



# Rhode Island 2018 Lighting Sales Data Analysis

FINAL

September 18, 2019

SUBMITTED TO:  
National Grid

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# Rhode Island Lighting Sales Data Analysis

Analyzing Market Trends for Light Bulbs

NMR conducted a study to examine light bulb market shares obtained from retail locations in Rhode Island. The study compares market share and bulb prices in Rhode Island, the United States, and various comparison areas with different levels of lighting program activity. The report explores 2018 market share by bulb type, shape, and ENERGY STAR® status; compares bulb prices; and considers trends in market share from 2015 to 2018. Although the sales data suggest that the ENERGY STAR Lighting Program still has positive effects, the impact may be dwindling as transformation of the LED market progresses across the nation.

## Key Findings



Rhode Island's market share for efficient bulbs (LEDs + CFLs) stood at 59% in 2018. LEDs alone accounted for 57% of all bulb sales.

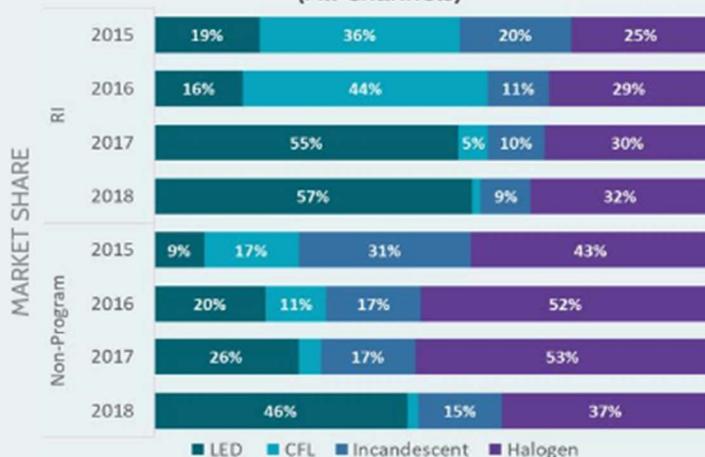


Non-program LED market share grew substantially in 2018.

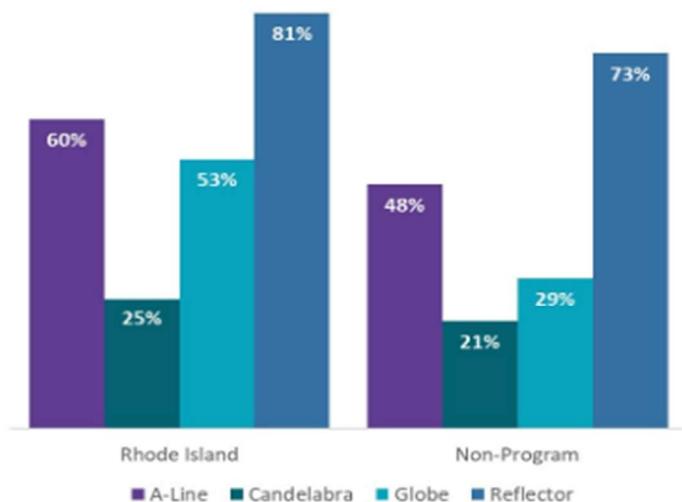


LED market share grew by 200% in Rhode Island and 400% in non-program areas between 2015 and 2018.

### Rhode Island and Non-Program Market Share by Bulb Technology (All Channels)



### LED Market Share by Bulb Shape



LED reflector sales were high in the areas examined, suggesting that the market is nearly transformed.



A-line sales were near or above 50% in all areas, pointing towards strong progress on transformation.



Globe market share was above 50% in Rhode Island, but less than 30% in non-program areas.



Candelabra market share was low across the board, suggesting that transformation is a long way off.

## Data Sources



Consortium for Retail Energy Efficiency Data



NEMA shipment

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## Executive Summary

This report describes recent screw-base light bulb market share, shipments, and prices in Rhode Island and Massachusetts, the entire United States, states with upstream residential lighting programs (program states), and states without upstream residential lighting programs (non-program states).<sup>1</sup> The analyses draw on screw-based light bulb sales data compiled by the LightTracker Initiative of the Consortium for Residential Energy Efficiency Data (CREED) and shipment data reported by the National Electrical Manufacturers of America (NEMA).<sup>2,3,4,5</sup> The report addresses four lighting technologies: light emitting diodes (LEDs), compact fluorescent lamps (CFLs), halogens, and incandescents.

**Table 1** summarizes the topics explored in this report and their relevant data sources. LightTracker provided NMR with two different datasets: the full category lighting data (FCD) and the point of sale (POS) data. The FCD cover all retail channels (discount, dollar, drug, grocery, hardware, home improvement, mass merchandise, and membership stores). The POS data only include a subset of channels (discount, dollar, drug, grocery, mass merchandise, and some membership stores), which covers approximately 25% of the Rhode Island lighting market, 31% of the Massachusetts market, and 35% of the national market. The POS data represent sales as reported by retailers. The FCD draw on the same POS data, but also draw from the consumer purchase panel (the National Consumer Panel or NCP, in which panelists scan all purchases they make), incorporating protections to avoid double-counting of sales in channels represented in both data sources. NMR uses the acronyms FCD and POS in figure and table titles and footnotes to clarify the data sources covered in the analysis.

CREED cleans and vets the data before releasing the annual LightTracker dataset. They also attempt to mitigate or resolve known shortcomings. One shortcoming prior to 2017 involved a disconnect between program LED sales reported by administrators and total LED sales in numerous states, most of them with aggressive LED programs. The LightTracker FCD data

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<sup>1</sup> The Massachusetts findings presented here are drawn from research funded by the Massachusetts Program Administrators (PAs). The reporting schedule for delivery of the 2018 sales data results is approximately the same in Massachusetts and Rhode Island. Because they are still under review by the Massachusetts PAs and Energy Efficiency Advisory Council (EEAC) Consultants, this report provides limited discussion of the Massachusetts results.

<sup>2</sup> The study uses data purchased by CREED from IRI and Nielsen. IRI (<https://www.iriworldwide.com/en-us/Company/About-Us>) and Nielsen (<https://www.nielsen.com/us/en.html>) track and compile information on sales and purchases in numerous sectors of the economy. Nielsen is better known for its tracking of television-viewing habits.

<sup>3</sup> The information contained herein is based in part on data reported by IRI through its Advantage service, as interpreted solely by LightTracker, Inc. Any opinions expressed herein reflect the judgement of LightTracker, Inc., and are subject to change. IRI disclaims liability of any kind arising from the use of this information.

<sup>4</sup> Data presented include LightTracker calculations based in part on data reported by Nielsen through its Strategic Planner and Homescan Services for the lighting category for the 52-week period ending approximately on December 31, 2018, for the available state level markets and Expanded All Outlets Combined (xAOC) and Total Market Channels. Copyright © 2018, Nielsen.

<sup>5</sup> NEMA revised its calculation method to include newly available international shipment data for LEDs, as well as CFLs and halogens, and they also removed incandescents from the market share estimation. They provide data for 2017 using the prior and current calculation methods, but only share the current calculation method for 2018. See [Section 1.2.2](#), [Appendix A.2](#), and <https://blog.nema.org/2018/12/11/nema-lamp-index-adjusts-to-newly-available-a-line-led-data/> for more details. NMR has been tracking NEMA shipment data over time and last pulled data using the prior calculation method on September 5, 2018, covering all of 2017. An overview of the current NEMA data can be found at <http://www.nema.org/Intelligence/Pages/Lamp-Indices.aspx>.

seemed to undercount total LED sales when compared to program sales data. As discussed more in Section 1.2.1, in 2017, CREED introduced an adjustment of LED sales in some states – including Rhode Island and Massachusetts – to better align LED sales with known program sales for those states.<sup>6</sup> In 2018, CREED observed closer alignment between LED sales in Rhode Island and most other states. In fact, Massachusetts was the only state requiring adjustment of LED sales information in 2018.<sup>7</sup> When made in either year, the adjustment applies only to LED sales and not sales of other bulb types. The unadjusted LED sales data likely underestimate LED market share, but the adjusted data may overstate LED market share in Rhode Island, Massachusetts, and other adjusted states. Because CREED adjusted Rhode Island in 2017 and not 2016 or 2018, this report focused on comparisons of 2016 to 2018 rather than 2017 to 2018.

For most topics, NMR compared Rhode Island to four comparison areas: Massachusetts, the nation, program states, and non-program states. For FCD, estimates for the entire US reflect extrapolations to the nation and not the sum of individual states. NEMA limits public shipment data to the national level, so our review occurred at the national level.

**Table 1: Study Topics and Data Sources**

Topic	Years	Data Source <sup>1</sup>
Current market share (sales) by bulb type and bulb shape	2018	LightTracker FCD
Market share (sales) over time	2015 to 2018	LightTracker FCD
Market share (sales) by lumen bins, ENERGY STAR qualifications	2018	LightTracker POS
Market share (shipments)	2011 to Q1 2019	NEMA
Bulb price analysis	2018	LightTracker FCD

<sup>1</sup> LightTracker FCD includes sales information for all retail channels and represents 100% of the lighting market. POS data include discount, dollar, drug, grocery, mass merchandise, and membership stores, representing 25% of the lighting sales in Rhode Island. POS data exclude hardware and home improvement stores.

**OVERALL CONCLUSION**

**The sales data analysis, as well as the cumulative body of evidence, suggests that the National Grid Rhode Island ENERGY STAR Retail Lighting Program (the Program) had an important effect on the long-term evolution of the lighting market. Based on evidence in this report, that effect appears to be waning, as non-program areas begin to catchup with program areas.**

As of 2018, Rhode Island LED market share overall and for most screw-based bulb shapes was higher than that of Massachusetts, the nation, other program states, and non-program states. Likewise, Rhode Island market share of LEDs in lumen bins currently covered by the Energy Independence and Security Act (EISA) remained higher than in non-program states. Longitudinal analysis and the cumulative body of evidence that also includes shelf stocking studies and on-

<sup>6</sup> The Rhode Island LED market share in 2017 was 42% unadjusted and 55% adjusted.

<sup>7</sup> The Massachusetts 2017 LED market share was 36% unadjusted and 49%. The adjustment moved market share far less in 2018, from 50% to 53%,

site saturation visits suggests that Rhode Island (and Massachusetts) program activity convinced consumers to switch to LEDs sooner than in other parts of the nation.

Yet, there are signs that natural market adoption has strengthened throughout the nation. Rhode Island's 2018 LED market share was 12<sup>th</sup> in the nation, despite having the second highest LED incentive spending per bulb in the nation. Likewise, prices for LEDs in Rhode Island were very similar to prices in the comparison areas. While this partially reflects the strong LED incentives in Rhode Island (which in turn seem to be affected by the high cost-of-living in the Northeast), the lack of strong price differentials across areas also points to a market undergoing transformation.

Market share by bulb shape also shows indications of market transformation for reflectors and A-lines. Although Rhode Island's LED market share for these bulb shapes exceeded those of all other areas considered, nearly one-half of A-line bulbs and over two-third of reflectors sold in non-program areas in 2018 were LEDs. The program now faces the challenge of converting the last few sockets – the rarely used bulbs, such as decorative bulbs (globes and candelabras) with high aesthetic value to consumers – to LEDs. Program incentives may convince a consumer to purchase a candelabra LED for the dining room or an A-line LED for the closet instead of an inexpensive four-pack of halogens.

The analysis of the CREED data revealed several key findings that lead to this conclusion, as summarized below.

