Troubling Trends in Residential Lighting: Are CFLs Losing Ground to Halogen Lamps?

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ABSTRACT

The 2007 Energy Independence and Security Act (EISA) phased out traditional general purpose incandescent lamps between 2012 and 2014. Many lamp manufacturers began producing halogen lamps to minimally meet the Act's requirements for increased lamp efficacy, often marketing these lamps as "energy-efficient." While they are more efficient than their traditional incandescent counterparts, they are far less efficient than most compact fluorescent lamps (CFLs) and light-emitting diode (LED) lamps. CFLs and LED lamps produce the same amount of light as the halogen lamps at only a fraction of the wattage.

To positively impact efficiency, residential lighting programs must motivate consumers to choose CFLs and LED lamps over halogen lamps. However, data from recent market tracking studies in the Pacific Northwest, California, and other regions suggest that while halogen lamp prices remain low, LED lamp prices remain relatively high and CFL prices are increasing. In-store research suggests that the quantity of CFLs for sale in retail stores is declining while halogen lamp quantities are increasing. To make matters worse, many energy-efficiency program sponsors are shifting incentives away from CFLs and toward LED lamps, widening the price gap between CFLs and halogen lamps and not reducing LED lamp prices enough to make them cost-competitive with halogen lamps. The increased availability and lower prices of halogen lamps likely lead some consumers to purchase halogen lamps instead of more energy-efficient alternatives. This paper presents these troubling trends and suggests that program sponsors and regulators may need to reconsider shifting program incentives away from CFLs.

Introduction

Lamp Efficacy Regulations and Standards

The U.S. Congress passed EISA in 2007 (H.R. 6—110th Congress 2007). EISA requires that general purpose incandescent lamps meet minimum efficacy standards that traditional general purpose incandescent lamps[1] cannot meet, effectively pushing the most inefficient lamps

[1] When the authors refer to traditional incandescent A-lamps herein, we utilize the EISA definition of a general purpose incandescent lamp—"a standard incandescent or halogen type lamp that – 1) is intended for general service applications; 2) has a medium screw base; 3) has a lumen range of not less than 310 lumens and not more than 2,600 lumens; and 4) is capable of being operated at a voltage range at least partially within 110 and 130 volts." EISA also includes separate efficiency standards for reflector and modified spectrum lamps as well as a list of excluded lamp types. Unless otherwise noted, this paper focuses on general purpose lamps only (in other words, the authors exclude reflector, modified spectrum, and other EISA exemptions).

out of the market. As shown in Table 1, the EISA standards phased in gradually; on January 1, 2012, the legislation prohibited the manufacture and importation of general purpose incandescent lamps above 72 watts with light output in the 1,490 to 2,600 lumen range, beginning the phase-out of many traditional 100 watt incandescent lamps. After this date, it was illegal to manufacture or import lamps that did not meet the standard, but the standard allowed retailers to sell any existing stock. As of January 1, 2014, EISA's efficacy requirements were effect for lamps affected by each stage of the regulation.

Table 1. Summary of EISA standards

	Traditional incandescent lamps			EISA-compliant halogen lamps		
EISA effective dates	Wattage (W)	Typical light output in lumens (lm)	Typical efficacy in lumens/Watt (lm/W)	Wattage (W)	Typical light output ranges (lm)	Minimum efficacy ranges (lm/W)
1/1/2012	100 W	1,690 lm	17 lm/W	72 W	1,490-2,600 lm	21-36 lm/W
1/1/2013	75 W	1,170 lm	16 lm/W	53 W	1,050-1,489 lm	20-28 lm/W
1/1/2014	60 W	840 lm	14 lm/W	43 W	750-1,049 lm	17-24 lm/W
1/1/2014	40 W	490 lm	12 lm/W	29 W	310-749 lm	11-26 lm/W

Also in 2007, California's legislature passed Assembly Bill (AB) 1109, the California Lighting Efficiency and Toxics Reduction Act, which required the California Energy Commission to develop and implement a strategy that would reduce energy consumption related to general purpose indoor lighting by 50 percent by 2018 (Huffman 2007). California adopted the same efficacy standards as EISA with the effective dates one year earlier for each phase of the regulation—so, for example, while EISA prohibited the manufacture or importation of traditional 100 Watt incandescent lamps after January 1, 2012, AB 1109 did the same as of January 1, 2011.

Lamp manufacturers introduced halogen lamps that comply with the efficacy requirements of EISA and AB 1109 (to which the authors refer herein as "EISA-compliant halogen lamps"). While more efficient than traditional incandescent lamps, these lamps are less efficient than CFLs and far less efficient than LED lamps. However, as we will demonstrate below, retailers typically price EISA-compliant halogen lamps lower than CFLs—particularly in the absence of energy-efficiency program incentives for CFLs. Manufacturers and retailers may also market EISA-compliant halogen lamps as "energy efficient." As such, consumers may view these lamps as energy-efficient alternatives to traditional incandescent lamps.

