ENERGY STAR®

CFL MARKET PROFILE

DATA TRENDS
AND MARKET INSIGHTS

U.S. DEPARTMENT OF ENERGY

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Over the last 10 years—and particularly the last two—the CFL market has changed dramatically. This CFL market profile presents findings that policy makers, regulators, energy efficiency program sponsors, and ENERGY STAR® partners can use to develop energy efficiency programs that make the most of both market research and consumer behavior.

CFLs are a cornerstone product for energy savings programs, contributing 25 to 50 percent of total energy efficiency program portfolio savings. Energy efficiency program sponsors are investing heavily in CFL promotions, with planned CFL program spending in 2010 forecast to be $252 million, 162 percent of 2009 levels. Historically, such investments have yielded substantial results.

CFLs still have the potential to deliver considerable residential lighting energy savings. As most light sockets in America still hold incandescent lamps, more than two-thirds of the CFL savings potential remains unrealized. Even states with long-running and well-funded CFL programs have filled only one in five sockets; other states can have averages as low as one in 20.

CFLs are not preferentially installed in high-use or low-use sockets. A recent rigorous study showed that consumers install CFLs with little preference to room type or socket use. As a result, CFLs on average are used at the same rate as the average household light socket, less than two hours per day. This is considerably lower than many program sponsors have assumed.

Consumers are buying fewer CFLs. The market for CFLs has declined by more than 30 percent following a peak of shipments in 2007. While shipments of CFLs remain much higher than those in 2000, more than five of every six general service lamps shipped is still an incandescent. If CFL market share remains at current levels, unit sales will decline and future growth in socket saturation will slow further.

The vast majority of consumers are satisfied with CFLs. More than 85 percent of consumers report that they are satisfied with the performance of CFLs. The reasons for the decline in shipments are many, including reduced promotion by retailers and the recession, but consumer dissatisfaction is not a major contributor.

New efficiency standards alone will not transform the market. The standards set by the Energy Independence and Security Act of 2007 may have less effect on the lighting market than program sponsors and regulators expect. Many specialty lighting products are exempt from the new standards, and compliant incandescent lamps, which offer minimal energy savings over non-compliant lamps, are already available to consumers.

A word on nomenclature

For simplicity this document uses the term "lamp" to refer to screw-base lamps, bulbs, and light bulbs.

PROGRAM SPONSOR ACTIVITIES

How important are CFL programs to program sponsors? Are they continuing to invest in them? How much funding is being directed toward promotion of CFL sales? Are there regional differences in funding? What issues or obstacles do program sponsors face?

CFLs are a cornerstone product for energy savings programs, contributing 25 to 50 percent of total energy efficiency program portfolio savings. The number of utilities, states, and energy efficiency organizations sponsoring CFL programs—as well as the funding dedicated to those programs—has grown steadily over the past five years. Program funding for CFL promotions has grown five-fold and the number of programs has tripled. Western states spend the most per household on CFLs, followed closely by the Midwest and Northeast. Total spending on efficiency programs for CFLs is expected to continue growing as more states require utilities to achieve all cost-effective efficiency measures before investing in new capacity.

Generation and transmission constraints and mandated reductions in energy consumption are leading utilities to increase their investments in energy efficiency. Due to CFLs' relatively low purchase cost relative to other conservation measures and their high energy savings potential, they will continue to be a reliable and justifiable component for most efficiency programs.

Figure 1 | ENERGY STAR® Reported CFL Programs and Program Spending by Year, 2006 to 2010

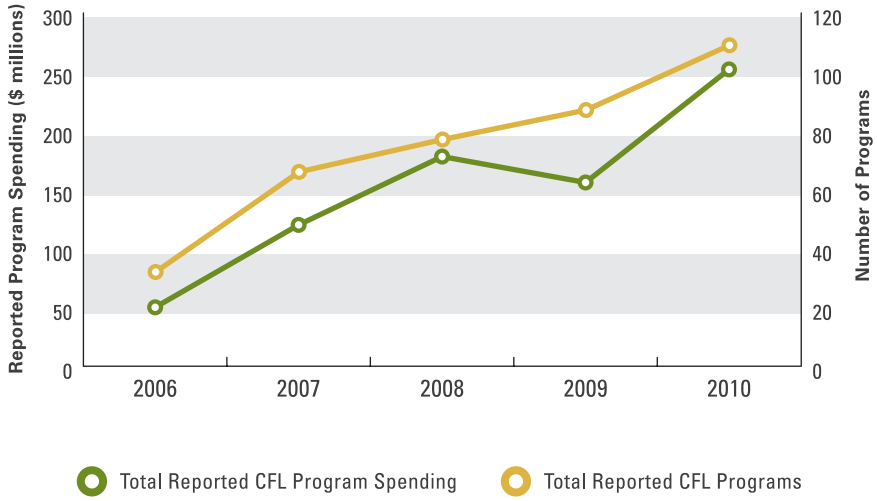


Table 1 | ENERGY STAR CFL Programs 2006-2010

Year	Total reported CFL program spending ($ millions)	Total reported CFL programs
2006	50	32
2007	120	66
2008	178	77
2009	156	87
2010	252	109

Table 2 | ENERGY STAR Reported Regional CFL Program Spending 2010

Region	States Included	2010 Reported Spending ($)		
		Per Capita	Per Household	Total (milllion)
CA	CA	2.14	5.73	78
Mid-Atlantic	DC, DE, MD, PA, VA, WV	0.16	0.44	5
Midwest	IA, IL, IN, KS, KY, MI, MN, MO, ND, NE, OH, SD, WI, WY	1.14	3.07	81
Northeast	CT, MA, ME, NH, NJ, NY, RI, VT	1.14	3.06	48
Northwest	ID, MT, OR, WA	1.51	4.04	19
Southeast	AL, AR, FL, GA, LA, MS, NC, SC, TN	0.08	0.21	5
Southwest	AZ, CO, NM, NV, OK, TX, UT	0.32	0.86	15
US Total	–	0.82	2.19	252

Note: Only reported spending is listed. Hawaii and Alaska did not report.

Table 3 | CFL Savings as a Percent of Total Demand-Side Management Savings

State	Measures	Savings	2005	2006	2007	2008	2009
California	CFL, All Sectors	Annual MWh	5,010,907				
	All Sectors & Measures	Annual MWh	9,367,350				
	CFL, All Sectors	% of All	53%				
Massachusetts	CFL, Residential	Annual MWh	3,252	2,903	9,973	3,279	10,710
	All Sectors & Measures	Annual MWh	12,267	17,464	17,149	10,070	20,577
	CFL, All Sectors & Measures	% of All	27%	17%	58%	33%	52%
New York	CFL, Residential	Annual MWh	171,168	188,999	149,143 (est)	103,846	142,591 (est)
	All Sectors & Measures (estimated)	Annual MWh	550,000	400,000	720,000	250,000	600,000
	CFL, All Sectors	% of All	31%	47%	21%	42%	24%
Vermont	CFL, Residential	Annual MWh	16,357	16,428	35,388	51,417	30,691
	Residential Only	Annual MWh	51,669	46,228	77,870	120,071	78,294
	CFL, Residential	% of All	32%	36%	45%	43%	39%

Note:
Utilities represented:
California: Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison
Massachusetts: Cape Light Compact
New York: New York State Energy Research and Development Authority
Vermont: Efficiency Vermont

EVALUATION ISSUES

Net-to-Gross

Many recent regional net-to-gross values from a variety of CFL programs are decreasing, indicating the potential need to redesign CFL programs to increase savings. Recent net-to-gross calculations indicate significant variation as well as uncertainty, both in actual results and in the method used to calculate results. This variation in method renders comparison among states difficult and underscores the need for standardized methods of gauging program success.

Table 4 | Net-to-Gross Values for CFL Programs

Location	2008 Net-to-Gross		
	Recommended or Official	Low	High
Wisconsin	0.62	0.36	1.69
Massachusetts	0.41	0.19	0.74
Connecticut	0.81	0.22	0.91
New York	1.60	0.93	9.17
New York City	1.60	0.93	6.73
Vermont	1.09	1.06	1.57
California	0.65	0.23	0.65

What is Net-to-Gross?

A net-to-gross value is the ratio of the energy savings that can be directly attributed to an energy efficiency program (net savings) to the total energy savings from the product or behavior the program promotes (gross savings). The purpose of a net-to-gross calculation is to separate those energy savings that occurred due to a program from those energy savings that would have occurred in the absence of the program. Examples of the factors that affect net-to-gross include free ridership, which decreases net-to-gross values, and spillover, which increases net-to-gross values. A low net-to-gross value indicates lower attributable savings.

Wisconsin calculated net-to-gross values in 2007 and 2008 by sales channel, demonstrating that program spending had varying impacts depending on sales channels.

Table 5 | Net-to-Gross Values by Sales Channel in Wisconsin

Sales Channel	2007 Net-to-Gross	2008 Net-to-Gross
Hardware	1.53	1.04
Home Improvement	0.27	0.46
Drug and Mass Merchant	1.00	0.51
Grocery and Other	0.97	0.66

Usage and Wattage Savings

Accurately calculating gross CFL savings requires understanding two key metrics:

Wattage Savings. The evaluator must determine wattage savings between the CFL installed and the equivalent incandescent it is replacing. ENERGY STAR has used a conservative estimated value of 47 watts, which represents the savings between a 13-watt CFL and an equivalent 60-watt incandescent lamp. However, recent on-site data from California suggest that even this estimate may be high, with a measured wattage savings of 40 watts between installed CFLs (17-watt average) and incandescent lamps (57-watt average).[1] In general, the wattage savings increase with lumen output. Therefore, ENERGY STAR recommends using on-site measurements to calculate wattage savings and to determine the inventory of lamps by wattage and lumen output.

Lighting Usage. The evaluator must measure daily lighting usage, which may then be extended to determine annual savings. ENERGY STAR has used a daily usage estimate of three hours for consistency with criteria for manufacturer lifetime claims. In light of recent measurements from California that found average usage closer to 1.9 hours per day, program sponsors should be careful not to overestimate projected savings.

> ***Utilities and program sponsors should use on-site measurements to calculate wattage savings and to determine the inventory of lamps by wattage and lumen output.***

Why Shipments?