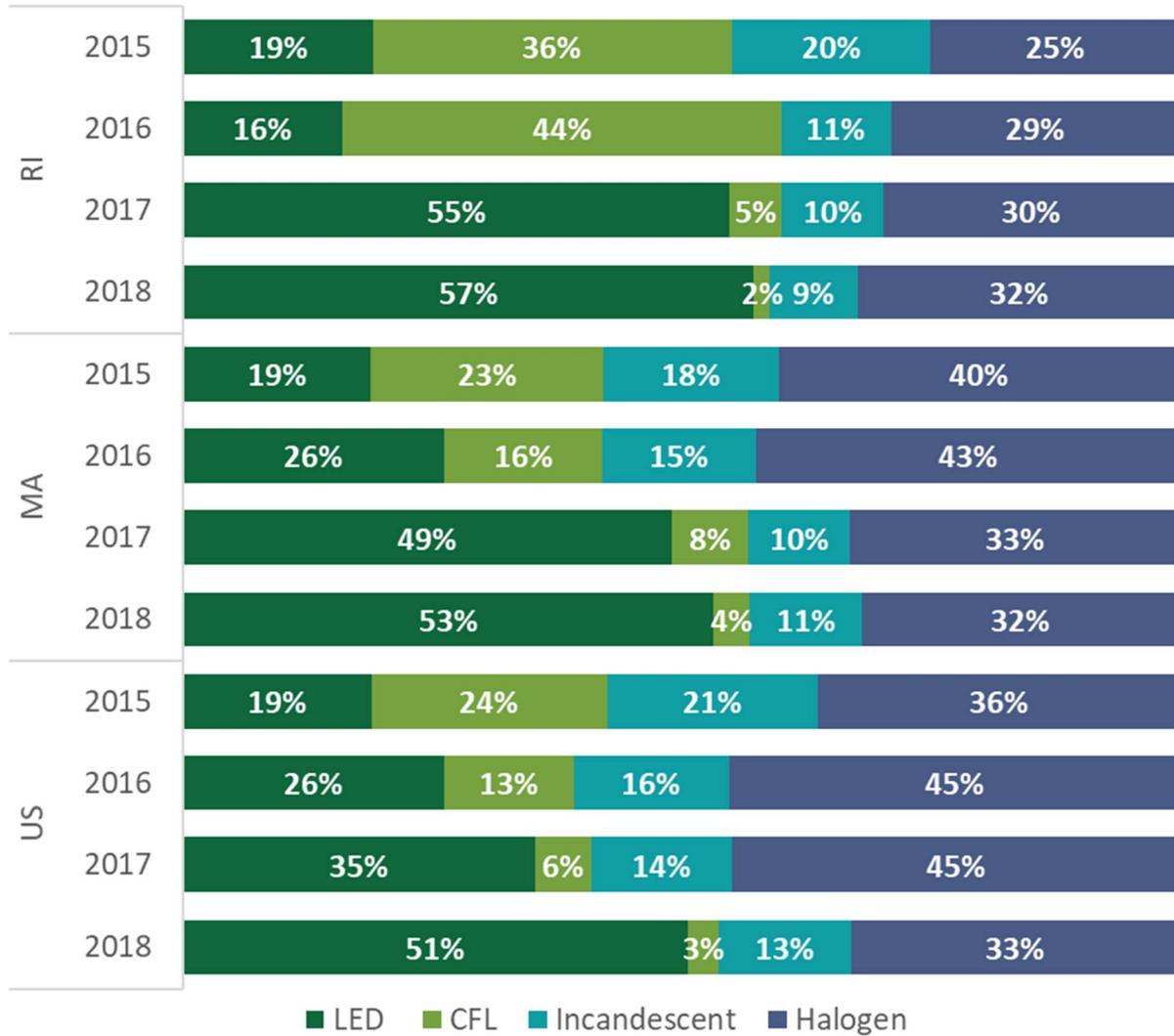
## KEY FINDINGS



**Rhode Island's market share for energy-efficient bulbs (LEDs + CFLs) stood at 59% in 2018.**

Efficient market share for screw-based bulbs in neighboring Massachusetts was 57% (54% unadjusted) (Figure 1). All program states combined had an efficient share of 55% in 2018, compared to 47% in non-program states (Figure 6 in the main body also lists program and non-program states). Rhode Island, Massachusetts, and the US each saw similar increases in LED market share from 2015 through 2018, from 19% to at least 50%. As discussed more fully in Section 2.1.3, program spending was associated with higher LED market share. States with greater program spending per household tended to have greater LED market adoption, with aggressive program states (over \$5 / home) demonstrating higher adoption compared to moderate (less than \$5 / home) and non-program states. Total program spending in both Rhode Island and Massachusetts was over \$5 per household in 2018.

Figure 1: Rhode Island, Massachusetts, and US Market Share by Bulb Technology 2015-2018 – FCD<sup>1,2,3</sup>



<sup>1</sup> All retail channels.

<sup>2</sup> CREED makes adjustments to LED sales in program states when total LED sales and program sales data are not aligned. They made this adjustment in Rhode Island in 2017 and in Massachusetts in both 2017 and 2018. Prior to the adjustment, Rhode Island's 2017 LED market share was 42% and Massachusetts's was 36%. Unadjusted LED market share in Massachusetts in 2018 was 50%. See [Section 1.2.1](#) for more detail.

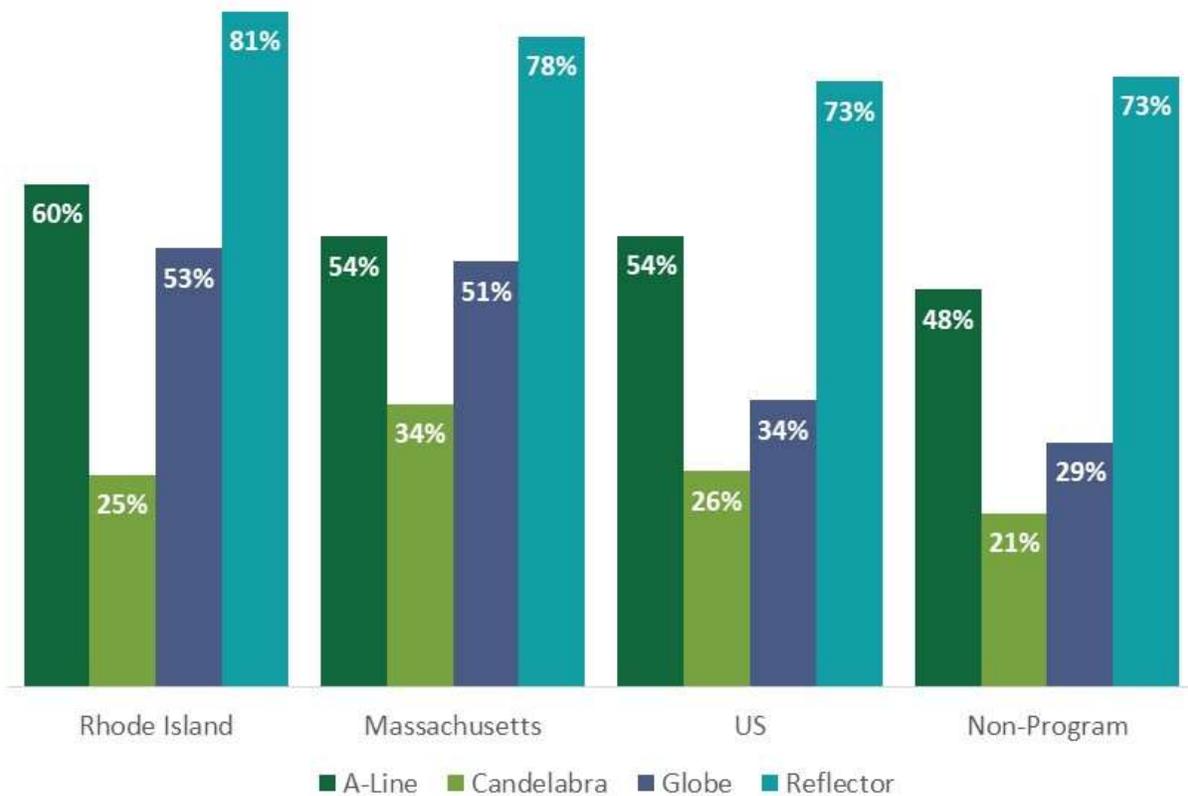
<sup>3</sup> Results subject to rounding error.



In 2018, LED market share in Rhode Island was higher than in other areas for most bulb shapes. Reflector bulbs had the highest LED market share in all areas.

Across all retail channels in 2018, Rhode Island displayed the greatest LED market share of all bulb shapes across the comparison areas (Figure 2). In Rhode Island, LEDs made up the largest share of A-line (60%), globe (53%), and reflector sales (81%), but only one-quarter of candelabra sales. From a market transformation standpoint, LEDs accounted for at least 70% of reflector sales in all areas, including non-program ones. About one-half or more of A-line sales were LEDs across the nation, even in non-program areas.

**Figure 2: 2018 Market Share by Bulb Shape in Rhode Island and Comparison Areas – FCD<sup>1</sup>**



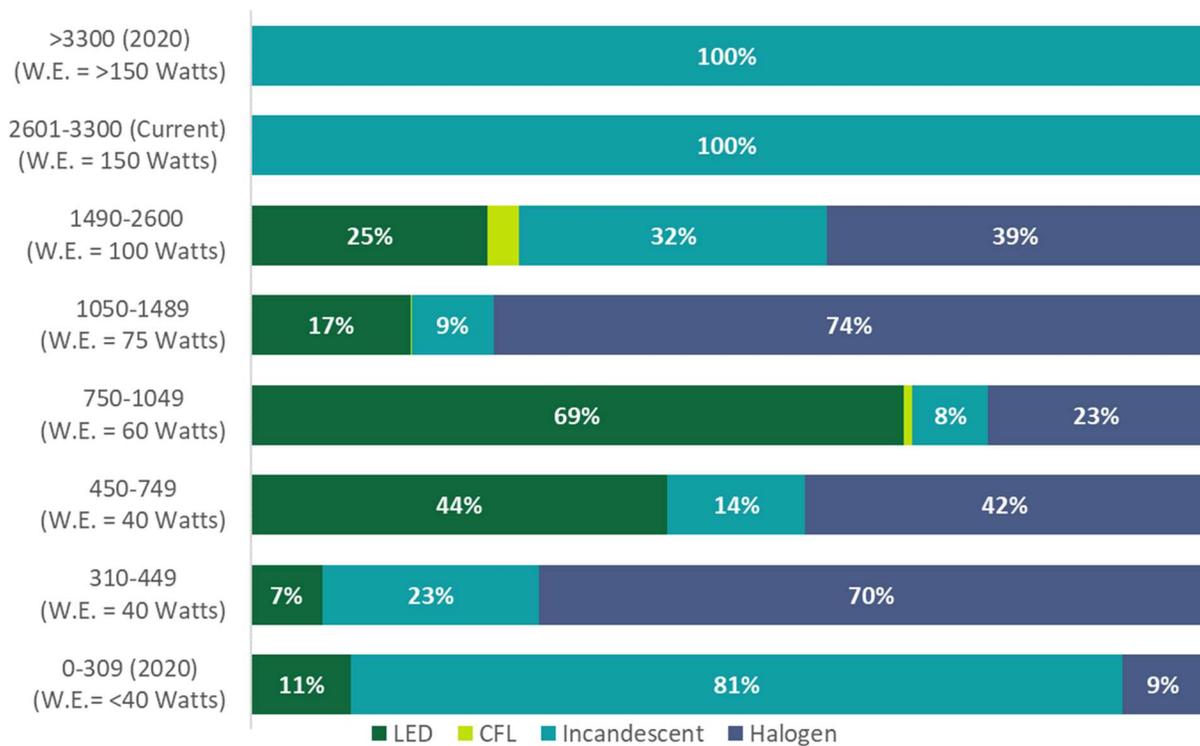
<sup>1</sup> All retail channels.



**LED sales in Rhode Island were strongest in lumen bins most closely associated with the equivalent 60-Watt and 40-Watt incandescent bulbs.**

Figure 3 presents market share by bulb type and lumen bins, along with the equivalent incandescent wattage (W.E.). The figure shows that LEDs dominated the 750 to 1,049 lumen bin, accounting for 69% of all sales. LEDs accounted for 44% of sales in the 450 to 749 lumen bin. In contrast, the lumen bins that are currently exempt from EISA (below 310 lumens and above 2,600) remained dominated by incandescents. Section 2.1.5 provides more details about EISA, and Table 6 in the body of the report provides a complete crosswalk between lumen bins and incandescent equivalence, as well as the percentage of all bulb sales in each lumen bin.

**Figure 3: 2018 Rhode Island A-line Market Share by Lumen Bin – POS<sup>1,2,3,4</sup>**



<sup>1</sup> Includes discount, dollar, drug, grocery, mass merchandise, and some membership stores, and represents approximately 25% of the Rhode Island market.

<sup>2</sup> Bins currently EISA Exempt: less than 310, above 2,600; bins that will remain exempt from EISA 2020 (if implemented): less than 310, above 3,300.

<sup>3</sup> The 750 - 1,049 lumen bin accounts for 52% of all bulb sales, followed by 19% in the 450 - 749, 10% in both the 1,050 - 1,489 and the 1,490 – 2,600 bins. The remaining bins collectively account for less than 10% sales.

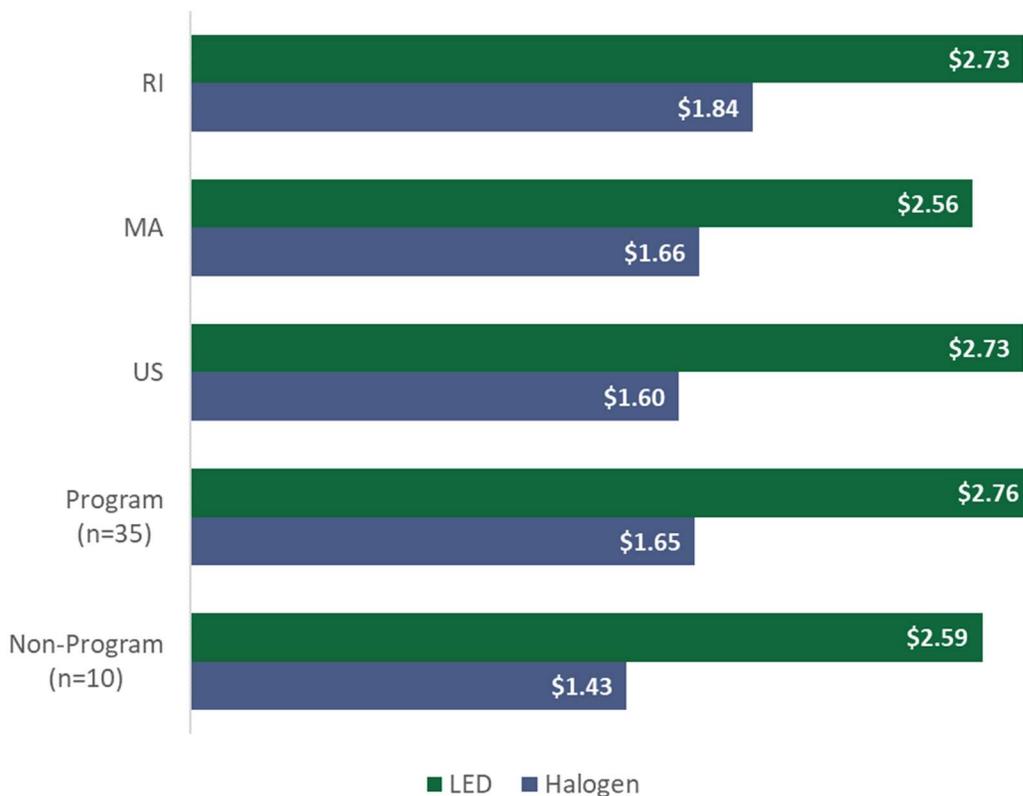
<sup>4</sup> Data labels removed for sales percentages less than 3%.