Another phase of EISA is scheduled to go into effect in 2020. The so-called "EISA 2020" standard will increase the efficacy requirements for general purpose lamps from the levels shown in Table 1 to 45 lumens per watt, regardless of wattage. In theory, these standards would lead to the elimination of all of the lamps currently considered as EISA-compliant halogen lamps since this technology will not be able to attain the required efficacy level. However, the rule for the EISA 2020 standard is unlikely to be finalized until the end of 2016, and there has been discussion about the efficacy requirement being regarded as a "fleet average" standard—in other words, this would mean that lower-efficacy lamps, such as halogen lamps currently considered EISA-compliant, could still be sold as long as the average efficacy of general purpose lamp sales reached the level of 45 lumens per watt (NEEP 2015). There are also noteworthy political and regulatory barriers to the full implementation of the EISA 2020 standard,[2] so the extent to which EISA 2020 is implemented remains to be seen.

Further complicating the residential lighting landscape is an update to the Energy Star lamp specification which will take effect on January 2, 2017. Energy Star Version 2.0 will require a minimum lamp efficacy of 70 lumens per watt for omnidirectional lamps with a Color Rendering Index (CRI) of 90 or greater and a minimum efficacy of 80 lumens per watt for omnidirectional lamps with CRI less than 90 (Energy Star 2016). This new Energy Star specification will not impact halogen lamps currently considered EISA-compliant because these lamps were never considered efficient enough to warrant Energy Star certification. However, Energy Star 2.0 will impact CFLs because many residential lighting energy-efficiency programs provide incentives only for lamps that meet the Energy Star specifications. Current CFLs do not meet Energy Star 2.0 requirements. However, Energy Star plans to host a list of CFLs models that qualified for Energy Star 1.1, which program sponsors could use if they choose to provide incentives for CFLs after Energy Star 2.0 goes into effect.

Residential Lighting Energy-Efficiency Programs

Energy-efficiency program sponsors in the Pacific Northwest and California have offered in-store discounts on CFLs for many years and have more recently added incentives for LED lamps. Below we provide brief overviews of these programs as context for the evolving replacement lamp markets in these regions. The paper also references market data from Massachusetts and New York, so we provide background on these regions' programs as well.

Pacific Northwest. Idaho, Montana, Oregon, and Washington each have many energy-efficiency program sponsors. The largest program is the Bonneville Power Administration's (BPA) Simple Steps, Smart Savings program. The program offers upstream incentives for CFLs and LED lamps and supports the region's program administrators with direct install, direct mail, and bulk purchase programs for these technologies (BPA n.d.). The program began in March, 2010 with incentives for CFLs, and added incentives for LED lamps in 2013.[3] During 2015, the program provided incentives for more than 2.9 million CFLs and more than 1.3 million LED lamps (Francis 2016).

California. Pacific Gas & Electric Company, Southern California Edison, and San Diego Gas & Electric Company began offering discounted CFLs to residential customers in 1989 and LED lamps in their 2006-08 program (DNV GL 2014; KEMA, Inc. et al. 2010). During the 2010-12 program, the three utilities provided upstream incentives[4] for nearly 70 million CFLs and approximately 110,000 LED lamps. Between 2013 and 2014, the program provided incentives for 12.2 million CFLs and 2.2 million LED lamps. The 2013-14 program was smaller than the 2010-12 program in part because LED lamps require higher incentives than CFLs to generate

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[2] For example, a November 2014 congressional budget rider prohibits the U.S Department of Energy from enforcing EISA. In addition, the regulation allows continued sale of traditional incandescent lamps which qualify for "rough and vibration service." A 2015 NEEP report found that sales incandescent lamps rated for rough and vibration service increased from about one million units in 2010 to about five million units in 2015 (NEEP, 2015).
[3] Note that various program administrators in the Northwest offered incentives for energy-efficient lamps prior to 2010, but the Simple Steps program represents the region's largest current residential lighting program offering.
[4] Upstream programs deliver incentives to lighting suppliers to reduce lamp prices to consumers in retail stores.

low price points for the consumer. The investor-owned utilities (IOU) also reduced the quantity of program-discounted bare spiral CFLs from more than 52 million lamps in 2010-12 to less than 4 million in 2013-14 (DNV GL 2016a).

Massachusetts. Starting in the late 1990s, Cape Lighting Compact, Eversource, National Grid, and Unitil sold CFLs through a mail-order catalogue, a website, and in-store instant rebate coupons in coordination with the Massachusetts Energy Efficiency Advisory Council. The program introduced an upstream initiative in 2002 and began offering discounts on LED lamps in the late 2000s. During the 2014-15 period, the program provided incentives for more than 10 million CFLs and LED lamps (Wilson-Wright 2016).