Ideally, an assessment of the CFL market would track the entire market path for CFLs from import to sale. However, as CFL sales expand into a greater variety of sales channels, the difficulty in collecting sales data has increased. Comprehensive sales data has not been available in recent years, and where sales data exist, it is generally only for specific regions, channels, or years. Therefore, shipments data remains the most complete longitudinal measure of the national CFL market.

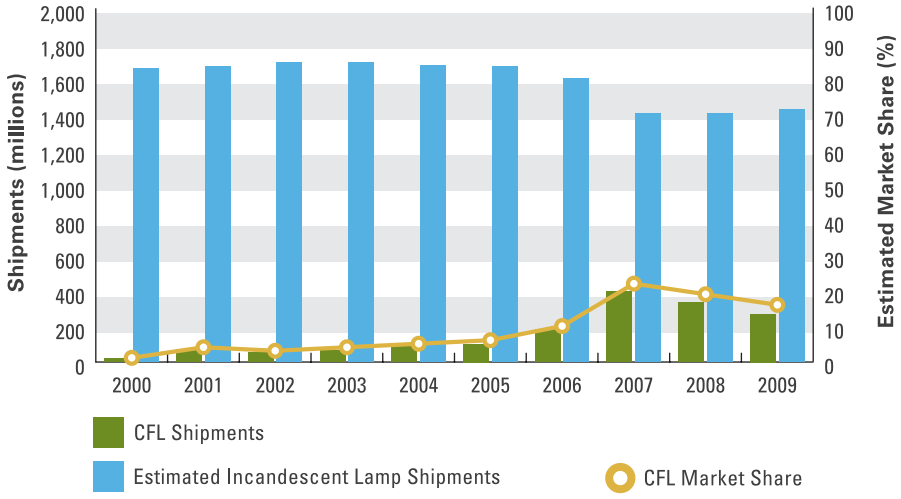
MARKET CHARACTERISTICS

Shipments and Market Share

What is the current volume of CFL sales? Are sales trending up, down, or flat? What is the CFL share of the medium screw-base lamp market?

One in 6.6 medium screw-base lamps shipped today is a CFL, down from a peak of 1 in 4.5 in 2007. This number is based on CFL shipments plus a modeled estimate of incandescent lamp shipments, as no public data on incandescent lamp shipments is available. After steady growth through 2007, U.S. CFL shipments declined by 15 percent from 2007 to 2008, from 397 million units to 337 million units.

Figure 2 | CFL and Incandescent Lamp Shipments Plus CFL Market Share, by Year



Shipments again declined by 20 percent from 2008 to 2009, from 337 million units to 272 million units. During the same two-year period, estimated shipments of incandescent lamps remained relatively level, increasing from 1,407 million in 2007; to 1,408 in 2008; to 1,431 in 2009. These two years of declining shipments represent a cumulative 31 percent drop from the 2007 peak. In some regions and states, such as the Northwest and Vermont, a decline in *sales* only began in 2009, but was more abrupt than the national trend. National market share for CFLs dropped from its 2007 peak of 22 to 16 percent in 2009.[†]

While many factors affect shipments and market share, two key factors may have contributed to the significant drop between 2007 and 2009. The first is Walmart's decision to end its 2007 promotion of CFLs. That year, the retail chain sold 162 million CFLs, or 41 percent of all shipments. Walmart sales data for 2008 and 2009 are not available, but it is likely that Walmart's decision to not actively promote CFLs lowered sales for Walmart and measurably affected the market as a whole in those years. The second is the influence of the recession, the full effects of which began in 2008. The loss of a significant national retail promotion at a time when consumer spending was falling may explain the majority of the drop in the CFL market.

Survey data shows that consumers primarily replace lamps when they burn out, which in turn means that shipments are driven by lamp failures. CFLs fail much less frequently than incandescent lamps due to their long lifetimes (10,000 hours for CFLs versus 1,000 hours for incandescent lamps). As a result, unit sales of CFLs will decline even if market share remains stable, as total lamp demand—and therefore total shipments of screw-base lamps—is expected to shrink in coming years.

> ***Unexpected consequences: Every time a CFL replaces an incandescent lamp, demand for screw-base lamps shrinks. The size of the lighting market, total shipments and sales are virtually entirely a function of how quickly lamps burn out. Longer life = less frequent failure = lower demand, shipments, and sales.***

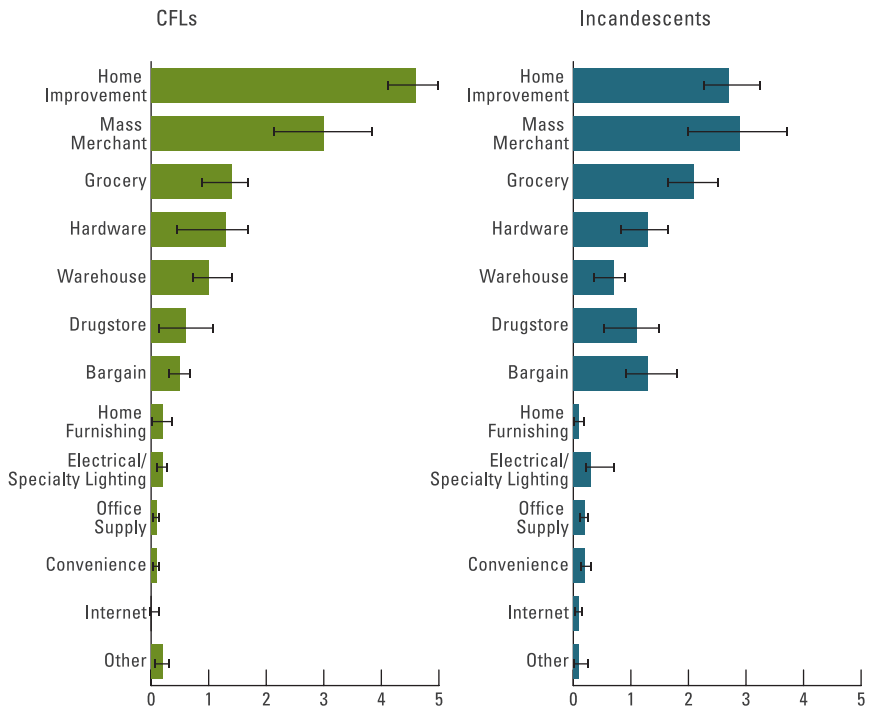
[†] Estimates of CFL market share from NEMA differ from those presented in this document. For example, in 2009, NEMA calculated CFL market share at 24 percent, while market share in Table 1 is listed at 16 percent. The source of this discrepancy is uncertain as the underlying data for NEMA's calculation is not available, but may rest in the estimated volume of incandescent sales.

Sales Channels

Where do people typically purchase CFLs? Are they the same places people typically purchase incandescent lamps?

In a series of recent surveys of 10 diverse locations, consumers consistently identified big-box stores, particularly home improvement and mass merchant stores, as the places where they most frequently purchase CFLs. In contrast, consumers reported purchasing incandescent lamps much more frequently at a wide variety of types of stores, such as drugstores, bargain stores, hardware stores, and grocery stores, in addition to big-box stores.

Figure 3 | Consumer-Identified Purchase Locations for Lamps



Note: Results are a weighted average of the responses from residents of Connecticut, Houston, Indiana, Massachusetts, New York City, New York State, Ohio, the District of Columbia, and Wisconsin. Responses have been normalized, with a value of 1 representing the average number of responses each for CFLs and incandescent lamps. The error bars represent plus or minus one standard deviation.

Compared to other store types, big-box stores (home improvement stores, mass merchants, and warehouse stores) are ideal sales channels for CFLs.

1. Big-box stores have greater available shelf space, allowing these stores to offer more wattages, lamp shapes, and specialty designs. Greater shelf space also allows these stores to offer multi-lamp packages, which lowers the cost per lamp.
2. Big-box stores purchase products in large volumes. This allows them to leverage pricing with suppliers, further reducing the initial price point.
3. Other products sold in these stores (such as consumer electronics, appliances, and power tools) have average prices that are much higher than even multipacks of CFLs, making CFLs appear inexpensive in comparison. This is in contrast to bargain, grocery, and drug stores, where CFL prices are comparable to other items on the shelves.
4. Big-box stores have promoted CFLs as a leading product in the past several years.

Significant volumes of CFLs in California and Vermont are sold through non-big-box channels such as grocery, drug, small hardware, convenience, and bargain stores. Programs in these states cover most of the cost of the lamp, and actively encourage stocking and marketing through a variety of incentives. CFLs incentivized in these types of stores are often priced from $0.99 to $1.99.

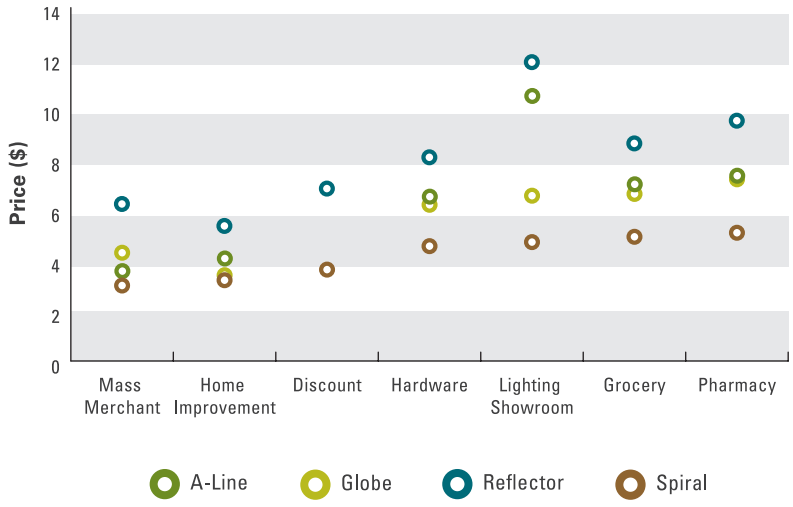
Pricing

What are the current prices for CFLs? How different are prices for common general service spiral-shape versus specialty lamps? How do prices vary among retail channels?