**LED prices remained about one dollar higher than halogens in every region examined, but LED prices varied little across the areas.**

Figure 4 displays the shelf price – including the application of program incentives – for LEDs and halogens. LEDs cost about 90 cents more than halogens in Rhode Island and Massachusetts, compared to about \$1.10 more in the other comparison areas. This implies that LEDs are more price competitive with halogens in Rhode Island and Massachusetts. However, LED prices in Rhode Island (\$2.73) were nearly identical to those across the US (\$2.73) and in other program areas (\$2.76), while the LED price in Massachusetts (\$2.56) fell just below that of non-program areas (\$2.59). The low price of LEDs in non-program states likely reflects a combination of cost-of-living and greater sales of non-ENERGY STAR LEDs.<sup>8</sup>

**Figure 4: 2018 Average Shelf Price per Bulb – FCD<sup>1,2</sup>**



<sup>1</sup> All retail channels.

<sup>2</sup> Does not include private label bulbs sold at specific retailers, so the prices reported here are likely somewhat higher than actual prices.

<sup>8</sup> The CREED data contain indications that both incentive levels and unsupported bulb prices are higher in high cost-of-living states like Rhode Island and Massachusetts. Also, retailers and manufacturers reported at the ENERGY STAR Partners meeting in September 2019 that they sell more non-ENERGY STAR LEDs in the absence of program incentives.

## CONSIDERATIONS

**Consideration 1:** National Grid should carefully consider the future of the program and stay alert to any regulatory movement at the state or federal level that would call for withdrawing support for A-lines, reflectors, and specialty products within the 310 to 2,600 range.

*Rational: National Grid still has a role to play in the residential market as it currently stands. National Grid's efforts have boosted adoption of LEDS and made LEDs more price competitive with halogens. Although A-line LEDs represent the majority of Rhode Island bulb sales in the lumen bin most closely associated with 60-Watt incandescents, inefficient bulb types still garner more than 50% of sales in every other lumen bin. The remaining inefficient sockets may be difficult to convert to LEDS, and efforts to educate consumers and reduce LED prices may help to capture substantial savings before the market fully transforms.*

**Consideration 2:** National Grid should carefully consider if and how to continue support for reflectors bulbs.

*Rational: Market share for reflectors is high in all areas examined, including non-program areas. The long life and directional nature of LEDs makes them well suited to the most common reflector applications (recessed ceiling cans and exterior floods). This has likely enhanced their rate of naturally occurring market adoption in Rhode Island and across the nation. Traditional upstream program interventions alone may not be enough to create continued lift for reflectors.*

**Consideration 3:** National Grid should consider continuing support for bulbs in the very low (below 310) and very high lumen range (above 3,300). Likewise, National Grid should continue support for candelabra and globe bulbs, which show fewer signs of transformation in Rhode Island and across the nation.

*Rational: Incandescent bulbs account for nearly all A-line sales in the lumen bins that are currently exempt from EISA (below 310 and above 2,600) and those that will remain exempt if the next phase of EISA is eventually implemented (below 310 and above 3,300). While these represent less than 5% of A-line lighting sales in Massachusetts, it appears that these lumen bins remain largely untransformed. Likewise, candelabra bulbs generally and globes outside of Rhode Island and Massachusetts have very small LED market shares, suggesting that program intervention still matters. Given that the September 4, 2019 final DOE prevents globes and candelabras from being defined as general service lamps, this intervention will likely remain important for at least a few more years (when either the outcomes of lawsuits or market transformation makes LEDs the dominant bulb type). While the achieved savings will likely be small due to the limited small sales volumes and delta watts for these bins and bulb types, program support for them could help convert the remaining decorative, appliance bulbs, and high lumen bulbs that largely remain incandescent.*

**Consideration 4:** National Grid and the implementation contractor should consider whether incentive levels should be adjusted downward.

*Rational: Rhode Island has one of the highest incentive levels in the nation. This likely reflects a combination of factors, including the cost-of-living and associated pre-incentive LED prices in the Northeast, the product mix offered, and program history. These deep incentives have helped Rhode Island and the Northeast achieve strong LED market share. Yet, as transformation progresses and LED prices remain low, it may be time to explore whether National Grid customers would continue to adopt LEDs at the same rate with a smaller incentive.*

## Section 1 Introduction

This report describes recent light bulb market share, sales, and shipment trends in Rhode Island, Massachusetts, the entire United States, states with upstream residential lighting programs (program states), and states without upstream residential lighting programs (non-program states).<sup>9</sup> This study is based on analyses of light bulb sales data compiled by the LightTracker Initiative of the Consortium for Residential Energy Efficiency Data (CREED).<sup>10,11,12,13</sup> This study also presents updated shipment data from the National Electrical Manufacturers of America (NEMA).<sup>14</sup> Finally, this study examines trends in light bulb shelf prices.

### 1.1 STUDY OBJECTIVES AND RESEARCH QUESTIONS

The study objectives included the following:

- Examine current market share and bulb shipments in Rhode Island, states with upstream programs, states without upstream lighting programs, and the entire nation.
- Provide breakdowns of market share by bulb type (i.e., light emitting diodes [LEDs], compact fluorescent lamps [CFLs], halogens, and incandescents), shape (A-line, reflector, and all other), lumen bins, and ENERGY STAR status, when data quality allow.
- Explore trends in bulb market share from 2015 to 2018 and NEMA reported quarterly bulb shipment share from 2011 to the most recent quarter available.
- Compare average prices of LEDs to halogens in the bulb price analysis.

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<sup>9</sup> The Massachusetts findings presented here are drawn from research funded by the Massachusetts Program Administrators (PAs). The reporting schedule for delivery of the 2018 sales data results is approximately the same in Massachusetts and Rhode Island. Because they are still under review by the Massachusetts PAs and Energy Efficiency Advisory Council (EEAC) Consultants, this report provides limited discussion of the Massachusetts results.

<sup>10</sup> The study uses data purchased by CREED from IRI and Nielsen. IRI (<https://www.iriworldwide.com/en-us/Company/About-Us>) and Nielsen (<https://www.nielsen.com/us/en.html>) track and compile information on sales and purchases in numerous sectors of the economy. Nielsen is better known for its tracking of television-viewing habits.

<sup>11</sup> CREED serves as a consortium of PAs, retailers, and manufacturers working together to collect the necessary data to better plan and evaluate energy-efficiency programs. LightTracker, CREED's first initiative, is focused on acquiring FCD lighting data, including incandescent, halogen, CFL, and LED bulb types for all distribution channels in the entire United States. As a consortium, CREED speaks as one voice for PAs nationwide as they request, collect, and report on the sales data needed by the energy-efficiency community (<https://www.creedlighttracker.com>). (<https://www.creedlighttracker.com>).

<sup>12</sup> The information contained herein is based in part on data reported by IRI through its Advantage service, as interpreted solely by LightTracker, Inc. Any opinions expressed herein reflect the judgement of LightTracker, Inc., and are subject to change. IRI disclaims liability of any kind arising from the use of this information.

<sup>13</sup> Data presented include LightTracker calculations based in part on data reported by Nielsen through its Strategic Planner and Homescan Services for the lighting category for the 52-week period ending approximately on December 31, 2018, for the available state level markets and Expanded All Outlets Combined (xAOC) and Total Market Channels. Copyright © 2018, Nielsen.

<sup>14</sup> The data presented in this report come from the NEMA "Lamp Indices" and have been supplemented with data provided to NMR by NEMA. The current lamp indices are available at <http://www.nema.org/Intelligence/Pages/Lamp-Indices.aspx>. See the main body of this report for more details about NEMA's estimation of bulb shipments.

- Assess market share in very low (<310) and very high lumen bins (>3,300), which roughly coincide with ranges that will remain exempt when (and if) Phase 2 of the Energy Independence and Security Act (EISA) goes into effect in 2020 (or some time later).

The study aimed to achieve these objectives by exploring the following research questions:

- What are the short- and long-term trends in market share in Rhode Island and shipment share nationally?
- How do these trends in Rhode Island compare with Massachusetts, other program states, non-program states, and the nation?
- What is the bulb price of LEDs compared to halogens in Rhode Island and other areas?
- Does the current LED share of bulbs in very high and very low lumen bins suggest any future program opportunities?
- What are the likely connections between the observed market share and price results and National Grid's upstream lighting program?
- To what extent do the sales data provide indications that upstream program activity may continue to have an impact on LED market share and sales?

### 1.2 DATA SOURCES<sup>15</sup>

The Lighting Sales Data study draws on two data sources: LightTracker Initiative Sales Data and NEMA shipment data. [Table 2](#) summarizes the topics examined and the sources of data. The report presents LightTracker data for Rhode Island, Massachusetts, the US, program states, and non-program states for nearly all analyses (noting any exceptions). NEMA only reports data at the national level. [Table 3](#) lists the retail channels included in each data source, with an X denoting coverage in the data source.

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<sup>15</sup> This section provides an overview of the data sources, while [Appendix A](#) provides a detailed discussion, including addressing variations in data provided by the LightTracker Initiative.

**Table 2: Study Topics and Data Sources**

Topic	Years	Data Source <sup>1</sup>	Market Coverage
Current market share (sales) by bulb type and bulb shape	2018	LightTracker FCD	100% for all areas
Market share (sales) over time	2015 to 2018	LightTracker FCD	100% for all areas
Market share (sales) by lumen bin, and ENERGY STAR qualification	2018	LightTracker POS	~25% of RI, 31% of MA and 35% of national markets
Market share (shipments)	2011 to Q1 2019	NEMA	Unknown <sup>2</sup>
Bulb price analysis	2018	LightTracker FCD	100% for all areas

<sup>1</sup> Full category LightTracker data (FCD) include sales information for all retail channels and represent 100% of the lighting market. Point of sale (POS) data include discount, dollar, drug, grocery, mass merchandise, and some membership stores, representing 25% of lighting sales in Rhode Island, 31% in Massachusetts, and 35% nationally. POS data exclude hardware and home improvement stores.

<sup>2</sup> Shipment shares prior to 2017 were based on surveys of NEMA members and addressed all four bulb types but failed to account for international shipments into the US. In addition, beginning in 2017, shipment shares account for international shipments but exclude incandescent bulbs.

**Table 3: Retail Channel Coverage by Source**

Channel	LightTracker FCD	LightTracker POS	NEMA Shipments <sup>1</sup>
Discount	X	X	X
Dollar	X	X	X
Drug	X	X	X
Grocery	X	X	X
Hardware	X		X
Home Improvement	X		X
Mass Merchandise	X	X	X
Membership	X	Some	X

<sup>1</sup> Includes all channels but coverage is unknown due to voluntary nature of NEMA member survey, one of the sources NEMA uses to estimate market share.

### 1.2.1 Lighting Sales Data

CREED generates the LightTracker dataset from two data sources: POS state sales data as scanned *at the register* and National Consumer Panel (NCP) state sales data. CREED purchases the data from third-party vendors, and the LightTracker team cleans, processes, and calibrates the data for analysis. Both the POS and the NCP datasets provide national level estimates of bulb sales. They also provide state-level data for individual states with sufficient sales and/or panel participation. CREED combines these two datasets into a single dataset known as the full category data (FCD)

The POS dataset represents discount, dollar, drug, grocery, mass merchandise, and some membership stores. It accounts for about 25% of retail lighting market share in Rhode Island and 35% nationally.<sup>16</sup> The NCP represents a panel of approximately 100,000 residential households

<sup>16</sup> Calculated as the number of bulb sales per area included in the POS dataset divided by the number of bulb sales per area in the FCD dataset.

across the US that are provided a handheld scanner for their home and instructed to scan in every purchase they make that has a bar code. The use of a scanner avoids potential recall bias, which is prevalent in self-report methods that ask about lighting purchases. While the NCP dataset includes sales from all retail channels, to avoid double counting sales when combining the two data sources to create the LightTracker FCD, CREED only uses sales from home improvement, hardware, online, and the remaining membership stores.

