

Examining Price Differentials between CFL and Incandescent Light Bulbs: Do Multi-packs and Specialty Bulbs Matter?

Greg Clendenning, Nexus Market Research, Inc., Arlington, VA
Lynn Hoefgen, Nexus Market Research, Inc., Cambridge, MA
Angela Li, National Grid, Northborough, MA
Gail Azulay, NSTAR, Boston, MA

ABSTRACT

The Massachusetts ENERGY STAR[®] Lighting Program, an ongoing effort to encourage the use of ENERGY STAR-qualified lighting among residential customers, has in recent years increasingly expanded beyond single-pack spiral CFLs to include rebates for multi-pack CFLs and specialty CFLs such as flood, A-bulb or 3-way bulbs.¹ A key question for program managers is the extent to which rebates need to be tailored to account for specialty CFLs and CFLs sold in multi-packs. Other key questions include the extent to which market transformation is taking place and whether price differentials between CFLs and comparable incandescent bulbs are declining.

This study uses data from a survey of lighting product retailers conducted in Massachusetts in early 2008 to assess the differences in prices between CFLs and comparable incandescent bulbs, to estimate the incremental costs of various CFL features, and to compare with findings from early 2006 (see Clendenning et al. 2007).

Results from this analysis show a decline in the incremental cost of a CFL over a comparable incandescent bulb from 2006, as well as lower incremental costs for CFLs sold in big box stores and sold in multi-packs. In addition, our analysis suggests that the price difference between specialty CFLs and specialty incandescent bulbs is similar to the price difference between a standard spiral CFL and a standard incandescent bulb. This analysis can help program managers develop appropriate incentive levels for CFL light bulbs as they take into account factors such as place of sale and bulbs sold in multi-packs.

Introduction

This study uses data from a survey of lighting product retailers conducted in Massachusetts as part of the Market Progress and Evaluation Report (MPER) for the 2007 Massachusetts ENERGY STAR Lighting Program. The Massachusetts ENERGY STAR Lighting Program is an ongoing effort to encourage the use of ENERGY STAR-qualified lighting among residential customers. For many years the Massachusetts Sponsors, both individually and collectively, have had active energy-efficient lighting programs that included markdowns/buydowns, catalog sales, direct installs, retail coupons, and consumer education. The Sponsors also work with other regional programs through the Northeast Energy Efficiency Partnerships (NEEP) to leverage program effectiveness by aggregating markets and coordinating consumer messaging. Additionally, all Sponsor lighting initiatives are coordinated with and designed to support the national ENERGY STAR program.

Since 2002, the Sponsors' Lighting Program has included three basic components:

- Negotiated Cooperative Promotions (NCP), more commonly known as markdowns and/or buydowns
- The ENERGY STAR Lights catalog (and website)
- Instant rebate coupons

¹ Throughout the rest of this paper we will use the term "spiral CFL" to refer to a spiral CFL with no specialty features.

In 2007, 89% of the products distributed through the Massachusetts ENERGY STAR Lighting program came from the NCP component. NCPs represent the Sponsors' most extensive effort to support industry initiatives promoting ENERGY STAR-qualified lighting products. NCPs are agreements with manufacturers and their retail partners to discount selected ENERGY STAR-qualified bulbs and fixtures as well as provide other promotional support such as advertising, point-of-purchase (POP) materials, and consumer education activities.

Since 2006, the NCP program has had structured incentive levels using a tiered approach based on wattage level, package size, program model (markdown/buydown, catalog and instant coupons), and additional product features, with higher incentives paid for higher wattage CFLs, those sold through markdowns rather than buydowns, and specialty bulbs. In 2007, the NCP buydown program reduced product prices by a range of \$1.40 to \$2.00 for standard bulbs in single-bulb packages, up to \$2.85 for specialty bulbs, up to \$3.50 for reflectors, and \$0.85 to \$2.45 per bulb in multi-packs. Prices for bulbs sold through the NCP program have in some cases been comparable to prices for incandescents. Setting appropriate incentive levels is an important issue as CFL prices tend to decline over time. For example, the import value of a CFL has declined from \$2.20 per CFL in 2004 to \$1.67 per CFL in 2007 and one would expect CFL prices to decline if import values decline (Table 1).