The per-lamp cost of CFLs varies widely among sales channels and between single packs and multipacks. CFLs are typically priced higher at lighting showrooms, drugstores, and grocery stores and lower at home improvement and mass merchant stores. This variation in price correlates with consumer purchasing behavior. Relatively few consumers report purchasing CFLs at retail stores with higher prices, such as lighting showrooms, drugstores, and grocery stores. Consumers instead purchase CFLs more frequently at home improvement and mass merchant stores, which offer not only the lowest prices, but typically the greatest availability of specialty-shaped lamps.

Specialty lamp shapes, such as reflector, A-line, and globe, are generally more expensive than spiral CFLs. This is true for all sales channels, although this difference is more pronounced in stores with higher overall prices and lower sales volumes, such as lighting showrooms, grocery stores, and drug stores.

Figure 4 | CFL Prices by Retail Channel

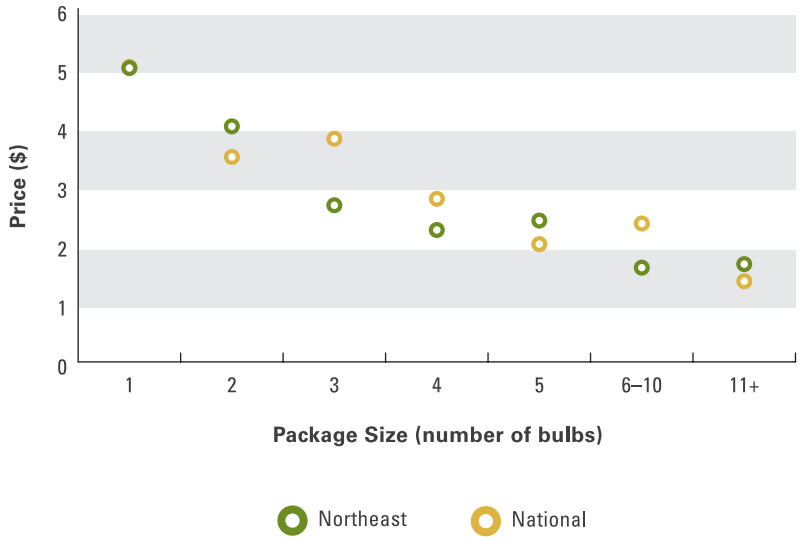


Note: Includes only CFLs intended for sockets with on/off switches. Prices reflect incentivized and non-incentivized lamps.

The price of a single lamp is significantly higher than the per-lamp price of CFLs sold in multi-packs. Per-lamp costs for spiral CFLs, which represent approximately 90 percent of sales, can be as low as $0.50 in a multipack at a big-box store or as high as $9.99 in a single pack at an office supply store. According to an inventory of CFL prices in the Northeast, the median per-lamp price in a multipack is $2.75, and the mean price of a single lamp is $4.99. The national data in Figure 5 is based on a smaller sample size and less rigorous study. It is included to verify the Northeast regional data.

How much does a CFL cost? It all depends on where you buy it and how many are in the package. Spiral CFLs can cost as little as $0.50/per lamp in a multipack at a big box store or as much as $9.99 in a single pack at a hardware store.

Figure 5 | Median Price Per Lamp: 10-Watt to 19-Watt Spiral CFLs



Note: Includes only CFLs intended for sockets with on/off switches. Prices reflect incentivized and non-incentivized lamps. A-line and globe prices were not available from discount stores. Due to the small sample size, national prices have been weighted by sales channel to reflect consumer purchasing behavior.

Spotlight On
Efficiency Vermont's CFL Program

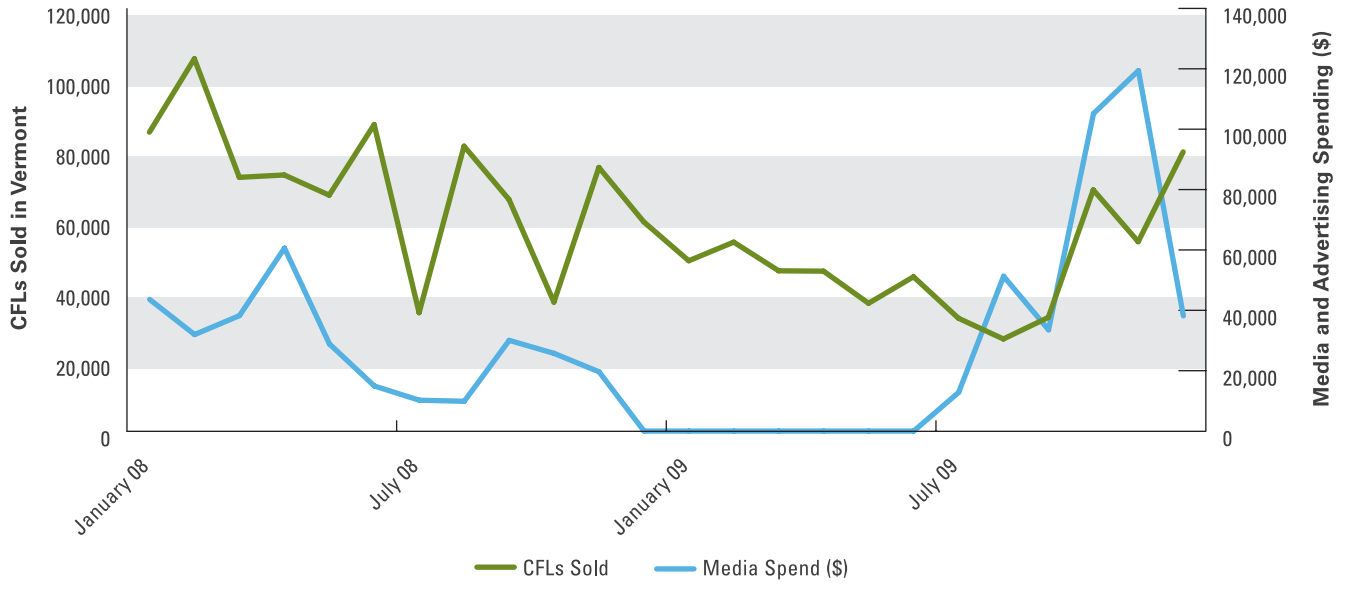
What do you do when your CFL sales suddenly drop by 29 percent? Efficiency Vermont faced this very question. Sales plunged from a monthly average of 71,071 in 2008, to 45,566 in the first half of 2009, following a reduction in program spending.

In response, Vermont re-energized its CFL campaigns in July 2009. It expanded its retail partner network by 40 percent to include more local hardware, grocery, convenience, and drug stores. The program also developed a new advertising campaign and reduced per-lamp prices for all CFLs (both specialty and general service) to as low as $0.99. Cooperative advertising, often commissioned in partnership with a local retailer, complemented these efforts.

By October 2009, sales had returned to 2008 levels and then continued to grow. Sales of specialty lamps tripled by the end of the year, and the number of participating retail partners more than doubled.

Sales and marketing data analyses suggest a correlation between promotional spending and CFL sales (see Figure). The late 2009 boost in sales was due to a campaign push: an increase in creative in-store messaging, prominent displays, multimedia advertising campaigns, and reduced price points. For more information, visit www.newbulbintown.com/guide.

Figure 6 | Media Spending and CFL Sales in Vermont



Product Availability and Variety

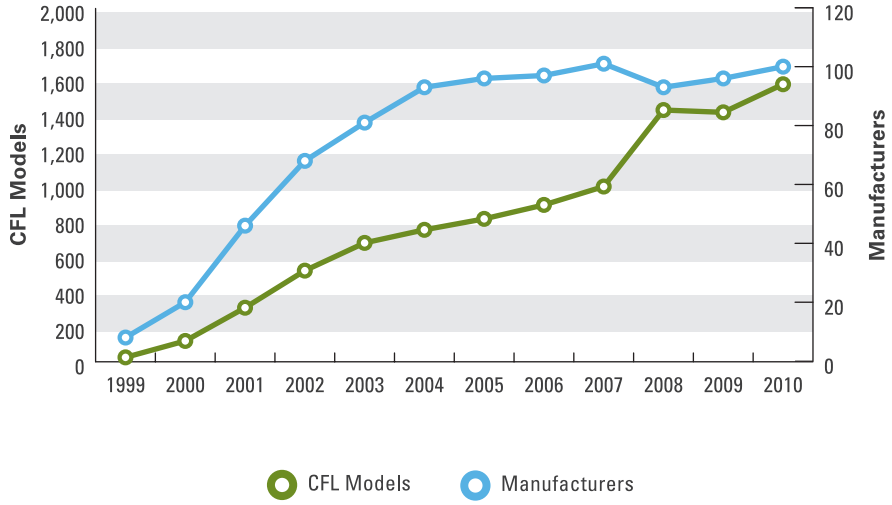
Is the market for CFLs competitive? Are CFLs widely available in shapes and wattages that are appropriate for the most common types of fixtures?

The CFL market today is highly competitive and offers products for all applications of screw-base lamps. Possible exceptions include dimmable and three-way products. Big-box stores and some hardware stores typically carry a full line of products. However, other channels usually limit offerings to bare spirals, which are appropriate for more than half of all sockets.

Today, 100 ENERGY STAR lighting manufacturing partners produce nearly 1,600 unique CFL products. Many of these products are repackaged and sold as private label products, with more than 4,500 CFLs sold under 234 brands. The majority (78 percent) of ENERGY STAR qualified products are general service lamps. These are bare spiral and A-line lamps that substitute for 40-, 60-, 75-, and 100-watt incandescent lamps. These lamps are designed to operate in a medium screw-base socket with an on/off switch. Reflectors represent 11 percent of products, and other specialty lamp shapes make up the remaining 11 percent. Few dimmable and three-way products are available.

Specialty products—including specialty shape, reflector, dimmable, and three-way lamps—represent 22 percent of qualified products. This is well above these products' share of installed CFLs.

Figure 7 | ENERGY STAR Qualified CFL Manufacturers and Models, by Year



Note: Following the issuance of ENERGY STAR CFL criteria v. 4.0 in December 2008, many previously qualified CFL products no longer qualified and were removed from the qualified product list. For this reason, the number of qualified CFL products decreased between 2008 and 2009. While the new criteria did affect the availability of some specific products in the short term, overall availability was not affected.