Each year, CREED improves its data cleaning and vetting procedures. Beginning with the 2017 dataset and continuing in 2018, they instituted a new method for determining ENERGY STAR qualification. While they list ENERGY STAR qualification for some LEDs, the IRI and Nielsen data are unable to determine ENERGY STAR qualification for all LEDs. Therefore, CREED assigned ENERGY STAR LED qualification based on a combination of the status reported in the original IRI and Nielsen databases and the rated measure life of LEDs. For the latter, CREED assumed that all bulbs with 15,000 hours or more were ENERGY STAR qualified. By matching UPCs across the two datasets, CREED maximizes the number of bulbs for which it can assign likely ENERGY STAR stats.

This approach to determining ENERGY STAR status has two shortcomings as it applies to Rhode Island. First, while CREED could determine ENERGY STAR qualification using this method for 99% of bulbs nationwide and in Massachusetts, they could only identify qualification for 57% of bulbs in Rhode Island. This is because the Rhode Island data rely heavily on IRI (due to limited sample size in the Nielsen NCP panel), and the IRI data do not list ENERGY STAR or measure life; ENERGY STAR status reflects the outcome of UPC matchups only. Second, NMR's review of Lockheed Martin shelf-stocking data for Rhode Island suggests that the 15,000 assumption may not be accurate. In particular, Lockheed Martin reported that 53% of non-ENERGY STAR A-line LEDs on the shelves of Rhode Island program partners had a rated life of 15,000 hours or more (97% of A-line ENERGY STAR qualified bulbs had a rated life of 15,000 hours). While it may be that some of the bulbs reported as non-ENERGY STAR met specifications but had not yet received official qualification, the implication is that the percentage of ENERGY STAR sales may be exaggerated. However, because CREED assigned ENERGY STAR status similarly in all states, the exaggeration would be more pronounced in states that actually have lower ENERGY STAR sales (which retailers and manufacturers report to be in non-program areas). Given the large percentage of bulbs with unknown ENERGY STAR qualification and the concerns about the use of the supplemental 15,000 hour life, NMR believes that the results capture the relative importance of ENERGY STAR across areas, but the point estimates reflect some level of bias.

The second change CREED introduced in 2017 involved instituting a process to align FCD total LED sales with known program-supported sales in the state. Prior to 2017, FCD total LED sales often seemed low compared to verified program sales. Starting in 2017, in states in which program-supported sales (which are almost universally ENERGY STAR-qualified across the nation) exceeded or rivaled total LED sales (comprising both ENERGY STAR and non-ENERGY STAR sales), they adjusted LED sales as reported in the FCD (but not POS only) upwards so that program-supported sales accounted for 90% of ENERGY STAR sales. For Rhode Island, CREED

concluded the adjustment was necessary in 2017 but not in 2018.<sup>17</sup> For Massachusetts, CREED concluded the adjustment was necessary in both years; moreover, Massachusetts was the only state to be adjusted in 2018.

Without the adjustment in this subset of states where program exceed LightTracker sales, it is almost certain that unadjusted LightTracker data under reports LED market. Yet, because the adjustment applies only to LEDs,<sup>18</sup> it increases LED market share, which may cause the adjusted LightTracker to overstate LED market share. Given the uncertainty in the accuracy and implication of the adjustment and that CREED adjusted Rhode Island only in 2017, this report focuses on unadjusted program data for 2015, 2016, and 2018 for both Rhode Island and Massachusetts.

This leads us to one word of caution about the use of LightTracker for Rhode Island. Nielsen, the third-party source of the NCP data, selects its panelists so that the resulting sample represents the entire nation, not individual states. States with larger populations have more households in the panel, which makes the panel a better representation of the state. Therefore, extrapolations from the panelists to larger population states have a higher likelihood of actually representing the state. The same is not true for lower population states like Rhode Island, with about 200 panelists (Massachusetts had about 1,000).<sup>19</sup> The NCP has fewer households from these states, and extrapolations from the panelists likely retain some of the bias related to the characteristics of the sample. For example, the purchase of a large number of CFLs by a few panelists could skew the market share results for a given year. Therefore, the LightTracker data are strongest in the aggregate (e.g., national, non-program areas) and for describing trends. At the state-level, the results can exhibit some instability from year to year or state to state.

The **key strengths and weaknesses** of the LightTracker dataset include the following:

- **Strengths:**
  - FCD sales reflect the entire market, comprising program and non-program sales as well as all retail channels.
  - Comparable data are available for most states in the nation.
  - Characteristics such as lumens, bulb shape, and pricing are included.
- **Weaknesses:**
  - POS data only cover a portion of the retail market (about 25%), notably missing the important hardware and home improvement channels (although the NCP data capture these channels based on sample of households for most states).

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<sup>17</sup> The Rhode Island LED market share in 2017 was 42% unadjusted and 55% adjusted. The Massachusetts 2017 LED market share was 36% unadjusted and 49%, while 2018 was 50% to 53%, respectively.

<sup>18</sup> CREED concluded that adjusting all bulb types would lead to unreasonable estimates of total bulb sales per household. Moreover, although they had program sales data for LEDs, CREED had insufficient information to make informed adjustments to other bulb types.

<sup>19</sup> Not every panelist purchased light bulbs during the year, let alone purchased bulbs of each type. This is why some analyses rely on POS data only. For example, it is possible that very few (perhaps no) NCP panelists bought a <300 lumen LED in 2017, but the POS sales data captured the purchases that were made.

- The method used to assign ENERGY STAR status may exaggerate the percentage of ENERGY STAR qualified LEDs sold and has limited coverage for Rhode Island.
- Raw sales data do not always align with program sales, leading CREED to make adjustments for some states (including Rhode Island in 2017 and Massachusetts in 2017 and 2018) that may overstate the market share of LEDs.
- Reliability is reduced with analyses of subsets of the market, such as those by bulb shape, lumen bins, and bulb prices.

### 1.2.2 Shipment Data

We also examined quarterly NEMA A-line national shipment data for Q1 2011 to Q1 2019.<sup>20</sup> Prior to 2017, NEMA estimated shipment share from a survey of NEMA members, but in 2017, the federal government began to track international shipments of LEDs and halogens into the US meant for domestic consumption.<sup>21</sup> The new international shipment data indicated that NEMA reports had been underrepresenting LED shipments (although not halogens, as many are manufactured in the US). Accordingly, in 2017, NEMA began to augment the surveys with the international shipment data for CFLs, LEDs, and halogens.<sup>22</sup> NEMA also stopped tracking incandescent shipment share in 2017, arguing (and supported by the CREED data in [Figure 13](#)) that most A-line incandescent shipments fell into categories not considered general service lamps (e.g., low-lumen appliance bulbs or high-lumen grow lamps). NEMA says that low- and high-lumen LEDs, CFLs, and halogen bulbs were already excluded from shipment share estimates, so this step brought incandescents in alignment with the other bulb types.

The **key strengths and weaknesses** of the NEMA dataset include the following:

- **Strengths:**
  - Shipments representing the national A-line market, except incandescents
  - Improved accounting of international shipments, particularly for LEDs
- **Weaknesses:**
  - Revised 2018 method is only limited to EISA compliant A-lines (low/high lumen bins are excluded)
  - Non-reporting of incandescent shipment share under the current method.
  - Data not available for individual states
  - Break in the time series due to a revision in shipment share calculation approaches

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<sup>20</sup> NMR obtained the data from <http://www.nema.org/Intelligence/Pages/Lamp-Indices.aspx>, including direct correspondence with NEMA to get more precise shipment share estimates using the current calculation method. NEMA only releases national shipment share data and does not provide shipment counts or data for individual states.

<sup>21</sup> Prior to this time, the federal government only tracked CFLs. Data are available at <http://dataweb.usitc.gov/>

<sup>22</sup> Direct correspondence with NEMA.

### 1.3 PROGRAM ACTIVITY

Many of the analyses in this report assess market share and price by the presence and level of upstream lighting program activity. To determine program activity, the LightTracker team conducted a literature review of publicly available reports found on the internet or provided by program administrators (PAs) or their evaluators.<sup>23</sup> The team contacted local utilities in areas that did not have reports with the relevant information available. Additionally, the team accessed DSM Insights, an E Source product that provides a detailed breakdown of program-level spending, including incentives, marketing, and delivery for over 100 PAs around the country.<sup>24</sup> All states with at least some program activity in 2018 were designated *program states*; the remaining states were designated *non-program states*.

### 1.4 APPROACHES

NMR and LightTracker Initiative analysts performed the following descriptive analyses of light bulb market share, sales, shipments, and prices:

- Compared 2018 market share by bulb type (Section 2.1.1) and bulb shape (Section 2.1.2) from the full LightTracker database for Rhode Island, Massachusetts, states with lighting programs (program states), states without lighting programs (non-program states), and the US
- Described trends in market share in Rhode Island and Massachusetts FCD lighting data for 2015 to 2018 (Section 2.1.1)
- Examined 2011 to 2018 national NEMA shipment market share (Section 2.1.1)
- Explored general (not statistical) relationships between program spending and per-household bulb sales (Section 2.1.3)
- Examined the proportion of LED sales in Rhode Island, Massachusetts, other program states, non-program states, and the US that are ENERGY STAR qualified (Section 0)
- Analyzed market share by lumen bin for Rhode Island and non-program states to assess the distribution of bulb sales by current and future EISA exemption (Section 2.1.5)
- Reviewed prices for LEDs and halogens in Rhode Island, Massachusetts, other program states, non-program states, and the US for 2018 (Section 2.2)

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<sup>23</sup> Specifically, the team began by searching the ENERGY STAR Summary of Lighting Programs website <https://www.energystar.gov/ia/partners/downloads/2017%20ENERGY%20STAR%20Summary%20of%20Lighting%20Programs.pdf> and referenced the Database of State Incentives for Renewables & Efficiency ([www.dsireusa.org](http://www.dsireusa.org)).

<sup>24</sup> E Source. "DSM Insights." April 2018.

## Section 2 Data Examination

NMR examined trends in market share, ENERGY STAR market share for LEDs, and bulb prices using the LightTracker and NEMA shipment data. [Table 2](#), above, summarizes the data sources and their coverage, and the bullets below serve as a reminder (we also footnote coverage in each figure):

- **Full category (FCD):** used for 2015 to 2018 market share and 2018 pricing data; represents all retail channels, including hardware and home improvement; estimates for the entire US reflect extrapolations to the nation and not the sum of individual states.
- **Discount, dollar, drug, grocery, mass merchandise, and some membership club retail channels (POS):** used for analysis of market share by bulb shape, ENERGY STAR qualification, and lumen bins; data reflect 25% of the Rhode Island lighting market, 31% of Massachusetts, 35% of the US, 34% of program states, and 41% of non-program states.
- **NEMA Shipments:** used for assessment of A-line shipment share back to 2011; represent an unknown portion of the market due to exclusion of international shipments 2011 to 2017 (prior NEMA method) and of incandescents from 2017 onwards (current NEMA method).

The results generally describe market share and bulb prices in Rhode Island, Massachusetts, program states, non-program states, and the nation. The NEMA shipment review in [Section 2.1.1](#) covers national shipments only, while the program activity review in [Section 2.1.3](#) considers all available states.

### 2.1 MARKET SHARE

NMR assessed market share in Rhode Island, Massachusetts, program states, non-program states, and the nation in various ways, as summarized in [Table 4](#). We note the percentage of the market covered under each figure in the discussion that follows.

**Table 4: Summary of Market Share Analyses**

Type of Analysis	Dataset	Year(s) Addressed	Retail Channels
Annual	LightTracker FCD	2018	All
Longitudinal	LightTracker FCD	2015 to 2018	All
By Bulb Shape	LightTracker FCD	2018	All
by Lumen Bin			Discount, dollar, drug, grocery, mass merchandise, some membership clubs
by ENERGY STAR	LightTracker POS	2018	
Longitudinal	NEMA	2011 to 2017 <sup>1</sup> 2017 to Q1 2019 <sup>2</sup>	All

<sup>1</sup> Quarterly data from 2011 to December 2017, excluding international shipments.

<sup>2</sup> Quarterly data from Q12017 to Q12019, including international shipments but excluding incandescents.