New York. The New York State Energy Research and Development Authority's (NYSERDA) offered an upstream CFL program for many years and added LED lamps more recently. In 2012, the program discontinued its incentives for basic bare spiral CFLs. Across all of its residential lighting programs, NYSERDA provided incentives for approximately 4.3 million lamps in 2011 (when bare spiral CFLs were still included) and just under 340,000 lamps in 2012 (NMR Group, Inc. and Apex Analytics, LLC 2014).

Methodology

California and the Pacific Northwest

This paper draws primarily on market research and evaluation study results from two regions: the Pacific Northwest (Idaho, Montana, Oregon, and Washington) and California. Results from lighting retailer shelf surveys conducted by DNV GL for the Northwest Energy Efficiency Alliance (NEEA) in the Pacific Northwest and the California Public Utilities Commission (CPUC), Energy Division (ED) in California comprise the core of the discussion below. Shelf surveys involve gathering detailed information regarding all residential replacement lamps for sale in brick-and-mortar retail stores. During the shelf surveys, field staff record key information for every store visited such as the retail channel, store name, and store address using a tablet computer. They also record information specific to each package of lamps in the store, including model number, lamp type, base type, lamp shape, manufacturer, wattage, and the number of lamps in each package. Additionally, field staff recorded the number of packages, number of lamps per package, and numerous other details regarding lamp color, brightness, and so on. DNV GL staff compiled all shelf survey results into a comprehensive database for analysis.

In California, DNV GL designed the sampling approach to ensure representation of each of the three IOUs' service territories as well as each of seven retail channels (including discount, drug, grocery, hardware, home improvement, mass merchandise, and membership club). In the Pacific Northwest, DNV GL designed the approach to ensure representation of each of the four states (Idaho, Montana, Oregon, and Washington) and the same retail channels as in California, except with discount stores included in the mass merchandise channel and drug and grocery combined into one channel (for a total of five channels).

In both regions, field researchers collected recent shelf survey data in multiple phases – annually in the Pacific Northwest and one to two times per year in California. Table 2 shows the distribution of completed shelf surveys by retail channel and data collection period in the Pacific Northwest, and Table 3 shows the same information for California.

Table 2. Number of completed shelf surveys in the Pacific Northwest by retail channel and data collection period

Retail channel	Data collection period Winter 2012-13	Winter 2013-14	Winter 2014-15	Overall
Drug and grocery	28	28	22	78
Hardware	27	27	22	76
Home improvement	13	13	10	36
Mass merchandise	22	22	18	62
Wholesale club	6	6	4	16
Total	96	96	76	268

Table 3. Number of completed shelf surveys in California by retail channel and data collection period

Retail channel	Data collection period Winter 2012-13	Summer 2013	Winter 2014-15	Overall
Discount	29	29	29	87
Drug	29	29	29	87
Grocery	28	28	28	84
Hardware	29	29	29	87
Home improvement	28	29	28	85
Mass merchandise	29	29	29	87
Wholesale club	28	28	28	84
Total	200	201	200	601

Other Regions

This paper also draws on data from other regions, including Massachusetts and New York, where data are available and relevant. In these cases we direct the reader to the sources cited for further details regarding data collection methods.

Results

Unless otherwise noted, we have limited this discussion to general purpose lamps. This category of lamps includes traditional incandescent A-lamps (which do not meet EISA standards) and the technologies and styles that typically replace them, including:

- halogen A-lamps that meet EISA standards (to which we refer herein as “EISA-compliant” halogen A-lamps)
- LED A-lamps
- CFL A-lamps
- CFL bare spiral lamps (since these are designed as A-lamp replacements)

Data from other regions (Massachusetts and New York) includes all lamp styles – in other words, the results for these regions are not limited to the general purpose lamp category.

Lamp Availability

Pacific Northwest. Researchers reviewed the quantity of general purpose lamps (medium screw-base A-lamps and spiral CFLs) available for sale in the Pacific Northwest (based on in-store counts of lamp packages and the quantity of lamps per package) by technology across all retail channels. The share comprised by CFL A-lamps and spiral CFLs remained fairly consistent between late 2012 and late 2014 at around 37% to 39% of lamps, while EISA-compliant halogen A-lamp shares increased nearly three-fold in the same timeframe from 12% to 35% (Figure 1). LED A-lamp shares increased from 1% to 7% of general purpose lamp stock in the Pacific Northwest while incandescent A-lamp shares declined between mid-2012 and early 2015 from 49% to 20%. Energy-efficient lamps—including basic spiral CFLs, CFL A-lamps, and LED A-lamps—maintained a share of roughly 40 to 45% of general purpose lamp stock while relatively inefficient lamps—incandescent and EISA-compliant halogen A-lamps—comprised roughly 55% to 60% of general purpose lamp stock.