Table 1: Annual U.S. Sales of Residential Screw-Based CFLs²

Year	U.S. Residential CFLs	Import Value per CFL	% Change from Previous Year
2004	82,000,000	\$2.20	NA
2005	90,000,000	\$2.00	-9.1%
2006	163,000,000	\$1.71	-14.7%
2007	349,000,000	\$1.67	-2.3%

Program-related sales of CFLs have increased dramatically since the Sponsors first began offering a joint efficient lighting program—from 158,000 in 1998 to 2.6 million in 2007, and lifetime savings resulting from the 2007 program year are estimated to be 1,655,000 MWh, as adjusted for hours of use, in-service rates, and free ridership, and spillover. The average cost per MWh saved is estimated to be about \$5. Total sales of CFLs in Massachusetts in 2007—including program-supported sales—appeared to amount to nearly 13.3 million bulbs and accounted for nearly 19% of 2007 sales of medium-screw based bulbs in Massachusetts (NMR, RLW Analytics and Conant 2008).³

Program-related shipments of CFLs have shifted in recent years to include more specialty CFLs and more bulbs sold in multi-packs (**Figure 1**). For example, bulbs sold in multi-packs accounted for 57% of all bulbs distributed through the NCP program in 2007 compared to 12% of all NCP bulbs in 2005, while specialty bulbs accounted for 13% of NCP bulbs in 2007 compared to 6% in 2005 (NMR, RLW Analytics and Conant 2008 and NMR et al. 2006).

² See NMR, RLW Analytics and Conant 2008 for more details.

³ In Massachusetts in 2005, program related shipments of CFLs totaled 3.3 million and total sales of CFLs totaled nearly 6 million (NMR et al. 2006).