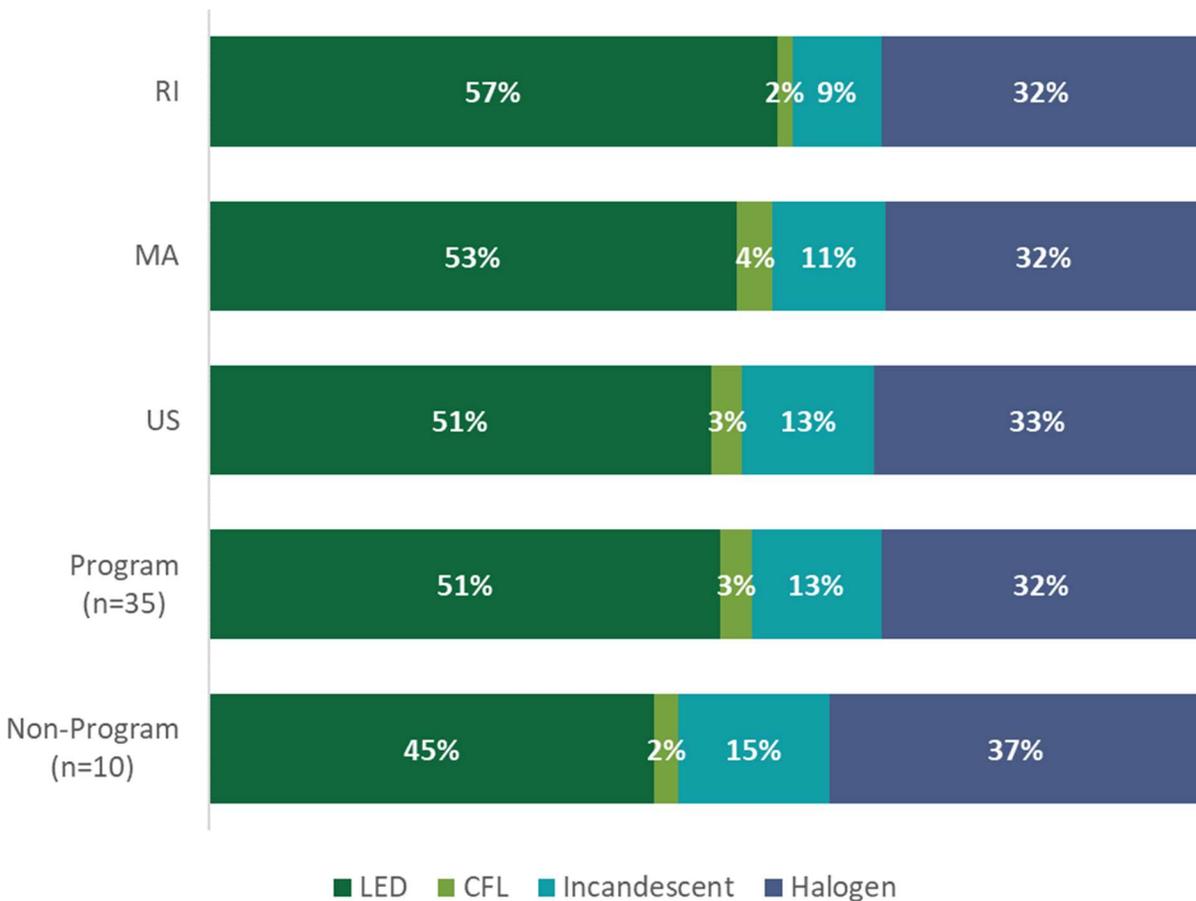
2.1.1 Market Share by Bulb Technology



Rhode Island’s market share for efficient screw-in bulbs (LEDs + CFLs) stood at 59% in 2018, with LEDs alone accounting for 57% of all bulb sales.

Efficient bulb share in Rhode Island edged out neighboring Massachusetts, 59% to 57% (post-adjustment) (Figure 5). All program states had an efficient share of 54% (post adjustment).<sup>25</sup> LED market share in Rhode Island (57%) and, to a lesser extent, Massachusetts (53% or 50% unadjusted) exceeded that of the combined other program states (51%). Although programs remain associated with higher efficient bulb market share, efficient bulbs in non-program areas are also strong. LEDs (45%) and CFLs (2%) collectively make up almost one-half of sales, even in non-program areas.

Figure 5: 2018 Market Share in Rhode Island and Comparison Areas – FCD<sup>1,2,3</sup>



<sup>1</sup> All retail channels.

<sup>2</sup> CREED adjusted LED sales in 2018 in Massachusetts for better alignment with program sales data; pre-adjusted market share was 50%. See Section 1.2.1 for more detail.

<sup>3</sup> Results subject to rounding error.

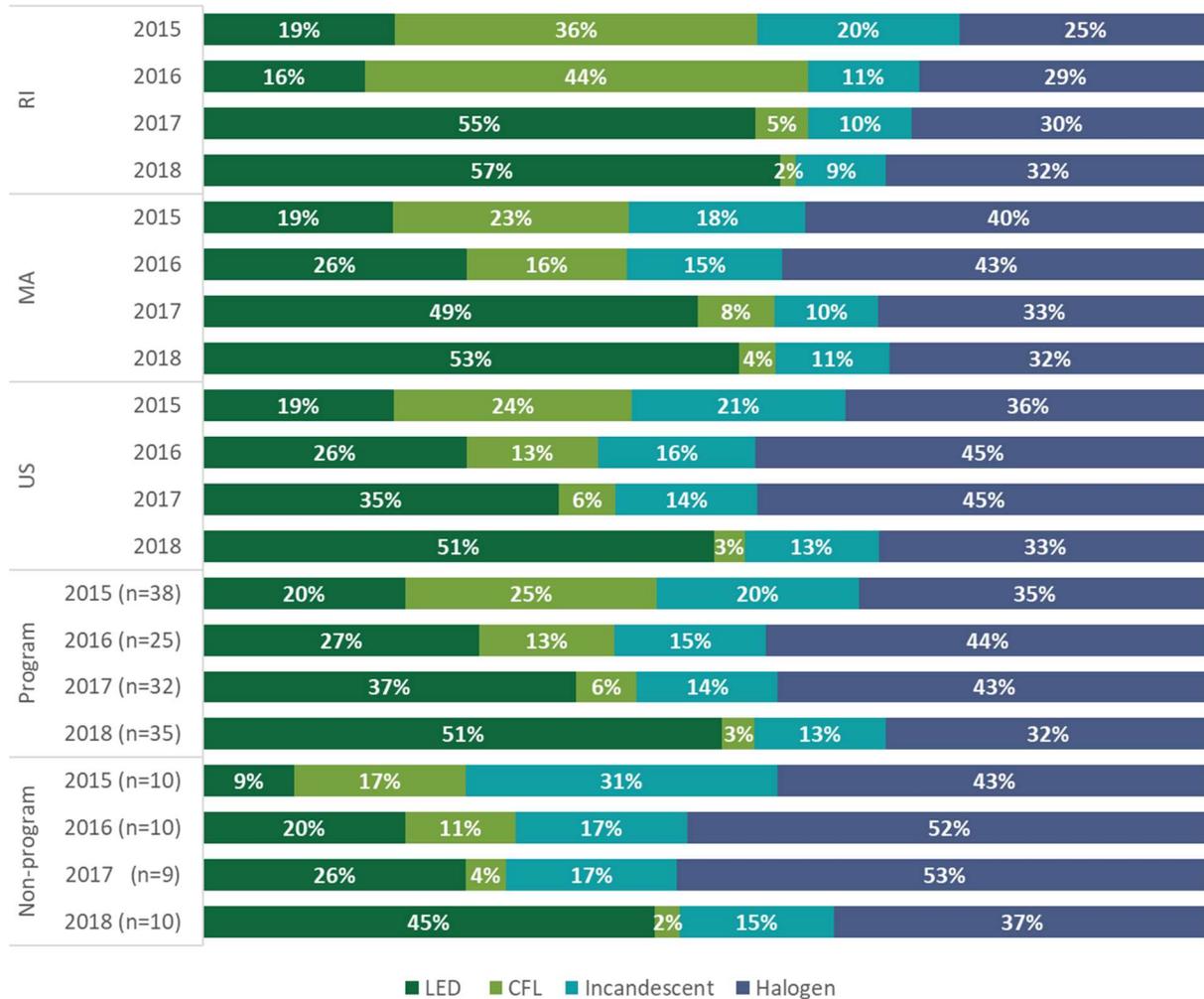
<sup>25</sup> The LightTracker adjustment applied to multiple program states. NMR does not have access to pre-adjusted program state market share.



**LED market share increased three-fold in Rhode Island between 2015 and 2018, but non-program areas saw a five-fold increase.**

LED market share has increased substantially between 2015 and 2019 in all areas considered (Figure 6). While Rhode Island, Massachusetts, the US, and program areas, saw increases from about 20% to 50% or greater, non-program areas rose from a market share of only 9% to 45%. This suggests strong progress towards market transformation. Recall that the adjustment factor taken in Rhode Island in 2017 and Massachusetts in both 2017 and 2018 complicates comparisons in these years, so it is best to focus on trends over the entire time period.

**Figure 6: Market Share in Rhode Island and Comparison Areas by Bulb Technology 2015-2018 – FCD<sup>1,2,3</sup>**



<sup>1</sup> All retail channels.

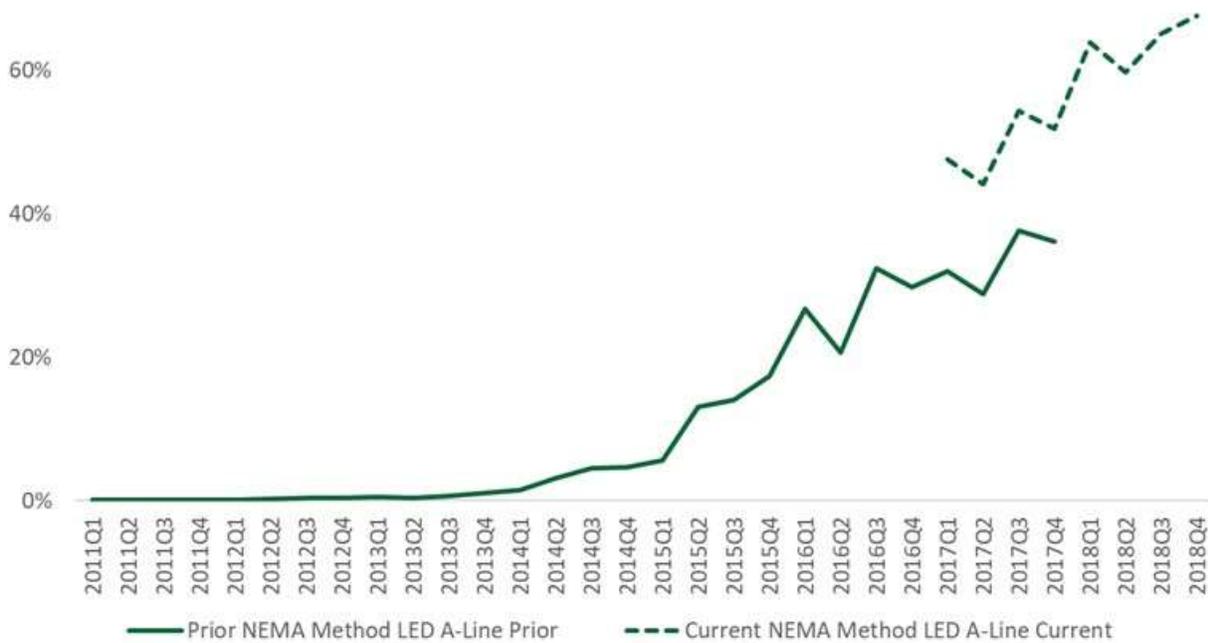
<sup>2</sup> CREED makes adjustments to LED sales in program states when total LED sales and program sales data are not aligned. They made this adjustment in Rhode Island in 2017 and in Massachusetts in both 2017 and 2018. Prior to the adjustment, Rhode Island's 2017 LED market share was 42% and Massachusetts's was 36%. Unadjusted LED market share in Massachusetts in 2018 was 50%. See Section 1.2.1 for more detail.

<sup>3</sup> Results subject to rounding error.

**NEMA Shipment Share**

NEMA publishes national shipment shares for A-line bulbs. It is important to remember that sales often lag shipments, as bulbs sit in warehouses before being placed on store shelves and sold to customers. As described above (Section 1.2.2), NEMA recently revised its approach to estimating shipments, incorporating international sales and dropping incandescents from the shipment share calculations. In Figure 7, the solid line shows the LED portion of A-line bulb shipments of NEMA members from Q1 2011 to Q4 2017 (the prior method). The dashed line shows the LED portion of A-line bulb shipments of NEMA members augmented with data on international shipments into the US for Q1 2017 to Q1 2019 (the current method).<sup>26</sup> Both methods point to the same trend of growing LED market share, but they differ in magnitude. The average LED shipment shares for 2017 were 34% using the prior method and 50% using the current method, a difference of 16%. The most recent update (Q1 2019) placed LEDs at 70% of all shipments.

**Figure 7: A-line LED Shipment Share Over Time per NEMA (Prior and Current Calculation Methods)**



<sup>1</sup> Market coverage is unknown, but the *prior* method excludes international shipments and the *current* method excludes incandescents.

<sup>26</sup> Appendix A.2 compares the shipment share for all four A-line bulb types. The prior method included incandescents in the calculation of shipment share, while the current method does not.

### 2.1.2 Market Share by Bulb Shape



**The 2018 LED market share in Rhode Island for A-line, reflector, and globe bulb shapes exceeded that of all other comparison areas, but candelabra market share was comparable to Massachusetts and the US.**

Across all retail channels in 2018, Rhode Island displayed the greatest LED market share of all bulb shapes across the comparison areas (Figure 8). In Rhode Island, LEDs made up the largest share of A-line (60%), globe (5%), and reflector sales (81%), but only one-quarter of candelabra sales.