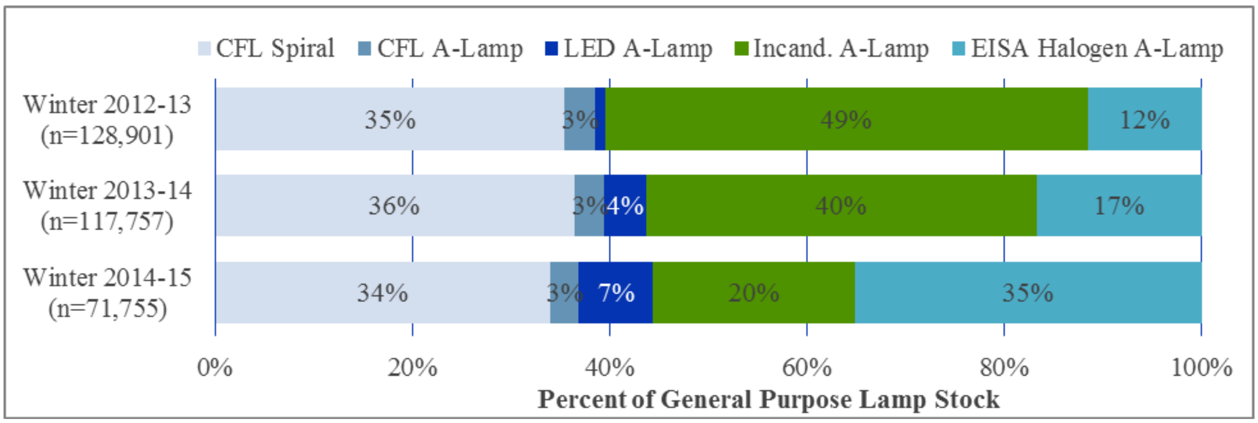

Figure 1. Percent of general purpose lamp stock by lamp technology and data collection period across all retail channels: Pacific Northwest (ID, MT, OR, WA). *Source*: DNV GL 2015.

California. Figure 2 below shows the share of general purpose lamps stocked in California retail stores by technology between late 2012 and early 2015. During this timeframe, CFL stock varied from period to period. The CFL trend here is less clear than in the Pacific Northwest, with an increase in the share of general purpose lamps comprised by spiral and A-lamp CFLs between late 2012 and mid-2013 and then a drop in late 2014 to levels below those in late 2012. EISA-compliant halogen A-lamps more than doubled their share of general purpose lamps between late 2012 and late 2014, and LED A-lamps increased from 1% of stock to 9% in the same period.

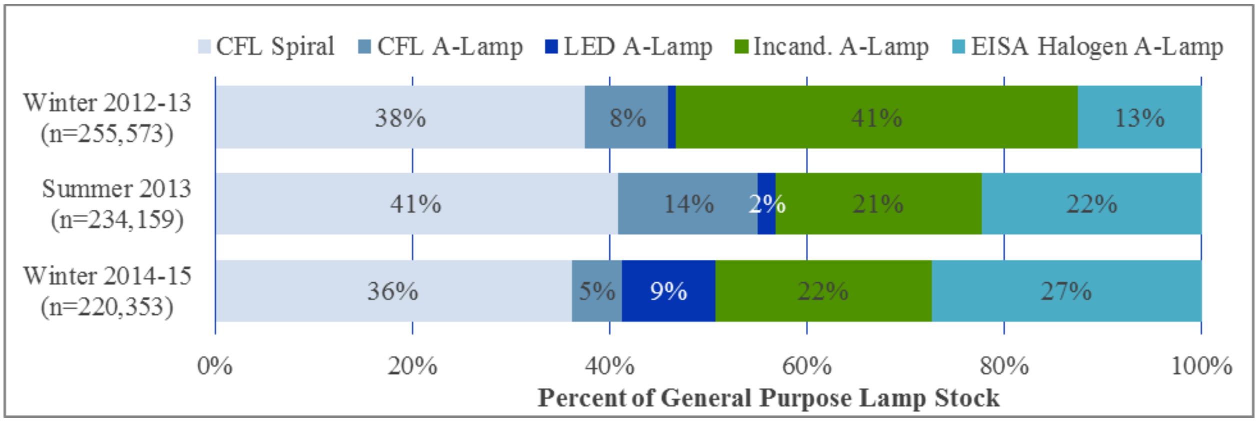

Figure 2. Percent of general purpose lamp stock by lamp technology and data collection period across all retail channels: California. *Source:* DNV GL 2016b.

Program-Discounted Lamps in California. Results from another recent study in California[5] suggest that overall CFL sales in the state (across all lamp styles) declined from roughly 43.5 million lamps in 2009 to roughly 30.5 million in 2014 (Figure 3). Although the study authors acknowledge that various market factors likely influenced this change, they note that the dramatic decline in CFL sales coincided with an even more dramatic decline in the quantity of program-discounted basic spiral CFLs (from approximately 21 million CFLs in 2009 to only 6 million in 2014). CFL suppliers interviewed in support of a 2015 Massachusetts study[6] asserted that California's dramatic reduction in incentives for bare spiral CFLs between 2012 and 2013 led consumers to switch to lower-priced halogen lamps.