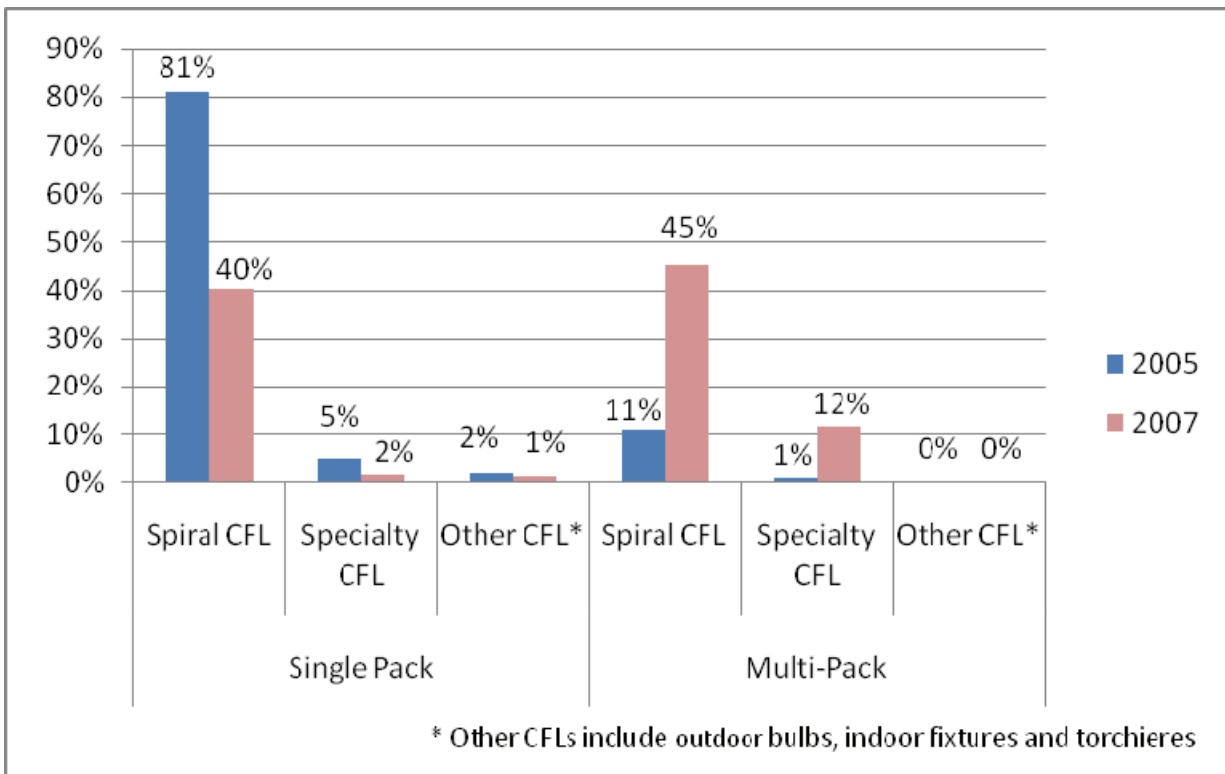


Figure 1: Types of CFLs distributed through the NCP Component of the Massachusetts ENERGY STAR Lighting program, 2005 and 2007⁴

Results from a stocking inventory conducted during in-store visits to Massachusetts retailers found a similar shift in stocking practices, as well as more widespread stocking of CFLs by Massachusetts retailers in 2008 than in 2006 (Table 2). Eighty-seven percent of lighting retailers visited in Massachusetts in 2008 stocked standard spiral CFL bulbs, compared to 70% of retailers in 2006. CFL A-Bulbs and Flood bulbs were the next most commonly found CFL, stocked by approximately 44% and 42% of retailers in 2008, respectively and representing 8% and 9% of all CFL bulbs stocked, respectively. Overall, there was an increase in the prevalence of specialty bulbs from 2006 to 2008 (NMR, RLW Analytics and Conant 2008 and NMR et al. 2006).

⁴ Other CFLs include outdoor bulbs, indoor fixtures and torchieres.

Table 2: Massachusetts CFL Stocking Inventory

Type of CFL ⁵	2006		2008	
	Percent of MA Stores Stocking Bulb	Percent of Total CFL Bulbs Stocked	Percent of MA Stores Stocking Bulb	Percent of Total CFL Bulbs Stocked
Spiral	70%	66%	87%	66%
Quad Tube	29%	2%	<1%	<1%
A-Bulb	1%	2%	44%	8%
Flood	5%	5%	42%	9%
Globe	4%	5%	31%	3%
Candelabra	1%	0%	26%	3%
Spiral 3-way	NA	NA	15%	3%
Other screw-based CFLs ⁶	NA	2%	NA	1%
Pin-based CFLs ⁷	NA	19%	NA	7%
TOTAL	NA	100%	NA	100%

Methodology

This study uses data from a survey of lighting product retailers conducted in Massachusetts in early 2008 to assess the differences in prices between CFLs and comparable incandescent bulbs, and extends analysis conducted using data from early 2006. For the analysis we used data on 1,718 unique bulbs that were collected from a total of 40 retailers, including retailers participating in the NCP program, non-participating stores in participating chains, and non-participating retailers. Stores were sampled in order to best estimate CFL sales in Massachusetts.⁸ Data were collected on standard incandescent bulbs and standard spiral CFLs, bulbs sold individually and in multi-packs, and several specialty bulbs, including flood, three-way and A-bulbs. Bulb price was corrected for any program incentives. We conducted analyses to answer the following sets of questions:

1. What is the incremental cost of a CFL over an incandescent light bulb among medium screw-based bulbs, controlling for wattage, place of sale, and bulbs sold individually or in multi-packs? How does the incremental cost in 2008 compare to 2006?
2. Among CFL bulbs alone:
 - a. What is the incremental cost per lumen for ENERGY STAR certification, CFLs sold in multi-packs, CFLs sold in big box stores, and various specialty features?

To estimate the incremental cost of a CFL over an incandescent light bulb among medium screw-based bulbs we used logistic regression to predict whether a bulb was a CFL or an incandescent based upon price per bulb (without Sponsor incentive), wattage and place of sale (a big box store such as Home Depot or Wal-Mart, or a grocery, drug store, or small hardware).⁹

Logistic regression is an analytical technique that predicts a binomial outcome, in this case CFL bulb or incandescent bulb, with multiple independent variables that can be both continuous data and categorical. With the results of our logistic regression model we can calculate probabilities of a bulb being classified as a

⁵ All bulbs are screw-based unless otherwise indicated

⁶ Other screw-based CFLs include bullet, torpedo, double tube and circline bulbs

⁷ Pin based CFLs include spiral, quad tube, double tube and circline bulbs

⁸ Bulbs were differentiated by type of bulb, specialty features, place of sale, type of base, program support, manufacturer, wattage, lumens of light output single vs. multi-packs, and other factors. For more information on the store sampling procedures see Appendix C-1, NMR, RLW Analytics and Conant 2008.