Table 6 | Percentage of Qualified Products by Switch Type and Base Type

Switch Type	Base Type (%)		
	Medium Screw	Small Screw	All Base Types
On/Off	92	2	94
3-Way	1	0	1
Dimmable	4	0	4
All Switch	98	2	100

Table 7 | Percentage of Qualified Products by Type and Wattage

Product Category	Wattage Range				All Wattages
	1-10	11-19	20-24	25+	
	Lumen Range				
	100-700	400-1,400	800-1,800	1,300-5,000	
	Incandescent Lamp Equivalent Wattage				
	25-40	40-75	60-100	>100	
	Percentage of Product (%)				
General Service	**13**	**35**	**19**	**11**	**78**
Spiral	11	31	19	11	71
A-Line	2	5	0	0	7
Specialty	**4**	**13**	**5**	**1**	**22**
Reflector	0	7	3	0	11
Globe	1	3	0	0	5
Bullet	0	1	0	0	2
Tube	0	2	1	0	3
Other	2	0	0	0	2
All Types	**17**	**48**	**24**	**11**	**100**

GENERAL SATURATION CHARACTERISTICS

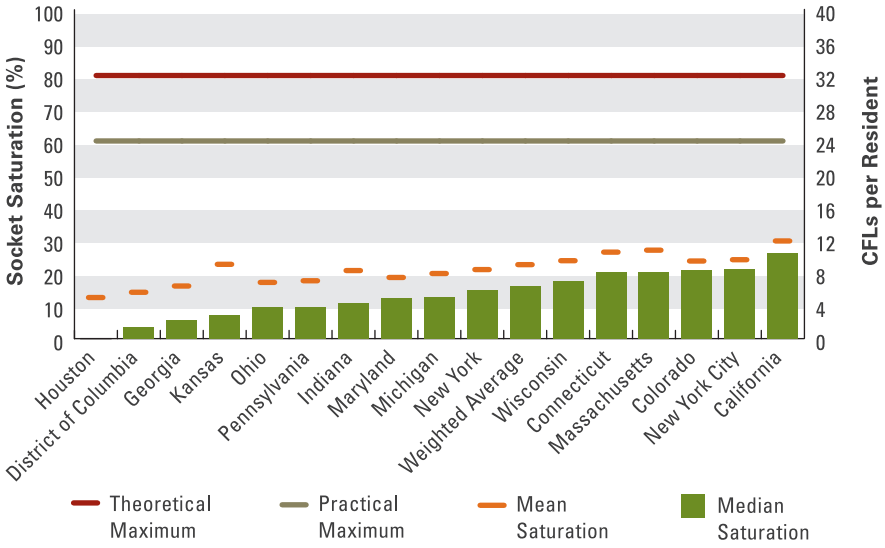
Regional Socket Saturation

How many light sockets contain a CFL? Does the proportion of light sockets that contain a CFL vary by region? If so, by how much? For how many of the remaining sockets are CFLs appropriate?

A coordinated assessment of 16 distinct geographic regions found that 16 percent of sockets in the typical household have CFLs. More than 70 percent of the sockets that can hold CFLs remain unfilled, even in states with long-established CFL incentive programs. In states without established programs, 90 percent of potential remains.

States with established CFL programs, such as California, New York, Massachusetts, Connecticut, and Wisconsin, had median household saturations of approximately 20 percent. Most of those without well-funded, long-standing programs had median saturation of about 10 percent or below (or fewer than five lamps per household). Median and mean saturation were 16 percent and 22.5 percent, respectively, across all regions assessed. In all cases, median saturation is lower than mean saturation.

Figure 8 | Regional CFL Saturation



Note: Theoretical saturation of 80 percent is defined as the point at which all sockets other than pin-base sockets are filled with CFLs and is derived from on-site data. Practical saturation of 60 percent is an achievable level of saturation based on the current availability of CFL products and feedback from manufacturers.

Ownership Distribution

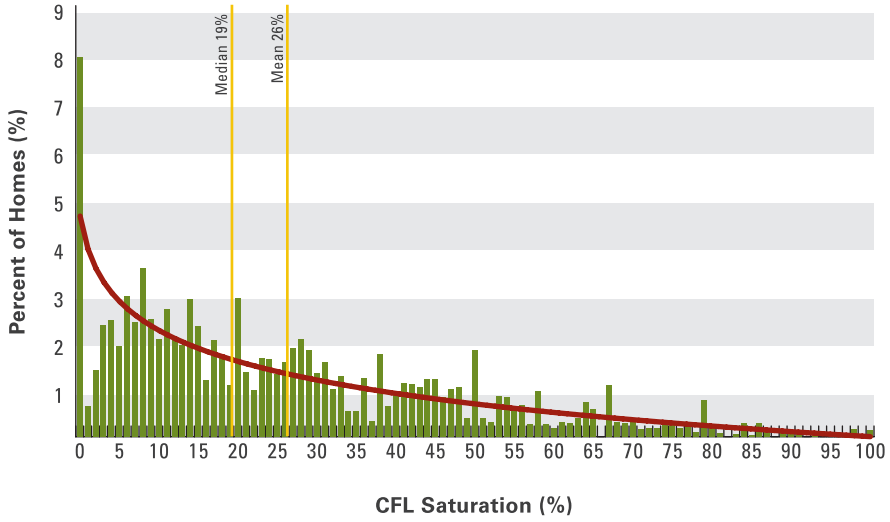
Do households in a given region have similar numbers of CFLs? If they are unevenly distributed, what does this imply for program design?

Most states and programs use mean CFL distribution as their primary program metric. This can give the misleading impression that CFLs are evenly distributed among households within a region, possibly following a normal distribution.

Mean saturation values are consistently higher than median levels because the distribution of CFLs among households is highly skewed. This means the minority of homes have most of the installed CFLs, while the majority of homes have just a few. Mean saturation is useful for calculating energy savings, but median saturation is a better indicator of how CFLs are distributed across homes given the skewed distribution of CFLs.

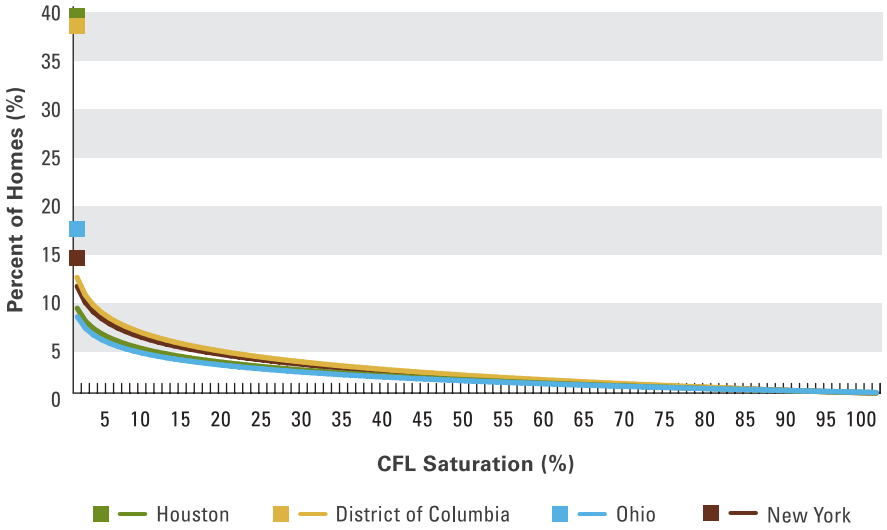
A recent on-site inventory of 1,200 homes in California revealed that 8 percent of homes do not use CFLs, and 57 percent of homes had socket saturation of less than 25 percent. California leads the nation in residential CFL saturation, yet socket saturation remains below 20 percent for more than half of the households that were inventoried. Less than 9 percent of homes had socket saturation at or above the practical maximum of 60 percent.

Figure 9 | Distribution of Household CFL Saturation (California)



On-site audits in New York State, the District of Columbia, Houston, and Ohio reveal a skewed distribution similar to California's, but with a higher proportion of households with no CFLs. In some cases, as many as 30 percent of homes had no CFLs.

Figure 10 | Distribution of Household CFL Saturation, Regionally



Note: Data has not been weighted and may not be representative of the entire city or state. Squares represent the percentage of households without any installed CFLs.

Table 8 | Proportion of Homes with Low Socket Saturation

	Percent of Homes with CFL Saturation of 25% or Less	Percent of Homes with CFL Saturation of 30% or Less
California	61	70
New York	82	86
New York City	78	86
Ohio	88	91
District of Columbia	85	92
Houston	88	92
Samples Average	72	79
Sample Average (Excluding CA)	84	89

Note: Data has not been weighted and may not be representative of the entire city or state. Averages are weighted by number of samples.

Residential lighting still offers a tremendous energy savings opportunity. Billions of sockets that could take a CFL still contain incandescents.

HOUSEHOLD CHARACTERISTICS

What types of CFLs have been installed? Where are they installed? What types of CFLs are needed to fill the remaining sockets?

The potential for CFLs remains high, even in mature markets. The majority of CFLs installed are general service lamps in medium-screw sockets with on/off switches. These types of sockets comprise 45 percent of all sockets.[3] However, only a third or fewer of these currently contain CFLs.

The remaining screw-base sockets include sockets appropriate for specialty-shaped (e.g., decorative, reflector), dimmable, three-way controlled, and small screw-base sockets (i.e., E12 or candelabra base). CFL saturation in these sockets is even lower than that of general service sockets, and these specialty sockets offer additional potential for CFLs.