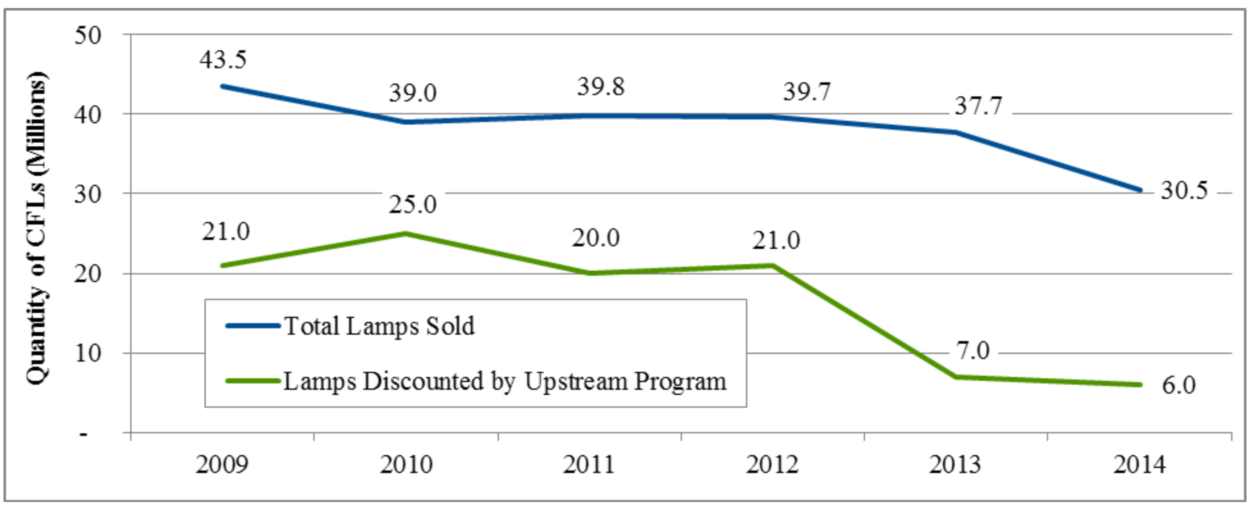

Figure 3. Quantity of CFLs sold and quantity of CFLs discounted by California upstream lighting program, 2009—2014. Note that these data include all CFL styles (bare spirals, A-lamps, and others). *Source:* TRC and PG&E 2015.

Massachusetts and New York. Figures 4 and 5 show the share of lamp sales by technology in Massachusetts and New York, respectively, across retail channels that represent approximately

[5] TRC and PG&E, 2015.
[6] NMR Group *et al.*, 2015.

one-quarter of total sales.[7] As shown, halogen lamp shares overtook CFLs in both regions as of 2014. CFLs comprised only 17% of lamps sold in Massachusetts in 2014 compared to 24% for halogen lamps. The same gap of seven percentage points was present in New York in 2014, with CFLs at 13% of sales and halogen lamps at 20%. The decline in CFL share in New York coincided with NYSERDA's elimination of bare spiral CFL incentives in 2012. CFL suppliers asserted that New York's discontinuation of incentives for bare spiral CFLs led consumers to switch to lower-priced halogen lamps (NMR Group, Inc. et al. 2015).

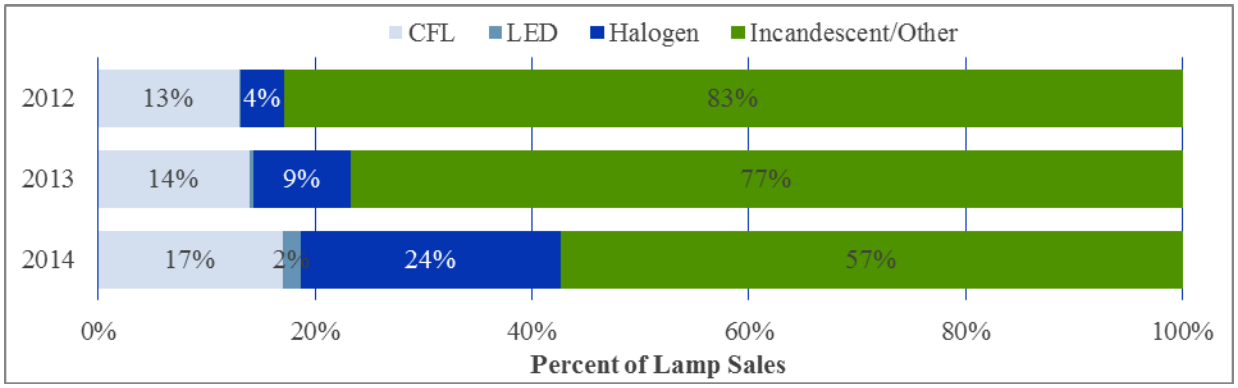

Figure 4. Share of lamp sales by technology in Massachusetts excluding the home improvement and hardware channels, 2012—2014. Note: These channels represent approximately 25% of state-level sales across all lamps styles. *Source*: NMR Group, Inc. et al. 2015.