⁹ Our logistic regression model was limited to bulbs with a price of \$11 or less and excluded incandescent over 150 Watts and less than 25 Watts. Comparable CFLs for extremely high and low wattage incandescent bulbs are not readily available.

CFL or incandescent (dependent variable), based upon a specified model of wattage, price, retailer type and single or multi-pack bulbs (independent variables).

We also used multiple linear regression analyses to estimate the price difference between an ENERGY STAR CFL and a non ENERGY STAR CFL, while controlling for lumens of light output, single or multi-pack bulbs, specialty features of CFL bulbs such as dimmability, covered, 3-way, A-line, and place of sale (Table 7).¹⁰

Analysis and Discussion

Incremental Cost Analysis

The result of our specified model is as follows:

$$\text{Logit}(\pi) = 5.331 - .492*(\text{Watts}) + 1.567*(\text{Price per bulb}) + 1.62*(\text{Place of sale}) + 1.405*(\text{Multipack})^{11}$$

Where:

π = the probability of a bulb being identified as a CFL

Watts is the wattage of the bulb

Price per bulb is the price of the bulb in dollars

Place of sale is 1 for a big box store and 0 for a non-big box store,¹² and

Multipack is 1 for bulbs sold in multipacks of two or more bulbs and 0 for bulbs sold individually.

The model was highly significant, with an overall χ^2 value of 1,801.55 ($p < .001$), and the model correctly identified 98% of the bulbs in the data set ($n = 1,718$).

From this model we estimate that, taking into account incentives provided by the Sponsors, the incremental cost of a CFL over a comparable incandescent bulb was \$2.80 in early 2008, and that a CFL cost \$1.03 less at a big box store than at a non-big box store. In comparison, our 2006 analysis estimated the incremental cost of a CFL over a comparable incandescent bulb to be considerably higher at \$4.39, but the incremental cost of a CFL at a non-big box store over a big box store was very similar to the 2006 estimate at \$0.97. In addition, we estimated that Medium Screw-Based (MSB) CFLs sold in multipacks in early 2008 cost \$0.90 less than bulbs sold individually.¹³ We should note, however, that our logistic regression analysis does not give estimates of bulb prices *per se*. Instead, it produces a probability that a given bulb is a CFL or an incandescent at a specified combination of wattage, price place of purchase, and single or multi-pack bulbs. According to the model, as price increases, the bulb is more likely to be identified as a CFL; conversely, as wattage increases, it is more likely to be identified as an incandescent bulb. As a result, the model is not as effective at estimating prices at low and high wattages.

Our model is based on the assumption that CFL and incandescent bulbs are essentially interchangeable and that two of the primary factors affecting a consumer's choice between CFLs and incandescent bulbs are wattage and price. Our model offers some support for these assumptions as wattage is the most influential variable in the model, followed by price. Interestingly, when variables accounting for specialty features such as flood, globe and candelabra bulbs are included in the model they do not improve its performance (though the variables are significant). Our model confirms our original assumptions that wattage and price are the primary factors differentiating CFL and incandescent bulbs.

¹⁰ All pin-based CFL bulbs were excluded from this analysis.

¹¹ All independent variables in the model are significant at $p \leq .004$

¹² The following stores were classified as a big box store: BJ's, Home Depot, Lowe's, and Wal-Mart

¹³ The 2006 data did not include information about multipacks.