Table 9 | Residential Socket Configuration and Potential, In California

Socket, Shape, Control	Percent of All Sockets (%)	Current CFL Socket Saturation (%)	Remaining Potential Compared to Current Saturation (%)
Medium Screw, General Service (A-Line, Globe), On/Off	45	16	180
Medium Screw, Specialty Size, On/Off	14	2	670
Medium Screw, All Sizes, Dimmable/3-Way	10	1	650
Small Screw, All Sizes, On/Off	8	<1	4,000
Small Screw, All Sizes, Dimmable/3-Way	3	<1	Negligible
Pin-Base, All Sizes, All Controls	20	15*	Negligible
All Sockets	100	19 (34 fluorescents)	–

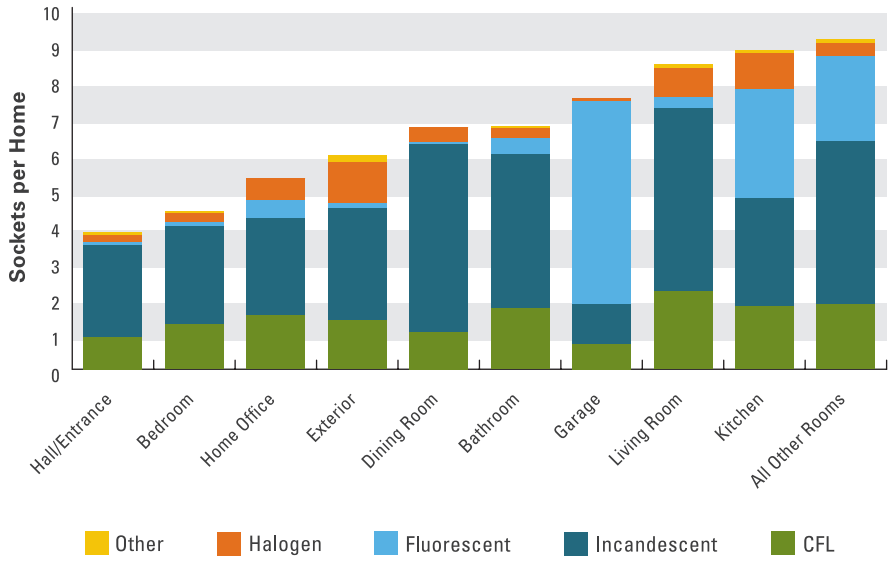
*Three-quarters of pin-base sockets contain fluorescent lamps (CFL or other) and one-quarter contain halogen lamps.

HOUSEHOLD USE AND PLACEMENT

Where are people installing CFLs? Do people tend to install CFLs in certain rooms? How similar is the distribution of CFLs to the distribution of sockets in general?

Given that use of CFLs in U.S. households remains low, it is not surprising that incandescent lamps are still the most common type of lamp installed in most rooms. The exceptions are garages and kitchens, where traditional fluorescent tube and circline lamps are more common. Like other rooms, garages and kitchens still have relatively low CFL saturation, however they have less potential for CFL saturation, as fewer sockets in those areas are compatible with CFLs. Living rooms, dining rooms, bathrooms, and home exteriors have the greatest untapped CFL potential.

Figure 11 | Where Are CFLs Installed?



Note: Values do not include empty sockets. "All other rooms" includes closets, laundry rooms, and others not encompassed by the other categories.

About one-third of sockets require a screw-base specialty lamp of some type. A negligible number of these sockets contain dimmable, three-way, and small-screw-base CFLs, presumably because these kinds of CFLs are less widely available and considerably more expensive than standard lamps. Still, the majority of energy savings from CFLs will come from general service medium screw-base sockets with on/off switches.

Table 10 gives a breakdown of the on-site data from the 1,200-home California on-site assessment.

Table 10 | Distribution of Sockets

Control Type	Percent of Sockets (%)
On/Off	85
Dimmer	12
3-Way	3
Base Type	**Percent of Sockets (%)**
Medium Screw	69
Pin	20
Small Screw	10
Other	1
Lamp Type	**Percent of Sockets (%)**
Incandescent	55
CFL	**20**
Other Fluorescent	12
Halogen	8
Other	5

Household Placement

Do people prefer to install CFLs in high-use or low-use fixtures?

Consumers who use CFLs appear to install them wherever a lamp needs replacing. On-site audits of socket distribution demonstrate that the majority of CFLs are installed where the majority of sockets are located: in bedrooms, bathrooms, kitchens, and living/family rooms. This is a consistent finding everywhere that on-site lighting inventories have been conducted, such as Massachusetts and Connecticut in 2008, and California in 2005 and 2009.[4]

While CFL installations correspond closely to the proportion of sockets in each room, biases exist for the installation of CFLs in kitchens, living rooms, and bedrooms, and against the installation of CFLs in dining rooms and bathrooms. The underrepresentation of CFLs in bathrooms, hallways, and dining rooms may be due to the desire for immediate full brightness in these locations or the need for specialty lamps such as globe and candelabra shaped.

Table 11 | Distribution of Sockets and CFLs Throughout a Typical Home

Room	California 2005		California 2009		Massachusetts 2008		Connecticut 2008	
	Socket (%)	CFL (%)	Socket (%)	CFL (%)	Socket (%)	CFL (%)	Socket (%)	CFL (%)
Kitchen	9	12	13	11	13	16	12	13
Dining Room	11	5	6	5	7	6	7	2
Living/Family Room	16	19	14	17	15	17	14	18
Exterior	3	5	11	11	7	5	8	5
Bathroom	23	19	18	20	14	10	14	11
Home Office	3	3	4	4	2	1	2	2
Garage	2	3	5	2	1	2	4	2
Hall	10	8	8	9	5	6	5	5
Bedroom	19	23	16	20	19	20	17	21
Closet	2	2	Not Reported		2	1	1	1
Other	3	2	5	1	14	17	16	18

Note: The socket distribution refers to the number of sockets in each room as a percentage of all sockets in a home. The CFL distribution refers to the number of CFLs in each room as a percentage of all CFLs in a home.

Saturation Versus Distribution

Saturation refers to the ratio of installed CFLs to total sockets. Sockets may include pin-base sockets, small screw sockets, tube fluorescent fixtures, and appliance sockets (e.g., stove, refrigerator). This number provides a measurement of the penetration of efficient lighting and indicates the remaining potential growth for efficient lighting.

CFL distribution refers to the ratio of installed CFLs in a particular room to the total number of installed CFLs throughout the home. Independent of other lighting technologies found throughout a home, CFL distribution shows the frequency with which consumers install CFLs in particular rooms.

$$\text{Room Saturation} = \frac{\text{\# of Lamps Installed in Room}}{\text{\# of Sockets in Room}}$$

$$\text{Room Distribution} = \frac{\text{\# of Lamps Installed in Room}}{\text{\# of Lamps Installed in Whole Home}}$$

This new data on actual hours of use will dramatically affect program design for regulators and energy efficiency program sponsors. At 1.9 hrs per day, the annual return on CFL program investment will be 30 to 40 percent below most current levels, but since lifetime energy savings remain unchanged, the annual return on investment will last proportionately longer.

Hours of Use

How many hours per day are CFLs in use?

Two independent studies (one national and one in California[5]) found that the typical residential lamp is used approximately 1.9 hours per day. Because of the similarity between the distributions of CFLs and fixtures as a whole, daily usage of CFLs is similar to that of typical household sockets, approximately 1.9 hours per day. Given that previous estimates may have used values of 3 hours per day or more, a measured use at 1.9 hours per day would indicate that annual savings estimates may be lower than previously estimated. Lifetime energy savings, which are a factor of the lifetime of the lamp, do not depend on daily use.

Table 12 | Daily Lighting Use by Room

Room	Hours of Use Per Day		
	U.S. 2002 (All Sockets)	California 2009 (All Sockets)	California 2009 (CFLs Only)
Overall	**1.9**	**1.9**	**1.9**
Kitchen	3	2.4	2.5
Dining Room	2.5	1.7	1.9
Living/Family Room	2.2	2.3	2.3
Exterior	2.1	3.8	3.9
Bathroom	1.8	1.3	1.4
Home Office	1.7	1.3	1.6
Garage	1.5	1.8	1.2
Hall	1.5	1.3	1.2
Bedroom	1.1	1.5	1.7
Closet	1.1	Not Reported	Not Reported
Other	0.8	1.5	1.4

Lamp Storage

How many CFLs are in storage? Are consumers reducing storage of incandescent lamps as they install CFLs?

On average, roughly 23 percent of CFLs in a home are stored, while 17 percent of all incandescent lamps in a home are stored. Incandescent storage rates are roughly constant at 5.5 lamps per household. CFL storage rates for households with five or more CFLs are proportional to the number of installed CFLs. Thus, households with more CFLs installed have more CFLs in storage. There are two implications: first, non-adopters of CFLs are still likely to replace failed incandescent lamps with new incandescent lamps; second, even heavy adopters of CFLs have not completely replaced all their incandescent lamps.

Table 13 | Storage of Incandescent Lamps and CFLs in Relation to Household CFL Saturation

Number of CFLs Installed	Average Number of Incandescent Lamps Stored	Average Number of CFLs Stored
0	5.1	0.4
1-2	6.4	1.1
3-5	5.7	1.9
6-10	4.4	2.5
11-20	5.5	4.3
>20	7.5	9.4
Average Across Samples	**5.6**	**3.2**

SATISFACTION

Are people generally happy with CFLs?

Consumer dissatisfaction with CFL performance is minimal and not the major barrier to wider adoption of CFLs. In 15 out of 16 separate surveys, more than 80 percent of the respondents indicated that they were either "satisfied" or "very satisfied" with CFL performance. Nine of these surveys reported specific consumer responses. These surveys demonstrated that 56 percent of consumers are "very satisfied" with CFLs, while only 3 percent are "very dissatisfied."