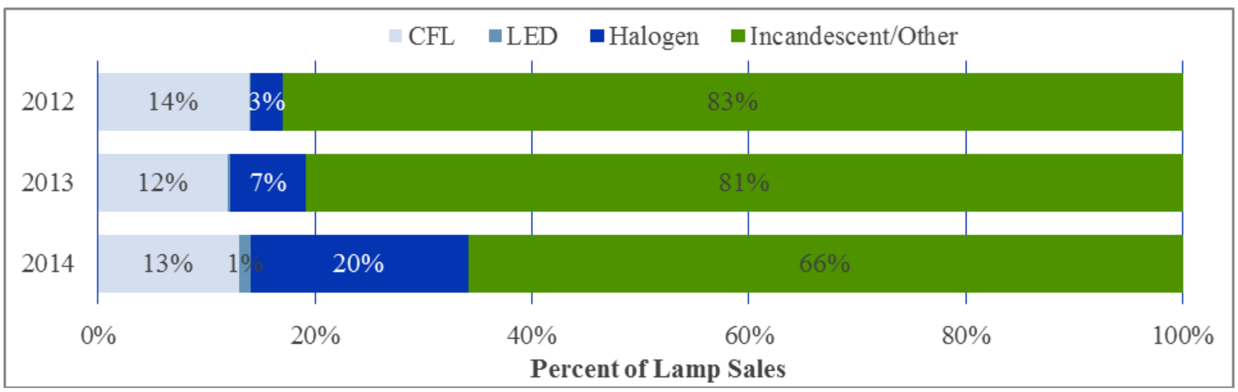

Figure 5. Share of lamp sales by technology in New York excluding the home improvement and hardware channels, 2012—2014. Note: These channels represent approximately 25% of state-level sales across all lamps styles. *Source:* NMR Group, Inc. et al. 2015.

Lamp Pricing

Below we detail the average shelf price for general purpose lamps (A-lamps and spiral CFLs) in brick-and-mortar retail stores that sell such lamps to consumers. The data represent the

[7] The data in Figure 4 and Figure 5 are point-of-sale (POS) data that do not include the home improvement and hardware retail channels because these data were not available. The study authors estimate that the POS data capture approximately one-quarter of total lamp sales in each state (NMR Group, Inc. et al. 2015). The Massachusetts and New York market data are thus less inclusive than the Pacific Northwest and California data, which include all major lighting retail channels. However, the Massachusetts and New York data reflects actual sales whereas the Pacific Northwest and California data are from shelf inventories which do not necessarily correlate with sales.

final price per lamp (including any discounts available at the time of the research). We present these results across all retail channels for the Pacific Northwest and California. Comparable data from Massachusetts and New York are not available.[8]

Pacific Northwest. Figure 6 shows the average price for general purpose lamps for sale in Pacific Northwest retail stores during three data collection periods between late 2012 and early 2015 across all retail channels. For all general purpose lamp types except LED A-lamps, the average price per lamp increased between late 2012 and late 2014. CFL A-lamp prices increased by the greatest margin (approximately $1), while average prices for bare spiral CFLs and incandescent A-lamps increased by about 50 cents per lamp and EISA-compliant halogen lamp prices increased by approximately 10 cents per lamp. Despite these increases, the average prices for incandescent A-lamps and EISA-compliant halogen A-lamps were roughly half the price of the least expensive efficient lamps (bare spiral CFLs), making these relatively inefficient lamps the lowest-cost option in the general purpose replacement lamp category.