Using data from the Department of Energy’s Office of Energy Efficiency and Renewable Energy, Table 3 shows categories of wattage equivalents for CFL and incandescent bulbs, from which we have derived our price estimates for both CFL and incandescent bulbs from the corresponding wattages below:

Table 3: Comparable Wattage of CFL and Incandescent Bulbs

Incandescent Wattage	CFL Wattage
25	5
50	9
60	15
75	20
100	25
120	28
150	39

Source: U.S. Department of Energy

To derive the price estimate of a CFL, we solved for the price of a bulb of a given wattage that resulted in a high probability of the bulb being identified as a CFL (90% probability). Conversely, to estimate the price of an incandescent, we solved for the price of a bulb at the same wattage that resulted in a low probability of being identified as an incandescent (10% probability). In other words, the price at the 10% probability corresponds to the price at which a consumer would likely choose a comparable incandescent for that particular CFL wattage. For example, we estimate the price of a single 25-watt CFL to be \$5.85 (price at the 90% probability level) while we estimate the price of a comparable single-pack 100-watt incandescent to be \$3.05 if both bulbs were purchased at a non-big box store (see Table 4). We should note that prices for incandescent bulbs may appear high because the model includes specialty bulbs, such as flood and 3-way bulbs. The same 25-watt CFL would cost approximately \$4.82 at a big box store while the same 25-watt CFL sold in a multi-pack at a big box store would cost approximately \$3.92 per bulb. As probabilities exceed the 50% level (marked with a ↓ in Table 4), the bulb is more likely to be identified as a CFL, and as probabilities fall below 50%, the bulb is more likely to be identified as an incandescent. As was noted earlier, the model is not as effective at estimating prices at the lowest or highest wattages (i.e., 5 watts or 9 watts in Table 4), as all bulbs are CFLs at these low wattage levels. For illustration purpose, Table 4 shows an example for non-big box stores.

Table 4: Bulb Price Estimates and Probabilities, Non-Big Box Stores

Probability	5 W CFL / 25 W Incand.	9 W CFL / 50 W Incand.	15 W CFL / 60 W Incand.	20 W CFL / 75 W Incand.	25 W CFL / 100 W. Incand.	28 W CFL / 120 W Incand.	39 W CFL / 150 W. Incand.
5%	-\$3.71	-\$2.46	-\$0.57	\$1.00	\$2.57	\$3.51	\$6.96
10%	-\$3.23	-\$1.98	-\$0.09	\$1.48	\$3.05	\$3.99	\$7.44
25%	-\$2.53	-\$1.28	\$0.61	\$2.18	\$3.75	\$4.69	\$8.14
50%	-\$1.83	-\$0.58	\$1.31	\$2.88	\$4.45	\$5.39	\$8.84
75%	-\$1.13	\$0.13	\$2.01	\$3.58	\$5.15	\$6.09	\$9.54
90%	-\$0.43	\$0.83	\$2.71	\$4.28	\$5.85	\$6.79	\$10.25
95%	\$0.05	\$1.30	\$3.19	\$4.76	\$6.33	\$7.27	\$10.72

Comparing our model results to the average prices of incandescent and CFL bulbs from our data set, it appears that our model reasonably estimates the price difference between a CFL and a comparable incandescent bulb (Table 5). Mean prices for both incandescent and CFL bulbs include specialty bulbs.

Table 5: Average Bulb Price of Incandescent and CFL Bulbs

Wattage (Incandescent / CFL)	Mean Price, Incandescent	Mean Price, CFL	Difference in Mean Prices	n, Incand.	n, CFL
25w / 3w to 7w	\$2.08	\$5.18	\$3.10	135	18
40w / 9w to 12w	\$1.78	\$4.66	\$2.88	290	85
60w / 13w to 16w	\$1.95	\$4.71	\$2.75	278	170
75w / 18w to 20w	\$2.31	\$4.69	\$2.37	105	59
100w / 22w to 28w	\$2.31	\$5.77	\$3.46	185	102
150w / 30w to 45w	\$2.84	\$8.77	\$5.92	76	22

Similarly, when we compare our model results to the average prices of incandescent flood bulbs and CFL flood bulbs from our data set, it appears that our model reasonably estimates the price difference between a CFL and a comparable incandescent bulb (Table 6). The price difference between an incandescent flood bulb and a comparable CFL flood bulb is similar to the price difference between a standard incandescent bulb and a spiral CFL.

