			Mass Merchant		
	Incr. Cost (IC)	Avg. Incent. (AI)	% AI/IC	Incr. Cost (IC)	Avg. Incent. (AI)	% AI/IC
60W Equivalent A-Line	$1.19	$1.12	95%	$1.55	$1.30	84%
75W Equivalent A-Line	$2.96	$1.70	57%	$4.29	$1.03	24%
100W Equivalent A-Line	$3.66	$1.81	50%	$5.62	$1.58	28%
25W Equivalent Candelabra	$2.10	$1.41	67%	$0.49	$1.02	208%
40W Equivalent Candelabra	$1.92	$1.70	88%	$2.12	$1.47	70%
60W Equivalent Candelabra	$2.29	$1.82	80%	$2.70	$1.61	60%
25W Equivalent Globe				$0.96		
40W Equivalent Globe	$1.27	$1.77	140%	$3.05	$1.07	35%
60W Equivalent Globe	$1.36	$2.02	148%	$2.75		
Retrofit Kits	$7.17	$3.63	51%	$3.35	$2.50	75%
65W Equivalent Directional	$0.95	$1.67	176%	$1.54	$1.79	116%

$#.## Average Incentive EXCEEDS Incremental First Cost.
$#.## Average Incentive less than 50% of Incremental First Cost.

Table 3. Incremental First Cost and Program Incentives by Retail Channel: Discount, Food, Hardware

LED Product	Discount			Food Market			Hardware/Lumber		
	Incr. Cost (IC)	Avg. Incent. (AI)	% AI/IC	Incr. Cost (IC)	Avg. Incent. (AI)	% AI/IC	Incr. Cost (IC)	Avg. Incent. (AI)	% AI/IC
60W Equivalent A-Line	$3.81	$1.59	42%	$2.12	$1.90	89%	$1.25	$1.82	146%
75W Equivalent A-Line		$1.91		$5.03			$4.34	$1.70	39%
100W Equivalent A-Line	$4.00	$2.27	57%	$7.11	$1.92	27%	$5.12	$1.79	35%
25W Equivalent Candelabra		$2.25		$3.40			$3.40		
40W Equivalent Candelabra	$2.50	$2.27	91%	$4.67	$2.50	54%	$3.02	$2.46	82%
60W Equivalent Candelabra	$4.75	$2.50	53%	$4.71	$2.50	53%	$4.21	$2.50	59%
25W Equivalent Globe				$2.50			$2.07		
40W Equivalent Globe	$3.50	$2.30	66%	$2.78	$2.47	89%	$2.84	$2.50	88%
60W Equivalent Globe				$1.00			$1.18		
Retrofit Kits	$13.49						$8.83		
65W Equivalent Directional	$4.50	$3.19	71%	$2.73	$3.43	125%	$1.33	$3.08	231%

$#.## Average Incentive EXCEEDS Incremental First Cost.
$#.## Average Incentive less than 50% of Incremental First Cost.

Some key findings for incremental first cost compared to average incentives are:

- In nearly every retail channel, incentives reduce the purchase price for 65W equivalent BR30 directional LEDs to less than the price of equivalent baseline bulbs.

- In several retail channels for 75W and 100W equivalent A-Line bulbs, incentives reduce the purchase price of LEDs, but efficient products remain more expensive than equivalent baseline bulbs.

- Incentives for 25W equivalent LEDs in mass merchant and both 40W and 60W equivalent LED G25 globes in DIY reduce the purchase price for efficient products to less than the price of baseline products.

Discussion

The preceding sections have demonstrated how a new approach to shelf survey study can bring actionable market information to key program design strategies for lighting products. This new method can be implemented at a fraction of the cost of typical shelf survey work. The method is less costly because of reductions both in data collection time and more straightforward analysis made possible by a stronger signal to noise ratio for these kinds of data. Clearly, the method does not capture all the variability present in the market, but it is easily scalable, intuitive to implement, and captures market information in a manner that is ideal for improving program design.

As lighting programs are adjusting to changing market conditions and federal regulations and targeting harder-to-reach customers, it is increasingly important to design program strategies that are exactly "dialed-in" to the levels needed to promote products to the customers who need the assistance most in the locations where those customers are shopping. This new shelf study approach allows program sponsors to gather the needed information in a manner that is cost efficient and accurate for the market conditions specific to their geographic region rather than relying on national data or data from other regions.

Although this paper describes the approach applied to residential retail lighting program efforts, the approach could also be used for other product categories. It is clear that the opportunity to promote residential lighting is diminishing as the LED market strengthens and federal conservation standards move forward that will likely disallow the sale of lower cost, inefficient halogen baseline products in the U.S. market over the next few years. The method is best applied to products at retail where pricing and availability information is needed to refine program design strategies for products with clear product characteristics that allow for the creation of a taxonomy of key product types. It also makes the most sense in cases where there are a relatively large number of product models on display and/or when completing a full inventory of available models is time intensive.

Consider, for example, large appliances such as refrigerators or laundry equipment. In these cases, most retailers display a wide range of model choices, and the inventory process (with complicated model numbers) is costly and fraught with logistical challenges. The product displays are less complicated visually than the lighting category, but there can be 40-70 refrigerator models available and 20-50 clothes dryer models available to be inventoried depending on the retailer. However, there are only a few key product characteristics that govern program design and savings opportunities: ENERGY STAR vs. baseline, size/capacity, product configuration (e.g. top-loading vs. front-loading, bottom freezer vs. side by side, etc.). So, using this new method for shelf inventory, these characteristics would be used to identify a handful of key product types, and then the SKU/model selection process (e.g. price point, brand, etc.) guides the selection of a single SKU (or even a small sample of SKUs) to represent that key product type.

Given the emphasis that can be placed on cost in SKU selection, this new approach is an ideal tool for income qualified program efforts where first cost is a key barrier to the adoption of energy efficiency. As programs continue to address equity concerns and try to extend evaluated results, this kind of actionable information is critical. Also, as income qualified programs still promote residential lighting measures to harder-to-reach customers, this method provides a cost-efficient way to collect local market information to adequately inform program design and ensure program cost effectiveness.

Conclusion

In conclusion, this paper describes a new method for shelf inventory study that provides much needed information about product availability and pricing at a reasonable cost to program sponsors. The method has demonstrated value both for assessing market conditions and refining program design in residential lighting programs, but also has applicability in other product types.