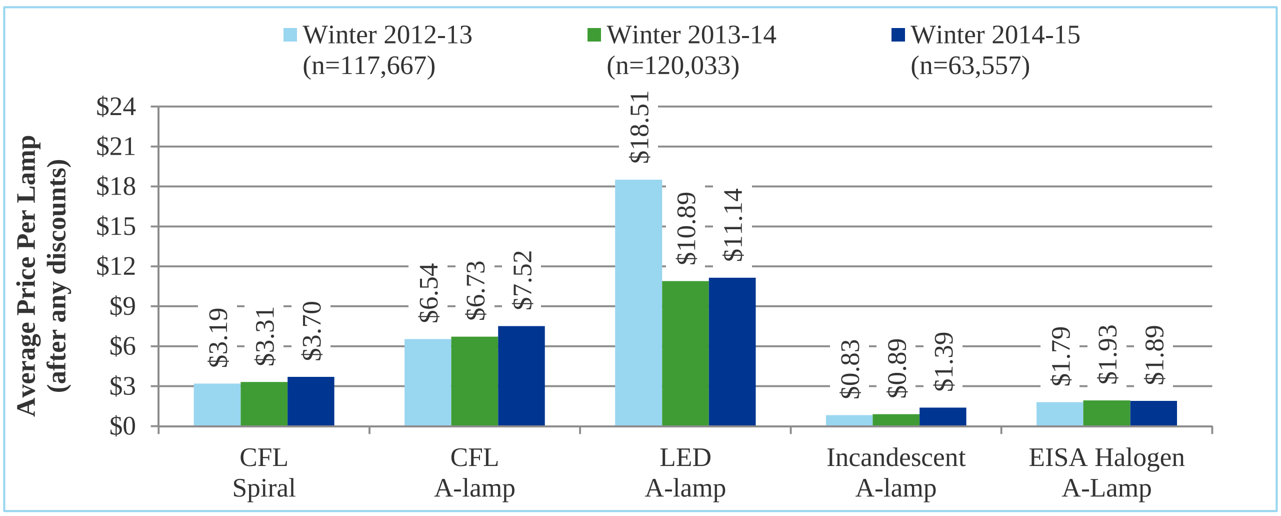

Figure 6. Average price per general purpose lamp by lamp technology, lamp style, and data collection period across all retail channels: Pacific Northwest (ID, MT, OR, WA). *Source:* DNV GL 2015.

California. Figure 7 shows the average price for general purpose lamps in California during three data collection periods between 2012 and 2015 across all retail channels. As in the Pacific Northwest, the average prices for incandescent A-lamps crept slowly upward, but the trends for other lamp styles were less consistent from year to year. On average, however, prices for bare spiral CFLs and CFL A-lamps increased between mid-2012 and late 2014, LED A-lamp prices declined, and EISA-compliant halogen A-lamp prices fluctuated by up to 60 cents per lamp, on average, settling at $2.30 per lamp in late 2014. At the same time, bare spiral CFLs were roughly 25 to 40% more expensive than incandescent or EISA-compliant halogen A-lamps in California. These results suggest that, again, relatively inefficient lamps (incandescent and EISA-compliant halogen lamps) were the lowest-cost general purpose lamp option in late 2014.

[8] Data are available from Massachusetts and New York on CFL and LED lamp prices, but data are not available for halogen lamp prices.

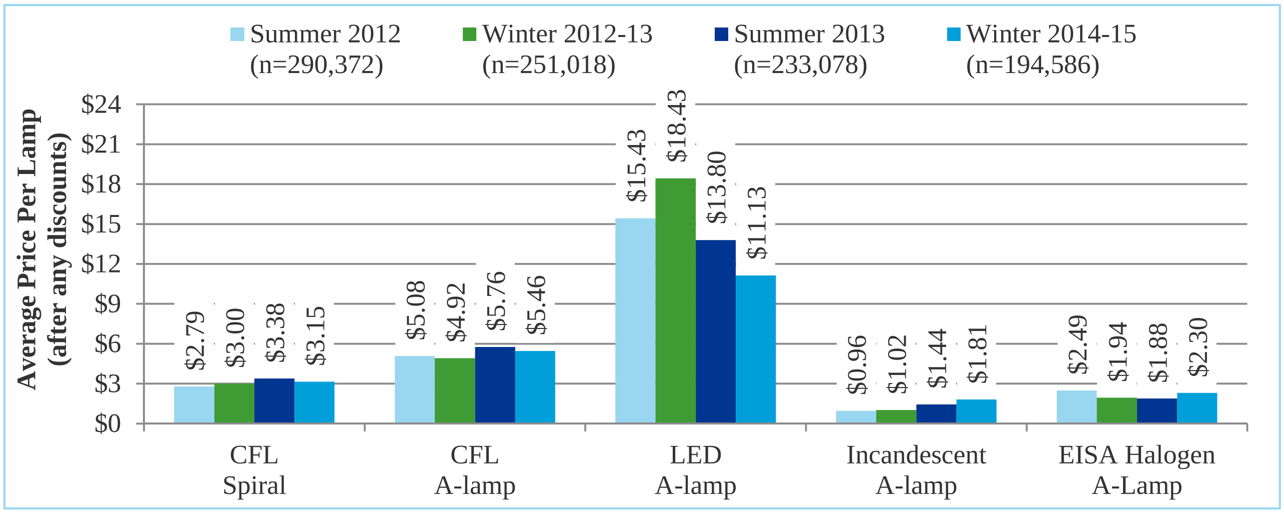

Figure 7. Average price per general purpose lamp by lamp technology, lamp style, and data collection period across all retail channels: California. *Source:* DNV GL 2016b.