Table 6: Average Bulb Price of Incandescent and CFL Flood Bulbs

Wattage (Incandescent / CFL)	Mean Price, Incandescent	Mean Price, CFL	Difference in Mean Prices	n, Incand.	n, CFL
40w / 11w	\$3.59	\$6.82	\$3.23	11	3
65w / 14w to 16w	\$5.41	\$6.83	\$1.41	83	33
90w to 120w / 23w to 26w	\$6.35	\$7.73	\$1.38	27	30

CFL Analysis

The separate multiple regression analysis, conducted for CFLs only, found that an ENERGY STAR CFL is \$1.09 less expensive than a comparable non-ENERGY STAR CFL. This price difference may be in part due to the fact that ENERGY STAR-qualified CFLs are more likely than non-ENERGY STAR-qualified CFLs to be packaged in multi-packs and multi-pack CFLs are \$1.95 less expensive, per bulb, than CFLs sold individually.¹⁴ The incremental costs associated with the key independent variables are as follows:

- One lumen adds \$.002 to the cost of a CFL
- A flood bulb adds \$3.15 to the cost of a CFL
- An A-bulb adds \$1.74 to the cost of a CFL
- A bullet or torpedo bulb adds \$2.78 to the cost of a CFL
- A three-way bulb adds \$2.76 to the cost of a CFL
- A bug bulb adds \$2.58 to the cost of a CFL
- A globe bulb adds \$2.27 to the cost of a CFL
- A candelabra bulb adds \$1.54 to the cost of a CFL
- CFLs sold at Home Depot, Wal-Mart and Rocky's Ace Hardware are \$0.58, \$0.84 and \$1.22 less expensive than comparable CFLs sold elsewhere, while bulbs sold at grocery stores are \$0.82 more expensive than CFLs sold elsewhere.

For example, a single-pack spiral 1,100-lumen CFL bulb with no specialty features is estimated to cost \$6.09 at Home Depot and \$6.67 at a drugstore. However, a comparable CFL that is ENERGY STAR qualified and sold in a multi-pack at Wal-Mart is estimated to cost \$2.79. The incremental cost per lumen is \$0.002 (e.g., 1,100 lumens x \$0.002 = \$2.20), a figure that might be used to develop incentive levels (Table 7).

¹⁴ Forty-nine percent of ENERGY STAR qualified CFLs in our data set were packaged as multi-pack bulbs while 22% of non-ENERGY STAR qualified CFLs in our data set were packaged as multi-pack bulbs.

Table 7: Multiple Regression Analysis Results for Price Estimates of Spiral CFL Bulbs

Variable*	B	Sample CFL Bulb Prices		
		Home Depot	Drugstore	Wal-Mart, ENERGY STAR qualified, multi-pack bulb
Number of Lumens		1,100	1,100	1,100
Constant	4.47	4.47	4.47	4.47
Lumens	0.002	2.2	2.2	2.2
ENERGY STAR	-1.094	0	0	-1.094
Multi-pack	-1.951	0	0	-1.951
Home Depot	-0.58	-0.58	0	0
Wal -Mart	-0.835	0	0	-0.835
Rocky's Ace Hardware	-1.219	0	0	0
Grocery store	0.818	0	0	0
Flood	3.148	0	0	0
Bullet / Torpedo bulb	2.778	0	0	0
3-way bulb	2.764	0	0	0
Bug bulb	2.584	0	0	0
Globe bulb	2.265	0	0	0
A bulb	1.741	0	0	0
Candelabra bulb	1.536	0	0	0
TOTAL COST		\$6.09	\$6.67	\$2.79

* all variables significant at $p \leq .001$

Figure 2 illustrates the impact of multi-packs and ENERGY STAR qualification on the price of spiral CFLs, particularly in relation to price estimates from our analysis in 2006.