Figure 12 | Consumers are Satisfied with CFLs

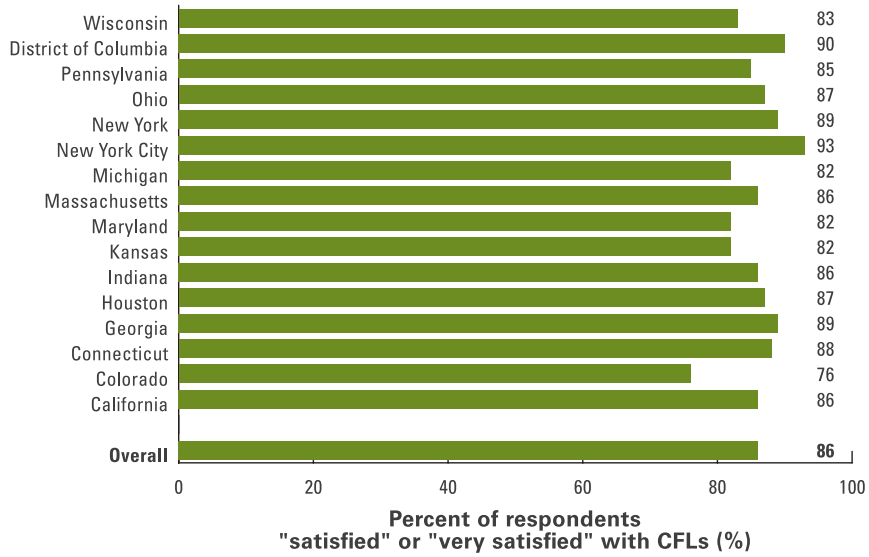
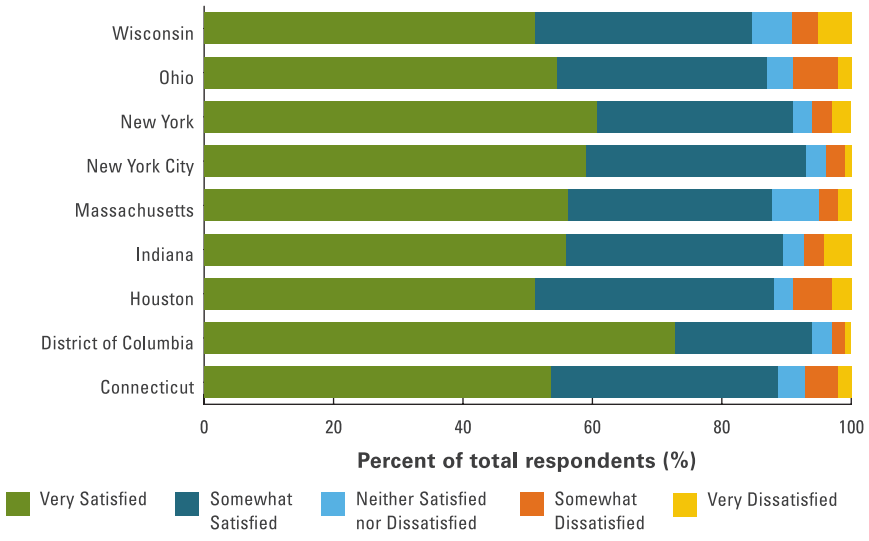


Figure 13 | Breakdown of Consumer Satisfaction



ENERGY INDEPENDENCE AND SECURITY ACT OF 2007 AND THE FUTURE MARKET FOR CFLS

What impact are impending federal efficiency standards for general service lamps likely to have on the CFL market?

The Energy Independence and Security Act of 2007 (EISA) amended laws relating to general service fluorescent, incandescent reflector, and general service incandescent lamps, and directed DOE to undertake new energy conservation standards rulemaking. While the new law is expected to affect the future market for lighting products, the impact may not be as great as initially expected.[†]

EISA prescribes maximum allowable wattage requirements for lighting products, with the first-tier phases beginning January 1, 2012 through January 1, 2014. A second-tier phase will begin January 1, 2020. Table 15 summarizes the tiers and phases.

EISA Tier 1, unlike EISA Tier 2, does not specify a fixed efficacy for lighting products or define efficacy as a continuous linear function. Rather, EISA Tier 1 prescribes maximum allowable wattages for ranges of lumen output. The end result is that lamps can comply with EISA Tier 1 at efficacies as low as 11 lumens per watt and as high as 36 lumens per watt. EISA Tier 2 prescribes a minimum efficacy of 45 lumens per watt regardless of lumen output.

Table 14 | EISA Transition Dates and Coverage

Tier	Effective Date	EISA-Rated Lumen Ranges	Efficacy Requirement	Major Incandescent Wattage Categories Affected (W)
1	2012	1,490 -2,600	Maximum wattage: 72 W~21-36 lumens/W	100 and 150
	2013	1,050 -1,489	Maximum wattage: 53 W~20-28 lumens/W	75
	2014	750 -1,049	Maximum wattage: 43 W~17-24 lumens/W	60
	2014	310-749	Maximum wattage: 29 W~11-26 lumens/W	40
2	2020	All	No less than 45 lumens/W*	All

* EISA Tier 2 will require all lamps to have an efficacy of at least 45 lumens/W unless higher standards are otherwise determined by DOE.

Note: For more information, see http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_public_laws&docid=f:publ140.110.pdf

[†] DOE published rules in July 2009 covering general service fluorescent and incandescent reflector lamps. Additional rules may be forthcoming.

Contrary to popular opinion, incandescent lamps are NOT going away. Incandescent lamps that meet the EISA Tier-1 standards are already available.

Impact of EISA on Lighting

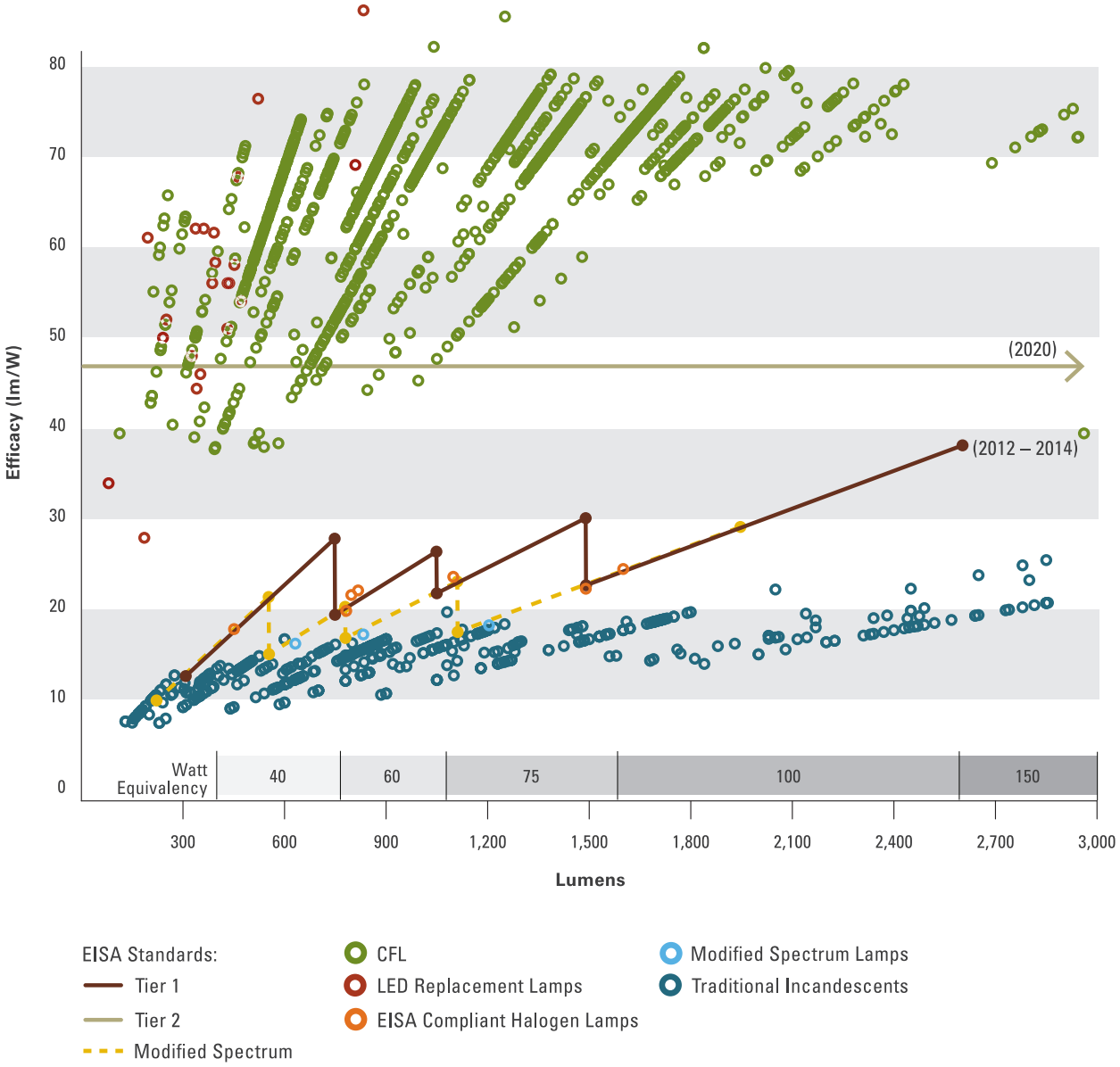
EISA coverage includes most general service, medium screw-base lamps. However, specific products are excluded from coverage:

- Three-way lamps
- Reflectors
- Globe lamps with a diameter greater than five inches
- Decorative lamps
- Small screw-base (candelabra) lamps

In addition, lower efficacy standards apply to modified spectrum products.

As illustrated in Figure 14, most incandescent lamps will not meet the EISA Tier 1 maximum wattages by the 2012 through 2014 implementation dates. Conversely, 100 percent of ENERGY STAR qualified CFL products meet the EISA Tier 1 maximum wattages, and 97 percent already meet the Tier 2 efficacy requirement. New EISA Tier 1-compliant incandescent lamps are already available on the market at price points close to those of CFLs. Therefore, it is unclear whether EISA efficacy requirements will lead to increased sales and saturation of CFLs.

Figure 14 | Impact of EISA Lighting Efficiency Standards on General Service Lamps



Incandescent, EISA-compliant halogen/incandescent, and modified spectrum data: Ecos Consulting, 2010. CFL data: ENERGY STAR CFL qualified products list, 2010. LED data: DOE Lighting Facts product database, 2010.

Near-Term Lighting Market Forecast

In the near term, what is the likely impact of the EISA standard?

The impact of EISA on the near-term lighting market rests on two factors:

1. **The availability and price of incandescent lamps.** EISA will prohibit the manufacture and shipment of most traditional incandescent lamps, effectively removing them from the market. When this happens, they may be replaced by EISA-compliant incandescent lamps, which are priced at or below the price of comparable CFLs. If so, there may be less of a transition to CFLs than expected.
2. **The growth rate of CFL socket saturation between now and when EISA Tier 1 begins.** If CFL saturation and, by implication, sales grow rapidly in advance of standards, the demand for lamps in general will shrink dramatically. CFLs last longer and consumers are likely to replace a burned-out CFL with another CFL. Therefore, demand for EISA-compliant incandescent lamps may be reduced.