**Reflector LED market share in 2018 was high in all comparison areas, suggesting strong natural market adoption of this technology.**

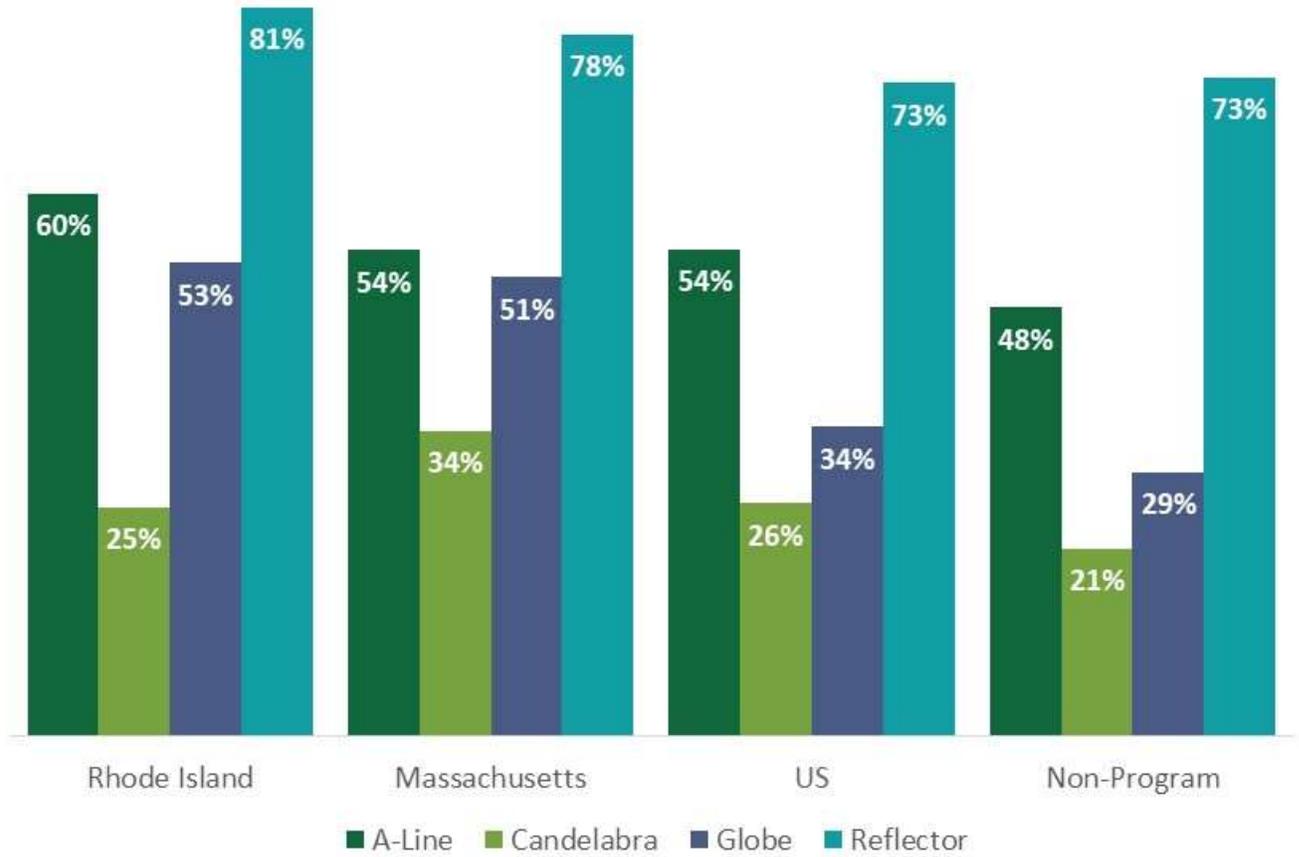
LEDs accounted for at least 70% of reflector sales across the nation, including in non-program areas. This implies that this bulb shape has made strong progress towards market transformation. Because they tend to be installed in ceilings, outdoors, and other areas that make it difficult to replace bulbs, long-life LEDs serve as a natural choice for reflector applications. Moreover, the Rhode Island shelf-stocking study found that program support contributed to a rapid decrease in LED reflector prices between 2016 and 2018, which now fall below the prices for halogens.<sup>27</sup> In contrast, halogen prices have remained relatively steady over the same time period. Thus, LEDs not only have a natural affinity to many reflector applications, but – in the presence of price supports – they may also be among the least expensive options.

It is also worth noting that, given current trends, LEDs will likely account for the majority of A-line sales in 2019, another sign of strong natural market adoption.

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<sup>27</sup> NMR Group, Inc. (forthcoming) *2018 Rhode Island Shelf Stocking Study*. Draft under development.

Figure 8: 2018 Market Share by Bulb Shape in Rhode Island and Comparison Areas – FCD<sup>1</sup>



<sup>1</sup> All retail channels.

### 2.1.3 Market Share by Program Activity Analysis



**Collectively, states with more aggressive program spending per household have higher LED market shares than states with moderate program spending or no program spending, but the data point to increased rates of natural market adoption throughout the nation.**

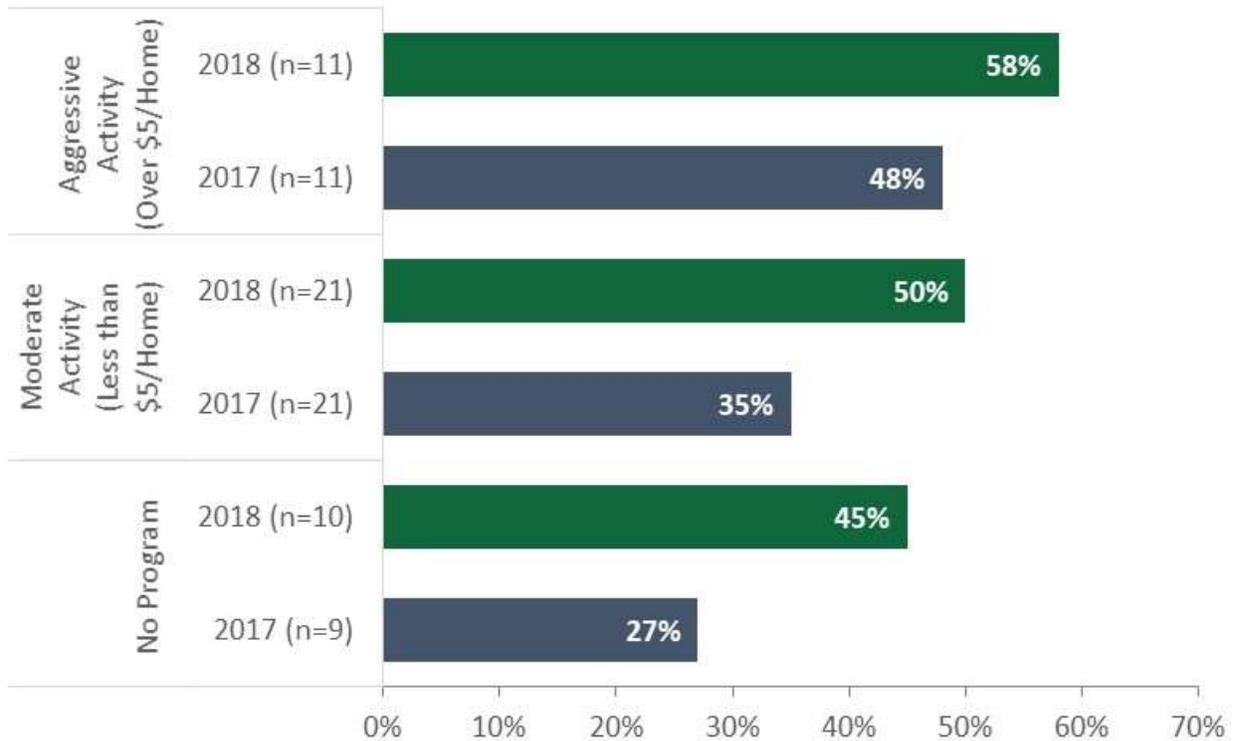
Figure 9 presents LED market share as a function of program spending (including incentives, marketing, and administration), and exhibits a clear increase in LED share as program spending increases.<sup>28</sup> States with aggressive program activity (including Rhode Island) spent over \$5 per household on upstream lighting programs. The average LED market share among these states was 58%, up from 48% in 2017. The average LED market share among non-program states in 2018 was 45%, compared to 27% in 2017.<sup>29</sup> Moderate activity states fell in between, with LEDs garnering 50% of the market share in 2018 and 35% in 2017. Program activity was clearly associated with higher market share in 2017 and 2018, but the rate of market share increase was lowest among the most aggressive states and highest among non-program states.

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<sup>28</sup> State-level spending varies for three primary reasons. First, the first being that the incentive levels and number of lamps incented can differ across states. Second, in some states, not all PAs support upstream lighting and the level of support by PA can vary. Finally, the non-incentive costs (e.g., marketing and outreach, allocation of admin) can also vary by PA, which could affect both program spending per household.

<sup>29</sup> See [Appendix A](#) for details on which states are included. Some states lacked sufficient program activity information to be included in this analysis. Note that CREED was able to secure adequate program activity information for 41 states in 2017 and 42 states in 2018.

Figure 9: 2018 Program Spending and LED Market Share – FCD<sup>1</sup>



<sup>1</sup> All retail channels.

Similarly, Figure 10 shows Rhode Island’s LED market share relative to Massachusetts’s and other states with sufficient data. Dark green denotes states with aggressive programs, teal bars represent moderate program states, and lime green bars represent non-program states. The figure shows that aggressive, moderate, and even non-program states share the top ten market shares in the nation, a change from prior years.<sup>30</sup> Rhode Island had the 12<sup>th</sup> highest LED market share in 2018, and Massachusetts the 21<sup>st</sup> (post-adjustment). This finding lends additional support to the argument that the rates of natural market adoption of LEDs increased rapidly in 2018, with market share in moderate and non-program states rivaling or exceeding those in many aggressive program states, including Rhode Island and Massachusetts. The apparent decrease of program influence on market share certainly points to a transforming market, but it would be imprudent to place too much emphasis on the individual rankings of states. The CREED market share estimates can be noisy: they are sensitive to the sample size of panelists, and CREED must align LED sales to known program sales. Thus, the 3% difference in share between “State 10” at 60% and Rhode Island at 57% could reflect data limitations as much as any true differences in market share.

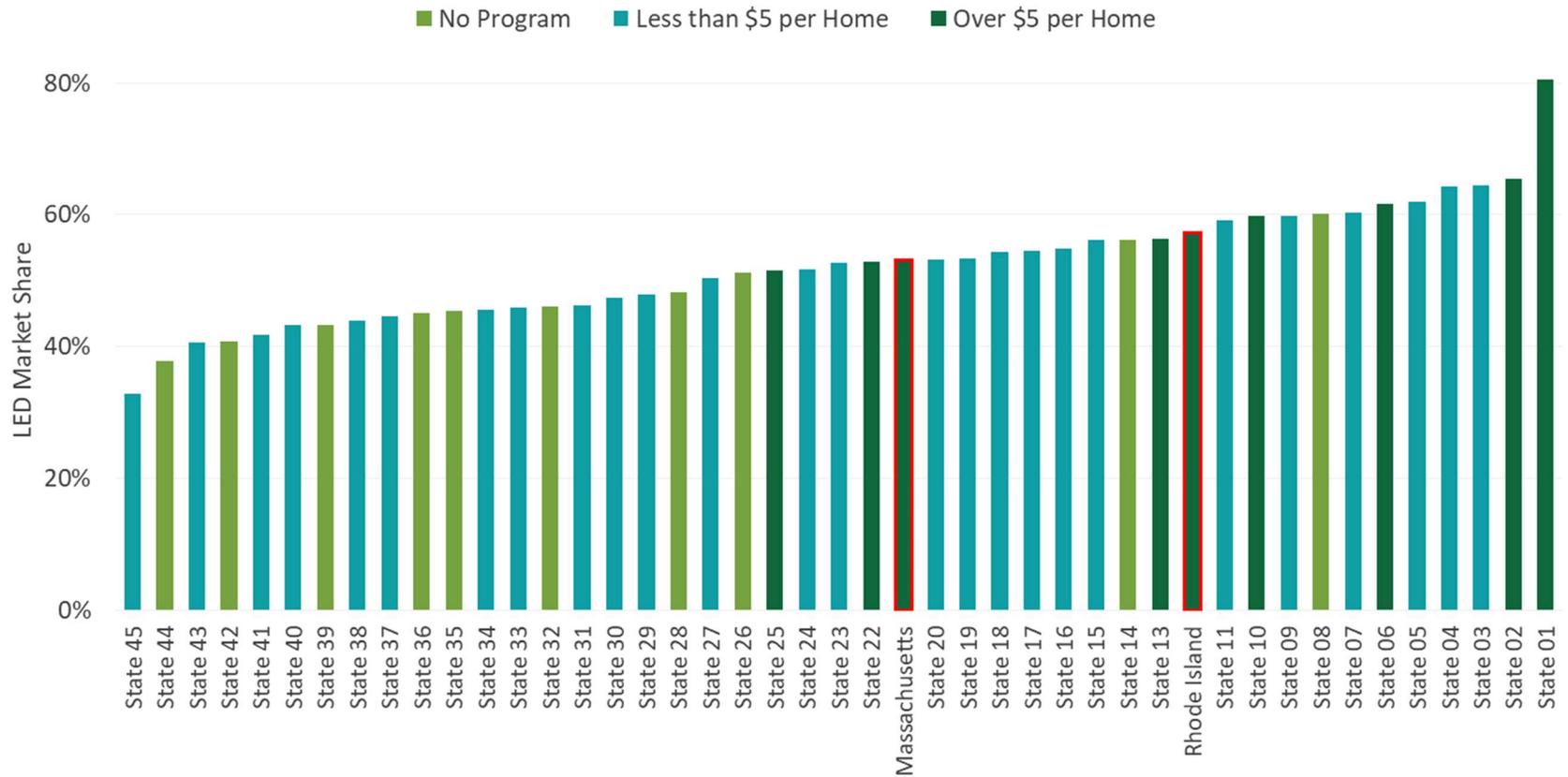
<sup>30</sup> NMR Group, Inc.(2018) *Rhode Island 2017 Lighting Sales Data Analysis: Final*. Delivered to National Grid on April 23, 2018. For 2016 data, see NMR Group, Inc. (2017) *RLPNC 16-5 and 17-10 Sales Data Analysis and Modeling*. Available at: [http://ma-eeac.org/wordpress/wp-content/uploads/RLPNC\\_165\\_1710\\_SalesDataReport\\_16NOV2017\\_FINAL.docx](http://ma-eeac.org/wordpress/wp-content/uploads/RLPNC_165_1710_SalesDataReport_16NOV2017_FINAL.docx).