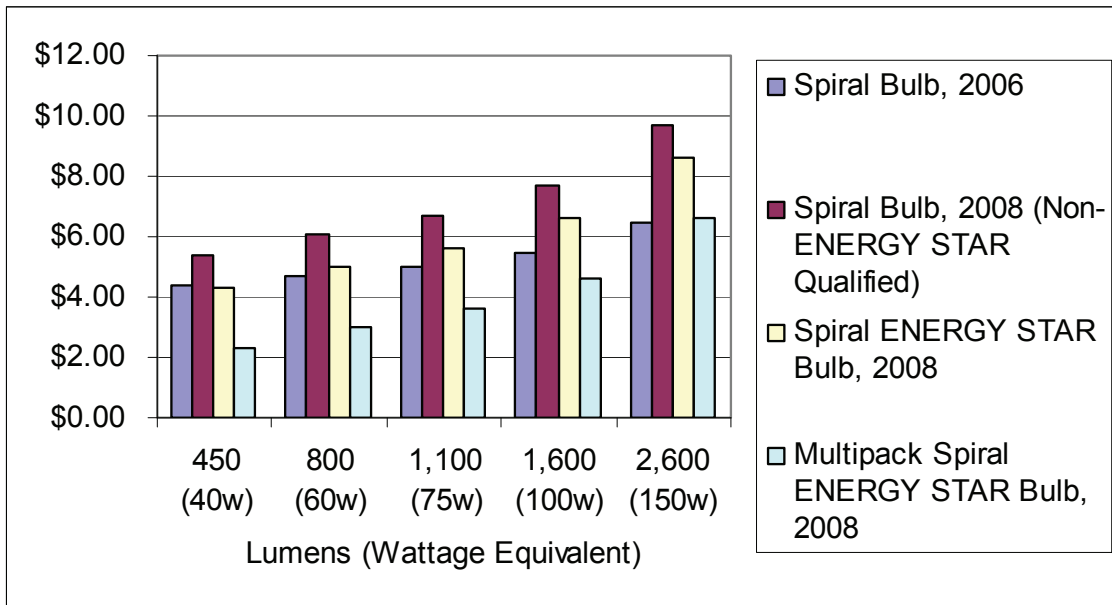


Figure 2: Estimated Prices of Spiral CFLs at Various Lumen Levels¹⁵

Our model estimated that the price of a CFL varied quite dramatically depending upon where the

¹⁵ To develop this figure we used lumen and wattage equivalents developed by the Environmental Protection Agency's ENERGY STAR program (ENERGY STAR n.d)

CFL was sold (i.e., a big box store such as Home Depot or Wal-Mart) and depending on whether the CFL was sold individually or as part of a multi-pack. (Table 8)

Table 8: Estimated and Observed Prices of a 13w / 800 Lumen ENERGY STAR Qualified Spiral CFL

Bulb	Observed / Estimated	Price
13w / 800 Lumen, multi-pack, BJ's Warehouse	Observed	\$0.50
13w / 800 Lumen, multi-pack, Wal-Mart	Estimated	\$2.19
13w / 800 Lumen, multi-pack, Home-Depot	Estimated	\$4.45
13w / 800 Lumen, multi-pack, hardware store	Estimated	\$4.99

Table 9 through 11 compare estimated prices for spiral, flood and A-bulb CFLs of common lumen levels. Estimated prices were derived using results from our analysis in 2006 and the results from early 2008, including estimated prices for ENERGY STAR qualified bulbs and bulbs sold in multi-packs. ENERGY STAR qualified CFLs accounted for 82% of the CFLs in our analysis while 44% of the CFLs in our data set were multi-pack bulbs. For all three types of CFLs, nearly all those that were ENERGY STAR qualified that were sold in multi-packs, regardless of lumen level, were less expensive in 2008 than comparable CFLs in 2006.¹⁶

Table 9: Estimated Prices of Spiral CFLs at Various Lumen Levels¹⁷

Number of Lumens (Wattage equivalent)	450 (40w)	800 (60w)	1,100 (75w)	1,600 (100w)	2,600 (150w)
Spiral Bulb, 2006	\$4.35	\$4.70	\$5.00	\$5.50	\$6.50
Spiral Bulb, 2008 (Non-ENERGY STAR Qualified)	\$5.37	\$6.07	\$6.67	\$7.67	\$9.67
ENERGY STAR Bulb, 2008	\$4.28	\$4.98	\$5.58	\$6.58	\$8.58
Multipack ENERGY STAR Bulb, 2008	\$2.33	\$3.03	\$3.63	\$4.63	\$6.63