Lighting Market Model

D&R International developed a model on behalf of DOE to ascertain the possible impacts of EISA based on the availability and price of incandescent lamps and the growth rate of CFL socket saturation between now and January 2012. This model is similar to forecasting models developed by manufacturers and other industry partners. Figures 15, 16, and 17 show possible outcomes for CFL shipments based on manipulation of these factors.

D&R used the following inputs for its calculations.

- 115 million homes in 2009
- Housing (and corresponding socket) growth rate of 1 percent per year
- 40 sockets per home
- 60 percent (24 total) sockets affected by EISA, with 40 percent (16 total) sockets containing lamps not subject to EISA Tier 1 standards
- Lifetimes of 8,000 hours for CFLs and 2,000 hours for incandescent lamps
- Daily usage of 1.9 hours
- 2009 CFL saturation of 17 percent
- Storage rates of 30 percent for CFLs and 20 percent for incandescent lamps

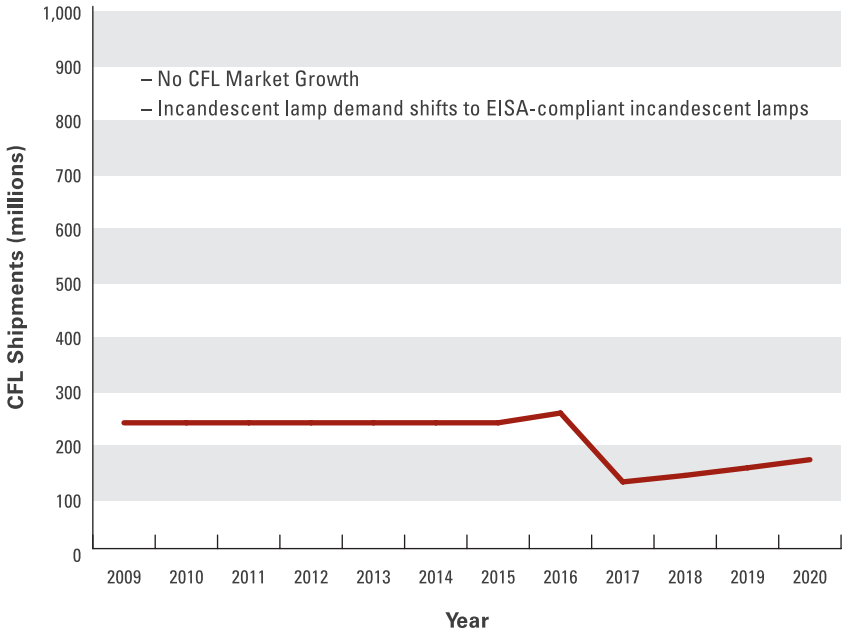
Possible Outcome 1: No EISA Impact on CFL Demand

Assumptions:

- CFL unit sales remain at their current level, with no market growth before EISA.
- EISA-compliant incandescent lamps are available in advance of standards and consumers purchase these incandescent lamps when they would have purchased a traditional incandescent. Following implementation of EISA, market share stops growing for these products and remains stable.

New demand and shipments of CFLs drop after the EISA transition is complete because all CFL sales simply replace existing CFLs.

Figure 15 | Possible Outcome 1: No EISA Impact on CFL Demand

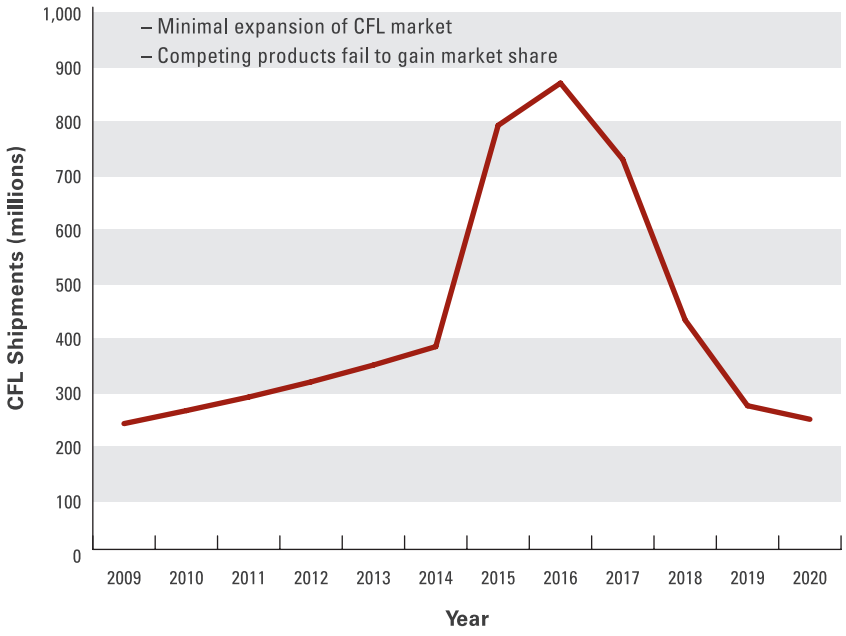


Possible Outcome 2: Delayed EISA Impact on CFL Demand

Assumptions:

- The CFL market grows at 10 percentage points per year until 2012.
- From 2012 to 2014, consumers substitute lower-wattage incandescents for higher-wattage incandescents that are no longer available (e.g., they buy 75-watt lamps to replace 100-watt lamps when 100-watt lamps are no longer available).
- In 2014, consumers begin purchasing CFLs because no low-price incandescent lamps are available.
- Demand for CFLs spikes in 2014 following the complete phase-in of EISA, and then drops rapidly as the long CFL lifetime reduces the total number of annual failures.

Figure 16 | Possible Outcome 2: Delayed EISA Impact on CFL Demand

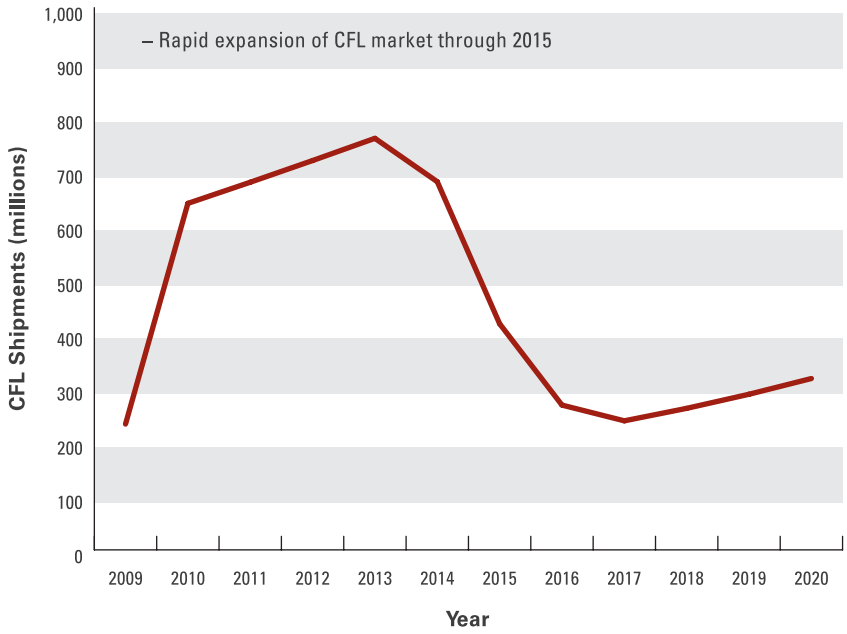


Possible Outcome 3: Rapid Early Growth in CFL Saturation Preempts EISA

Assumptions:

- Intense and coordinated promotion of CFLs causes rapid growth in CFL sales and socket saturation.
- As more sockets are filled with long-lived CFLs, demand shrinks.

Figure 17 | Possible Outcome 3: Rapid Early Growth in CFL Saturation Preempts EISA



Summary of Impacts

Table 15 summarizes the quantitative results of the three possible outcomes. While the scenarios presented are all possible, what actually occurs will depend on consumer, manufacturer, retailer, and program sponsor actions in the next several years.

Table 15 | Summary of Possible Outcomes in the CFL Market Due to EISA

	Outcome 1: CFL Market Stalls	Outcome 2: Delayed EISA Impact	Outcome 3: Rapid Early CFL Saturation Growth
CFL saturation in 2015	30%	43%	61%
Sockets filled with a CFL in 2015 (million)	1,457	2,086	2,951
Additional sockets filled with a CFL (million)	–	629	1,494
CFL sales to 2015 (million)	1,626	2,574	4,123
Additional annual savings potential (billion kWh)	**–**	**21**	**51**

Note: Savings are compared to Outcome 1.

ENERGY STAR

Criteria and Energy Savings

What recent changes in the ENERGY STAR CFL program have affected the market? Is there room for further improvement?

ENERGY STAR qualified CFLs are designed to replace existing inefficient incandescent technology with more efficient fluorescent technology. The ENERGY STAR criteria for CFLs have focused heavily on increasing quality and performance to address consumer concerns about previous CFL products.

ENERGY STAR criteria version 4.0 became effective December 2, 2008. Due to large unsold inventories of lamps qualified under criteria version 3.0, manufacturers could sell previously qualified product through July 1, 2009. Version 4.0 criteria addressed issues of performance and quality of reflector lamps, added a new ENERGY STAR product category for small screw base products, and introduced and formalized third-party testing for ENERGY STAR qualified CFLs. The new criteria are listed on the ENERGY STAR Web site at www.energystar.gov/ia/partners/product_specs/program_reqs/cfls_prog_req.pdf.

In general, version 4.0:

- increased efficacy requirements for most CFL product categories;
- increased the minimum lifetime for bare spiral models from 6,000 to 8,000 hours;
- added high-temperature testing requirements for indoor reflector models;
- introduced third-party independent testing of all ENERGY STAR qualified CFLs;
- set specific color categories;
- required manufacturers to disclose the mercury content of their CFL products; and
- added small screw-base (candelabra) products to the list of qualified product categories.