The LightTracker team was able to obtain LED incentive dollars for 15 of the program states.<sup>31</sup> A simple calculation of LED incentive dollars (a portion of total spending) divided by program LEDs yielded average LED incentives per state. As shown in [Figure 11](#), per-bulb LED incentives in 2018 ranged from slightly over \$1 to just over \$4; the average LED incentive was \$1.91. Rhode Island had the second highest upstream lighting incentive per LED in 2018, offering \$2.65 per LED, down substantially from \$2.88 in 2017. Massachusetts spent \$2.88 per LED in 2018. National Grid in Rhode Island (and Massachusetts) heavily supports specialty bulbs (e.g., candelabras, globes, and reflectors), paying larger incentives to achieve competitive prices with non-LED bulbs. At least some other program states still largely support less expensive but higher volume standard LEDs. Despite this, the combination of a high incentive and moderate market share relative to many other states suggests that National Grid Rhode Island and its implementation contractor Lockheed Martin determine if and by how much they can reduce LED incentives, as happened between 2017 and 2018, or alternatively target the incentives to higher price bulbs with currently lower market shares (e.g., candelabras, globes).

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<sup>31</sup> Note that this analysis focuses solely on incentive dollars, while [Figure 9](#) and [Figure 10](#) include all program spending.

Figure 10: 2018 LED Market Share Across States by Program Spending – FCD<sup>1</sup>



<sup>1</sup> All retail channels.

Figure 11: Average 2018 Upstream Incentive per LED (Program States) – FCD<sup>1,2</sup>



<sup>1</sup> All retail channels.

<sup>2</sup> LightTracker was able to isolate LED spending for only 15 states. Therefore, some states (e.g., State1) listed in Figure 10 do not appear in Figure 11.

Figure 10 and Figure 11 show that Rhode Island and Massachusetts have high program spending and LED incentives. However, the two states do not have the highest market share, and they also saw smaller increases in LED market share than some other areas between 2015 and 2018. This raises the question of whether incentives in Rhode Island and Massachusetts are higher than needed. NMR used CREED data, supplemented with information on cost-of-living, to explore this question for the 14 program states for which we had adequate data on LED-specific incentives as well as breakdowns of A-line versus specialty bulb program sales.<sup>32</sup> We considered the potential role played by A-line versus specialty proportions in program sales and cost-of-living in influencing incentive levels. Of the 45 states in the LightTracker dataset, Massachusetts has the third highest cost-of-living and Rhode Island the eighth. Other factors than those considered in the analysis almost certainly play into setting incentive levels, but we could only access variables for which we had adequate data.

<sup>32</sup> A fifteenth state actively manipulated its incentive levels to slow their residential upstream lighting program sales and divert funds to less successful programs in their portfolio, so we removed it from the analysis.

We ran Pearson’s correlations<sup>33</sup> to explore relationships among LED incentives, the proportion of specialty program sales, LED prices + known incentives (LightTracker LED prices include the application of program incentives), halogen prices (which, unlike LED prices, are not biased by program incentives), and the state cost-of-living index.<sup>34</sup> There are two important things to keep in mind for Pearson’s correlations. First, the closer a correlation is to +1 or -1, the greater the positive or negative relationship, respectively, between two variables. Second, correlation does not equal causation; the relationship may be due to a shared third, unmeasured factor or be coincidental.

Table 5 presents the correlations we ran to explore these relationships. The results seem to indicate that cost-of-living is more closely associated with halogen prices and LED incentives (alone or considered with prices) than is the concentration of specialty bulbs in the program. Of particular interest is the positive relationship between halogen price and cost of-living, implying that bulb prices generally are higher where the cost-of-living is higher. Again, we stress that this analysis is not meant to imply causation, but it does suggest that the high incentive levels in Rhode Island and Massachusetts may in part reflect higher bulb prices in the two states, which in turn could be due to the cost-of-living. Therefore, while this report includes a consideration about incentive levels, incentive adjustments should reflect the conditions in Rhode Island and not be based on simplistic comparisons to the rest of the nation.

**Table 5: Exploring Incentive Prices**

Relationship	Correlation	Sample Size (states)
Cost-of-living / LED Price + Incentive	0.83	14
Cost-of-living / LED Incentive	0.70	14
Cost-of-living / Halogen Price	0.67	45 (all LightTracker States)
% Specialty / LED Price + Incentive	0.56	14
% Specialty / LED Incentive	0.42	14
Cost-of-living / % Specialty	0.33	14

**2.1.4 LED Market Share by ENERGY STAR Qualification**



**Sales of ENERGY STAR qualified LEDs in Rhode Island outpaced non-ENERGY STAR LEDs four to one and ranked fifth in the nation for percentage of LED sales that were ENERGY STAR.**

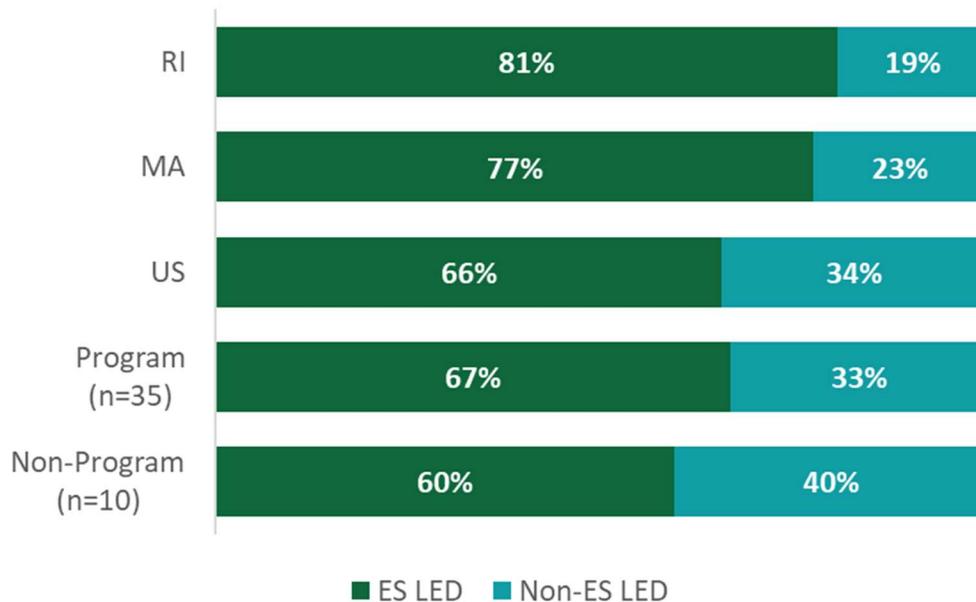
The Rhode Island and Massachusetts upstream residential lighting programs only support ENERGY STAR qualified products. Recalling the shortcomings of the dataset for determining

<sup>33</sup> Wikipedia offers an overview [https://en.wikipedia.org/wiki/Pearson\\_correlation\\_coefficient](https://en.wikipedia.org/wiki/Pearson_correlation_coefficient). NMR recognizes that the data are based on a small number of states that were neither randomly selected nor adhere to the normal curve. These characteristics violate the assumptions of Pearson’s correlations and related tests of statistical significance. Therefore, while NMR presents the correlations, we refrain from reporting *p-values* (a test of significance) and stress that the results should be considered indicative.

<sup>34</sup> Missouri Economic Research and Information Center. 2018. *Cost of Living Data Series*. Accessed August 20, 2019. <https://meric.mo.gov/data/cost-living-data-series>

ENERGY STAR qualified market share (Section 1.2.1), their exclusive support of ENERGY STAR qualified bulbs is evident in the LightTracker data. ENERGY STAR qualified LEDs accounted for 81% of LED sales in this subset of retail channels in Rhode Island and 77% in neighboring Massachusetts (Figure 12). With this ENERGY STAR market share of 81%, Rhode Island ranked fifth in the nation, very close to the leading state at 85%. In non-program states, only 60% of LED sales in the same retail channels were ENERGY STAR. These estimates are not subject to the CREED adjustment for program sales, as CREED adjusted only the FCD sales data, not these POS data based on a subset of retail channels.

**Figure 12: ENERGY STAR Status of 2018 LED Sales in Rhode Island and Comparison Areas – POS<sup>1</sup>**



<sup>1</sup> Includes discount, dollar, drug, grocery, mass merchandise, and some membership stores. Represents approximately 25% of the Rhode Island lighting market, and 31% of the Massachusetts, 35% of the US, 34% of the program state, and 41% of the non-program state markets.

### 2.1.5 Market Share by Lumen Bin

The 2007 EISA increased efficiency standards on most A-line general service lamps. A second phase of EISA (EISA Phase II or EISA 2020) was supposed to go into effect in January 2020, but its status remains uncertain due to a series of regulatory and legal actions (and inactions).<sup>35, 36</sup> National Grid asked NMR to examine 2018 market share for the LightTracker sales data to assess

<sup>35</sup> Early in 2017, the DOE issued a rulemaking expanding the definition of general service lamps to include reflectors, globes, candelabras, and some other bulb types currently exempt from EISA, but the DOE has since rescinded the rulemaking. The DOE has also indicated that the EISA 45 lumens per watt backstop general service lamps may not have been triggered, but the department has not released a final rulemaking on this topic. The outcome if, how, and when EISA 2020 will be implemented will most likely be cleared up in the courts as the outcome of lawsuits.

<sup>36</sup> While exempt from the first phase of EISA, reflector bulbs must adhere to their own set of efficiency standards that vary by size and shape. See [https://www1.eere.energy.gov/buildings/appliance\\_standards/standards.aspx?productid=23](https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=23).

the percentage of bulbs sold by type that are currently EISA exempt and that most likely will remain so if and when the EISA Phase II (EISA 2020) regulations go into effect for A-line bulbs. We used the following definitions, although we stress that they may differ in the future pending the outcome of regulatory and legal decisions:

- Currently exempt from EISA: A-line bulbs that exceed 2,600 lumens or fall below 310 lumens
- Exempt from EISA 2020: A-line bulbs that exceed 3,300 lumens or fall below 310 lumens

Table 6 lists the overall percentage of A-line bulb sales that fell into each lumen bin. This includes all bulb technologies but only for the POS dataset (discount, dollar, drug, grocery, mass merchandise, and some membership stores). The table also indicates whether the lumen bin is currently EISA exempt and will remain so in 2020 (if implemented).<sup>37</sup> Assessing market share by lumens highlights the market share of bulbs between 310 and 2,600 lumens once held by incandescents. According to the data for this subset of retail channels, about 3% of A-line sales falls into lumen bins that are currently exempt from EISA (greater than 2,600 lumens and less than 310 lumens).