Program-Discounted Lamps in California. When discounts are available, the California shelf survey data include details regarding discount providers and discount amounts. Table 1 shows the average price per lamp for general purpose lamps with and without upstream lighting program discounts across all retail channels during the winter 2012-13 and winter 2014-15 shelf survey data collection periods. The authors noted above that relatively inefficient (incandescent and halogen) lamps were the lowest-cost general purpose lamp option in early 2015, but the data in Table 1 suggest that this was not the case in California when program-discounted lamps were available. During both periods, the lowest-cost general purpose lamp option shifted to bare spiral CFLs when program discounts were available. In early 2015, program-discounted bare spiral CFLs were less than half the cost of incandescent A-lamps or EISA-compliant halogen A-lamps.

Table 1. Average price per general purpose lamp with and without program discounts across all retail channels by lamp technology and lamp style, winter 2012-13 and winter 2014-15*

	Winter 2012-13		Winter 2014-15	
General purpose lamp type*	Program-discounted lamps	Lamps without program discounts	Program-discounted lamps	Lamps without program discounts
CFL bare spiral	$0.80	$3.15	$0.59	$3.27
CFL A-lamp	$0.50	$4.92	$0.93	$5.45
Incandescent A-lamp	N/A	$1.17	N/A	$1.90
EISA-compliant halogen A-lamp	N/A	$1.86	N/A	$2.14
LED A-lamp	$18.39	$19.09	$6.92	$11.16

* Includes: CFL ≤ 30 W, incandescent ≤100 W, EISA-compliant halogen ≤ 72W, and LED A-lamps of all wattages. *Source:* DNV GL 2016a.

Conclusions & Recommendations

Recent data from four different regions in the U.S. suggest that:

- Halogen lamp market share is increasing

- CFL market share is decreasing in regions where there has been a significant reduction in the availability of energy-efficiency program incentives
- Halogen lamps are significantly less expensive than CFLs when CFL incentives are not available; and
- Despite declining prices, LED lamps continue to be substantially more expensive than other general purpose lamps.

These data indicate that many shoppers who purchased incandescent lamps before the EISA phase-out have chosen to purchase halogen lamps rather than more efficient alternatives, and interviews with lighting suppliers corroborate these results.

For more price-sensitive consumers, the fact that halogen lamps are considerably less expensive than non-discounted CFLs is likely an important driver for the increases halogen lamp market share.[9] Comparing the experiences of the California and Massachusetts retail lighting markets is instructive, even though the time periods and market share data sources are somewhat different. In California where there was a significant reduction in the availability of CFL discounts from 2013 to 2015, CFL market share declined from 55% to 41% in this timeframe. In contrast, in Massachusetts—where CFL discounts were more consistently available between 2012 and 2014—CFL market share actually increased by 4 percentage points. In addition, lighting manufacturers who sold CFLs in both California and Massachusetts claimed that the reduction or retention of CFL incentives was the best explanation for why their CFLs sales were declining in California but not in Massachusetts (DNV GL et al. 2015).

One of the conclusions from a 2015 report from the Northeast Energy Efficiency Partnership (NEEP) was that "as long as LEDs remain a relatively high cost product, it is still appropriate for [energy-efficiency] programs to support CFLs as a low-cost efficient option" (NEEP, 2015). The evidence summarized in this paper supports the same conclusion—that continuing to subsidize CFLs is a prudent short-term strategy until LED lamps become more affordable. A 2016 Massachusetts study found that even in 2020, LED lamps are still expected to be the most expensive option for general purpose lamps (NMR Group, Inc. et al. 2016).

Given the pending changes in Energy Star and EISA standards, future availability of both CFLs and EISA-compliant halogen lamps is somewhat uncertain. These standards have the potential for eliminating both halogen and CFL technologies. However, as discussed above, there are many factors – such as broad interpretations of the rules ("fleet average" efficacy), loopholes ("rough and vibration" use incandescent lamps), and legislative bans on rule enforcement (the 2014 congressional ban on EISA enforcement) – that may allow for continued sale of both halogen lamps and CFLs. So despite these changing standards, energy-efficiency program administrators may wish to continue subsidizing CFLs until LED lamps become more affordable.

An alternate strategy (aside from continuing to discount CFLs) may be for energy-efficiency program sponsors increase incentives for LED lamps to make them cost-competitive with EISA-compliant halogen lamps. However, given the dramatic differences in prices between these two technologies, this strategy may not be effective without substantial increases in residential lighting program budgets.

Finally, it is worth noting that the share of efficient versus inefficient lamp stock in the Pacific Northwest and California has not shifted significantly over the past several years. Slightly

[9]The physical resemblance of halogen lamps to incandescent lamps and the fact that halogen lamps are marketed as "energy-efficient" lamps may be additional explanatory factors.

more efficient lamps seem to be edging out the slightly less efficient competition (CFL shares shrinking while LED lamp shares increase, and EISA-compliant halogen lamp shares increasing while traditional incandescent lamp shares decline). Successful transformation of the residential replacement lamp market may require a more pronounced shift in market share away from inefficient lamps and toward energy-efficient CFLs and LED lamps.

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