ENERGY STAR Product Performance

The new criteria specify that off-the-shelf versions of all qualified products be periodically tested by an independent laboratory. DOE established this third-party testing program in December 2008. As of July 2010, the first round of testing had not yet been completed.

Test data submitted as part of the ENERGY STAR qualification process is available. The third-party testing program will reveal whether off-the-shelf products with the ENERGY STAR label meet ENERGY STAR performance criteria.

The qualification test data suggests that there may be room to tighten the ENERGY STAR qualification criteria because qualified products test notably better on average than the minimum proscribed criteria. See Table 18 for details.

Table 16 | Criteria Performance of ENERGY STAR Qualified Bare Spiral Medium-Screw Products

	Lamp Wattage	Required Value	Average Actual Value
Minimum Efficacy (lumens per watt)*	W < 10	50	65
	10 ≤ W < 15	55	68
	W ≥ 15	65	70
Minimum Color Rendering Index	–	80	83
Minimum Rated Lifetime (hours)	–	8,000	10,120
Maximum Mercury Content (mg)	–	5	3.35*
Minimum Operating Frequency (Hz)	–	40	49
Minimum Warranty (years)	–	2	4
Minimum Power Factor	–	0.5	0.6

* Mercury content is self-reported.

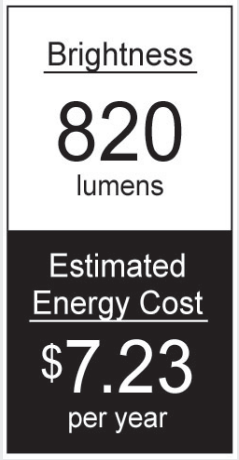
ENERGY STAR Lighting Integration Proposal

In December 2009, a proposal to integrate lighting products under a unified criteria system was announced. The ENERGY STAR program has had distinct areas and requirements for CFLs, fixtures, solid-state luminaires, and light emitting diode (LED) replacement lamps. Under the integration proposal, product criteria would apply across all technology types (incandescent, fluorescent, LED) and would cover three areas: residential light fixtures, residential lamps, and commercial/industrial light fixtures.

Additional information on the lighting integration proposal can be found on the ENERGY STAR Web site integration proposal page at www.energystar.gov/ia/partners/downloads/mou/ENERGY_STAR_Qualified_Lighting_An_Integration_Proposal.pdf.

Federal Trade Commission Labeling Requirements

In June 2010, the Federal Trade Commission (FTC) announced new lighting labels for all medium screw-base lamps, including incandescent, CFL, and LED. The new labeling requirements that take effect in 2011 will allow consumers to compare lighting products' lumen output, estimated energy costs, and lifetime. Additional information on the new FTC labeling requirements can be found at www.ftc.gov/opa/2010/06/lightbulbs.shtm.



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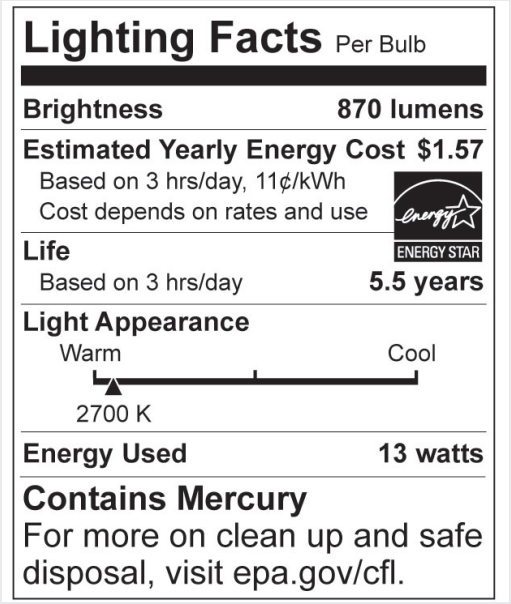

BACK

ENDNOTES

1 KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission. February 8, 2010.

2 KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission, Energy Division. February 8, 2010.

3 Based on on-site inventoried data from KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission, Energy Division. February 8, 2010.

4 Massachusetts: NMR Group, Inc. "The Market for CFLs in Massachusetts." Prepared for Cape Light Compact, NSTAR Electric, National Grid, Unitil, and Western Massachusetts Electric. January 28, 2010. Massachusetts 2008: NMR Group, Inc. January 28, 2010. Connecticut: NMR Group, Inc. "The Market for CFLs in Connecticut." Prepared for Connecticut Energy Conservation Management Board, Connecticut Light & Power, and The United Illuminating Company. March 2, 2010. Connecticut 2008: NMR Group, Inc. March 2, 2010. California 2005: RLW Analytics. "California Lighting and Appliance Saturation Study 2005." 2008. California 2009: KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission, Energy Division. February 8, 2010.

5 National: U.S. Department of Energy. U.S. Lighting Market Characterization, Volume I: National Lighting Inventory and Energy Consumption Estimate. 2002. California: KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission, Energy Division. February 8, 2010.

FIGURE SOURCES

Figure 1 | Page 2: ICF International. "ENERGY STAR Summary of Lighting Programs by Energy Efficiency Program Sponsors." April 2010, March 2009, September 2007. D&R International, Ltd. "ENERGY STAR Summary of Lighting Programs by Energy Efficiency Program Sponsors." March 2008, February 2006.

Figure 2 | Page 8: CFL shipments: U.S. Department of Commerce, U.S. International Trade Commission. CFL market share: D&R International, Ltd. Estimated incandescent lamp shipments: D&R International, Ltd.

Figure 3 | Page 10: D&R International, Ltd. based on data provided by: NMR Group, Inc. "The Market for CFLs in Massachusetts." Prepared for Cape Light Compact, NSTAR Electric, National Grid, Unitil, and Western Massachusetts Electric. January 28, 2010. NMR Group, Inc. "The Market for CFLs in Connecticut." Prepared for Connecticut Energy Conservation Management Board, Connecticut Light & Power, and The United Illuminating Company. March 2, 2010. NMR Group, Inc. "NYSERDA CFL Expansion Fast Track Program: Random Digit Dial and Onsite Survey Results." Prepared for The New York State Energy Research and Development Authority. March 2010. NMR Group, Inc. "The Market for CFLs in Wisconsin." Prepared for the Public Service Commission of Wisconsin. February 1, 2010.

Figure 4 | Page 12: Lockheed Martin. "2009 ENERGY STAR Lighting Practices Report: Lighting Retailer Product Stocking, Pricing and Promotional Practices." Data gathered for Efficiency Vermont, National Grid, NSTAR Electric, Western Massachusetts Electric, and Cape Light Compact. November 20, 2009.

Figure 5 | Page 13: Northeast: Lockheed Martin. "2009 ENERGY STAR Lighting Practices Report: Lighting Retailer Product Stocking, Pricing and Promotional Practices." Data gathered for Efficiency Vermont, National Grid, NSTAR Electric, Western Massachusetts Electric, and Cape Light Compact. November 20, 2009. National: D&R International, Ltd.

Figure 6 | Page 14: Efficiency Vermont.

Figure 7 | Page 15: ENERGY STAR product database, accessed May 21, 2010.

Figure 8 | Page 17: D&R International, Ltd. based on data provided by: NMR Group, Inc. "Results of the Multistate CFL Modeling Effort." Prepared for Connecticut Energy Efficiency Board. February 2, 2010. Population weighting: www.quickfacts.census.gov/qfd/index.html accessed June 6, 2010.

Figure 9 | Page 18: KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission, Energy Division. February 8, 2010.

Figure 10 | Page 19: New York State, District of Columbia, Houston, and Ohio: New York State Energy Research and Development Authority (NYSERDA). California: KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission. February 8, 2010. Customized query.

Figure 11 | Page 21: D&R International, Ltd. based on data provided by: KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission, Energy Division. February 8, 2010.

Figure 12 | Page 26: NMR Group, Inc. "The Market for CFLs in Connecticut." Prepared for Connecticut Energy Conservation Management Board, Connecticut Light & Power, The United Illuminating Company. March 2, 2010.

Figure 13 | Page 26: New York City, New York State, Houston, District of Columbia, and Ohio: NMR Group, Inc. "NYSERDA CFL Expansion Fast Track Program: Random Digit Dial and Onsite Survey Results." Prepared for NYSERDA. March, 2010. Massachusetts: NMR Group, Inc. "The Market for CFLs in Massachusetts." Prepared for Cape Light Compact, NSTAR Electric, National Grid, Unitil, and Western Massachusetts Electric. January 28, 2010. Connecticut: NMR Group, Inc. "The Market for CFLs in Connecticut." Prepared for Connecticut Energy Conservation Management Board, Connecticut Light & Power, and The United Illuminating Company. March 2, 2010. Wisconsin and Indiana: NMR Group, Inc. "The Market for CFLs in Wisconsin." Prepared for the Public Service Commission of Wisconsin. February 1, 2010.

Figure 14 | Page 29: Incandescent, EISA-compliant halogen/incandescent, and modified spectrum data: Ecos Consulting, 2010. CFL data: ENERGY STAR CFL qualified products list, 2010. LED data: DOE Lighting Facts product database, 2010.

Figure 15 | Page 31: D&R International, Ltd.

Figure 16 | Page 32: D&R International, Ltd.

Figure 17 | Page 33: D&R International, Ltd.

TABLE SOURCES

Table 1 | Page 3: ICF International. "2010 ENERGY STAR Summary of Lighting Programs by Energy Efficiency Program Sponsors." April 2010.

Table 2 | Page 3: ICF International. "2010 ENERGY STAR Summary of Lighting Programs by Energy Efficiency Program Sponsors." April 2010.

Table 3 | Page 4: California: KEMA, Inc. "Final Evaluation Report: Upstream Lighting Program." Prepared for the California Public Utilities Commission. February 8, 2010. Massachusetts: Cape Light Compact. New York: New York State Energy Research and Development Authority (NYSERDA). Vermont: Efficiency Vermont.

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Table 15 | Page 34: D&R International, Ltd.

Table 16 | Page 36: ENERGY STAR qualified product database, accessed June 2010.

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