Table 10: Estimated Prices of "Flood" CFLs at Various Lumen Levels

Number of Lumens	500	600	750	1,200
Flood (2006)	\$6.47	\$6.57	\$6.72	\$7.17
Flood (2008) (Non-ENERGY STAR Qualified)	\$8.62	\$8.82	\$9.12	\$10.02
ENERGY STAR Flood, 2008	\$7.52	\$7.72	\$8.02	\$8.92
Multipack ENERGY STAR Flood, 2008	\$5.57	\$5.77	\$6.07	\$6.97

¹⁶ The only exception is our estimated price for a 2,600 lumen ENERGY STAR qualified CFL sold in a multipack is \$0.13 higher in 2008 than a comparable bulb using our estimates from 2006.

¹⁷ To develop this table we used lumen and wattage equivalents developed by the Environmental Protection Agency's ENERGY STAR program (ENERGY STAR n.d.)

Table 11: Estimated Prices of “A-Bulb” CFLs at Various Lumen Levels

Number of Lumens	215	450	800
A-Bulb (2006)	\$6.18	\$6.42	\$6.77
A-Bulb (2008) (Non-ENERGY STAR Qualified)	\$8.05	\$8.52	\$9.22
ENERGY STAR A-Bulb, 2008	\$6.95	\$7.42	\$8.12
Multipack ENERGY STAR A-Bulb, 2008	\$5.00	\$5.47	\$6.17

We used multiple linear regression models to estimate the price differences between a pin-based and a spiral screw-based CFL,¹⁸ while controlling for lumens of light output, and place of sale (Table 12). Our analysis found that a screw-based CFL was \$2.03 less expensive than an identical pin-based CFL; in comparison, we found that a screw-based CFL bulb was \$1.22 less expensive in the 2006 analysis. All variables that were significant in the ENERGY STAR analysis were significant in this model except for three-way bulbs.¹⁹

Table 12: Multiple Regression Analysis Results for Price Estimates of CFL Bulbs, Comparing Screw-Based and Pin-Based CFLs

Variable *	B	Sample CFL Bulb Prices		
		Pin base	Screw base	Pin base, sold at Wal-Mart
Number of Lumens		800	800	800
Constant	4.219	4.219	4.219	4.219
Lumens	0.002	1.6	1.6	1.6
Screw Or Pin Bulb *	-2.027	0	-2.027	0
Wal-Mart	-1.422	0	0	-1.422
Rocky's Ace	-1.211	0	0	0
Grocery	1.282	0	0	0
TOTAL COST		\$5.82	\$3.79	\$4.40

* all variable significant at $p < .001$

Conclusion

Since our analysis conducted in early 2006 (Clendenning et al. 2007), as of early 2008 there continued to be signs of progress toward market transformation of the CFL market in Massachusetts: specifically, sales of CFLs outside the program were more than four times the sales inside the program; sales of CFLs accounted for nearly 19% of the sales of medium-screw based bulbs in Massachusetts in 2007; the price difference between a 25-watt CFL bulb and a 100-watt incandescent declined from \$4.39 to \$2.80; customer awareness of CFLs was nearly universal as 94% of MA residents were familiar with CFLs in 2007; 76% of all households were currently using at least one CFL in 2007 and the average household used approximately seven CFLs; approximately 22.6 million CFLs were installed in Massachusetts, or 21.4% of all installed medium screw-based lamps; and there were approximately 5.2 million CFLs in storage in Massachusetts homes in 2007, suggesting that CFLs had become standard options for meeting lighting needs (NMR, RLW Analytics and Conant 2008).

¹⁸ All specialty CFL bulbs were excluded from this analysis because there are no specialty pin-based CFLs in the data set.

¹⁹ It is important to note that there is some autocorrelation of the residual terms in this model. Autocorrelation can result in regression coefficients that are unbiased but not efficient; in other words, estimated standard errors of coefficients can be underestimated, making the coefficients seem more accurate.

Results from this analysis will continue to help track price differences between CFL and incandescent light bulbs and help track the market transformation of the Massachusetts residential lighting market. In addition, this analysis can help program managers to continue using a tiered approach to incentive levels for CFL light bulbs, taking into account lumen or wattage levels, package size and specialty features.

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