**Table 6: Lumen Bin Description – POS**

Lumen Bin	EISA Exemption	Approximate A-line Incandescent Wattage	Percentage of 2018 Bulb Sales (RI)	Percentage of Category of LED Sales (RI)
0-309	Current and 2020	Below 40 Watts	3%	11%
310-449	Not exempt	40 Watts	6%	7%
450-749	Not exempt	40 Watts	19%	44%
750-1049	Not exempt	60 Watts	52%	69%
1050-1489	Not exempt	75 Watts	10%	17%
1490-2600	Not exempt	100 Watts	10%	25%
2601-3300	Current	150 Watts	<1%	<1%
>3300	Current and 2020	Above 150 Watts	<1%	<1%



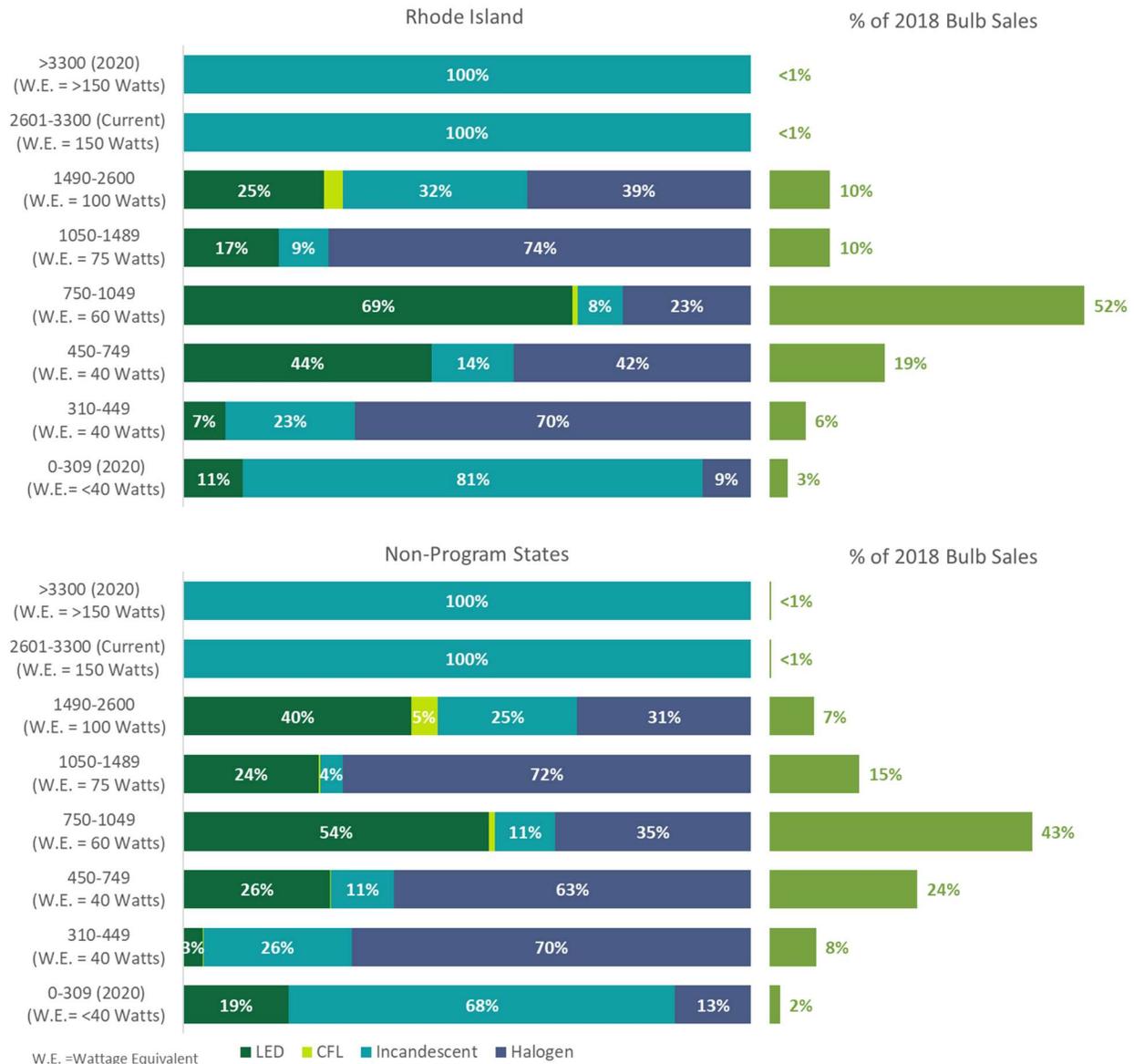
**LED sales in Rhode Island are strongest in lumen bins most closely associated with 60 Watt and 40 Watt incandescent bulbs.**

Figure 13 presents A-line market share by bulb type and lumen bins. It demonstrates that the 750 to 1,049 lumen bin garnered 52% of sales, of which 69% were LEDs. LEDs also accounted for 44% of sales in the 450 to 749 lumen bin (19% of sales). In contrast, the lumen bins that are currently exempt from EISA (below 310 lumens and above 2,600) remained dominated by incandescents, although they collectively garnered less than 3% of all bulb sales. A comparison to non-program states revealed much lower LED market shares in most lumen bins, except those currently and likely to be exempt from EISA in 2020, and those in the 1,050 to 2,600 lumen range.

<sup>37</sup> Wattage equivalents vary considerably by bulb shape and manufacturer, so these are only approximations.

Consumers in non-program states generally turned to halogens in the absence of program incentives on LEDs in the highest sales volume lumen bins.

**Figure 13: 2017 A-line Bulb Market Share by Lumen Bin – POS<sup>1,2,3</sup>**



<sup>1</sup> Includes discount, dollar, drug, grocery, mass merchandise, and some membership stores, and represents approximately 25% of the Rhode Island market.

<sup>2</sup> Bins currently EISA Exempt: less than 310, above 2,600; bins that will remain exempt from EISA 2020 (if implemented): less than 310, above 3,300.

<sup>3</sup> Small sample sizes of lumen bins less than 310 and above 2,600, while still in the hundreds and low thousands, are much smaller than the tens and hundreds of thousands of bulbs in the 450 to 2,600 lumen bins.

<sup>4</sup> Data labels removed for sales percentages less than 3%.

## 2.2 BULB PRICE ANALYSIS

NMR compared the average price of LEDs and halogens for Rhode Island and the various comparison areas using the FCD lighting data. The prices in the LightTracker dataset reflect the application of program incentives. However, the third-party sources do not report prices for private label bulbs (also known as store brands). Store brands usually sell for less than brand name models, so the prices reported in this section should be considered on the high end of what consumers pay at the register.



***LEDs prices vary by area, but the presence of energy-efficient lighting program activity is not always associated with lower LED prices.***

Figure 14 displays the average shelf price – including the application of program incentives – for LEDs and halogens.<sup>38</sup> The average LED bulb price was similar in \$2.73 in Rhode Island, the nation, and other program states (\$2.73, \$2.73, and \$2.76, respectively). Massachusetts, the state with the highest LED incentives Figure 11, had the lowest average LED price (\$2.56), but the average LED price was only three cents more (\$2.59) in non-program areas.

NMR believes that the low average LED price in non-program areas likely reflects a combination of factors. First, data collection and reporting error could underlie the result. Second, the prices include both ENERGY STAR and non-ENERGY STAR LEDs; non-program states had the highest proportion of non-ENERGY STAR LEDs, which tend to be less expensive than ENERGY STAR models (Figure 12).<sup>39</sup> Yet, it could also be that retailers have discounted the price of all LEDs in non-program areas either because of the lower cost-of-living in non-program states or to boost LED sales, given that, prior to 2018, LED sales in non-program areas lagged those in program areas. Although the explanation remains unclear, the low price of LEDs in non-program areas provides additional evidence that market transformation is progressing across the nation.

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<sup>38</sup> The small sample sizes of CFLs and incandescents leads to large swings in pricing across areas.

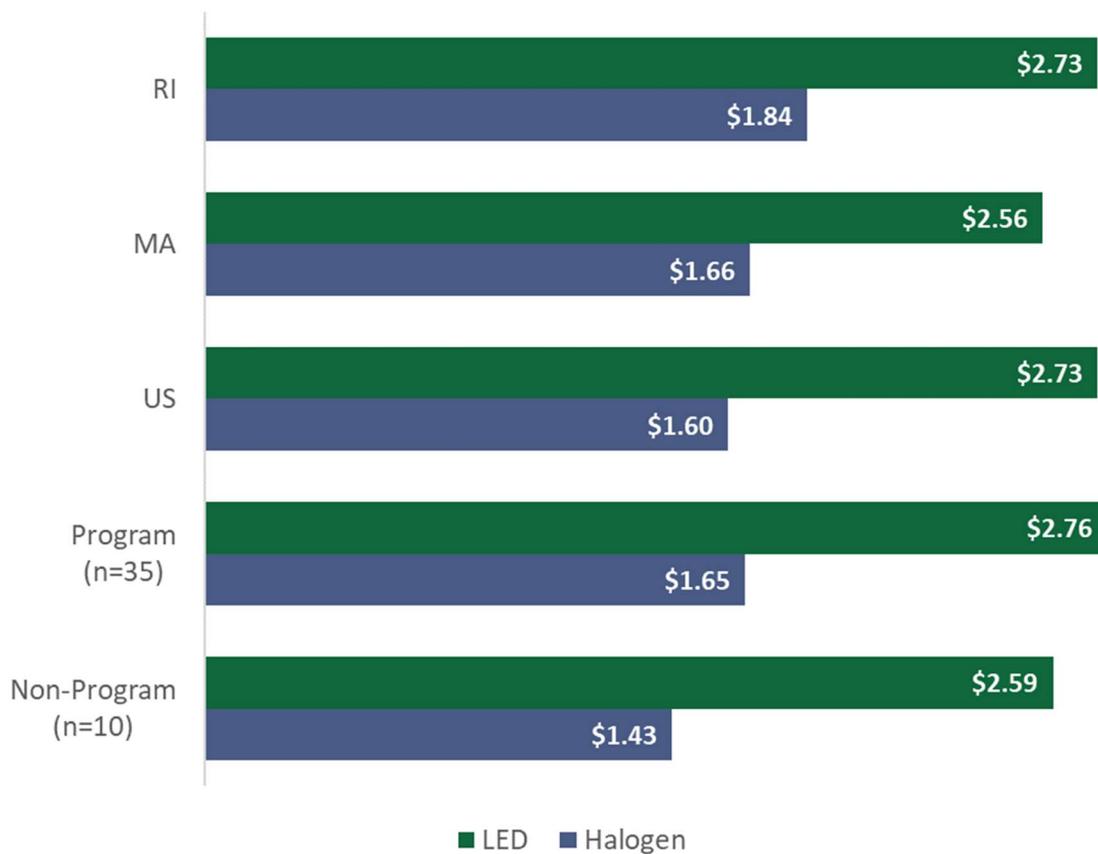
<sup>39</sup> Manufacturers and retailers also reported at the ENERGY STAR Partners meeting in September 2019 that sales of non-ENERGY STAR LEDs are higher in the absence of program incentives for ENERGY STAR qualified bulbs.



**LEDs remain more expensive than halogens bulbs, even with program price supports.**

LEDs cost about 90 cents more than halogens in Rhode Island and Massachusetts, compared to about \$1.10 more in the other comparison areas. Halogen prices were highest in Rhode Island and lowest in non-program areas.

**Figure 14: 2018 Average Price per Bulb in Rhode Island, and Comparison Areas – FCD<sup>1,2</sup>**



<sup>1</sup> All retail channels.

<sup>2</sup> Does not include private label bulbs sold at specific retailers, so the prices reported here are likely somewhat higher than actual prices.

## Appendix A Data Sources and Data Cleaning

This appendix provides a detailed discussion of data sources, data cleaning, and the strengths and weaknesses of each source.

### A.1 LIGHTING SALES DATA

The LightTracker Initiative dataset compiled by CREED exists to fill a gap in the availability of market-level lighting sales data. While many program partners readily share program sales data, they are reluctant to share non-program sales data. Non-program retailers and manufacturers also rarely share sales data with PAs or evaluators. The LightTracker Initiative pools the resources of multiple PAs to make a new source of market level information available. While not perfect (see [Section 1.2](#) for a listing of strengths and weaknesses), it offers improved estimates of market-level sales for all retail channels and most states. LightTracker provides data for 45 of the 50 United States (see [Table 7](#) for a listing of states).

Though the datasets CREED received included detailed records of lighting data purchases, the data required a considerable effort to ensure data integrity and inclusion of all the necessary bulb attributes. For example, some records did not have critical variables populated, such as bulb type, shape, or wattage. In addition, some records had clearly erroneous values (e.g., 60-watt LEDs). After thorough review and quality control of the dataset, CREED re-classified and standardized the data. CREED also populated missing records, created additional variables, and performed general enhancements to the data. To populate missing records, validate existing records, and include additional bulb attributes, CREED created a proprietary Universal Product Code (UPC) database with approximately 36,000 bulbs from the following five sources:

- Manufacturer product databases provided to LightTracker
- Product catalogs downloaded from manufacturer web sites via web scraping
- Product offerings downloaded from retailer web sites
- Automated lookups of online UPC databases, such as [www.upcitemdb.com](http://www.upcitemdb.com)
- ENERGY STAR databases available online at <https://www.energystar.gov/productfinder/product/certified-light-bulbs>

Table 7: Program Strength and Data Quality Confidence

Program States	Non-Program States	Unable to Categorize/ Excluded from LightTracker <sup>1</sup>
Arizona	Alabama	Alaska
Arkansas	Delaware	Hawaii
California	Kansas	Iowa
Colorado	Kentucky	Montana
Connecticut	Mississippi	North Dakota
Florida	Nebraska	
Georgia	Nevada	
Idaho	Tennessee	
Illinois	Virginia	
Indiana	Wyoming	
Louisiana		
Maine		
Maryland		
Massachusetts		
Michigan		
Minnesota		
Missouri		
New Hampshire		
New Jersey		
New Mexico		
New York		
North Carolina		
Ohio		
Oklahoma		
Oregon		
Pennsylvania		
Rhode Island		
South Carolina		
South Dakota		
Texas		
Utah		
Vermont		
Washington		
West Virginia		
Wisconsin		

CREED then merged the bulb database with the POS/Panel data, populating fields based on a hierarchy of data sources believed to be most reliable. Prioritization was typically in the following order: manufacturer specifications, UPC lookups, original data provider (IRI and Nielsen) database values. The team also conducted manual web lookups on individual bulbs to determine final assignments.

In addition, CREED investigated the bulb assignment and the quantity of bulbs per package by examining the average price per unit and by identifying outliers in terms of per bulb prices. This process helped identify misclassification of certain bulb types (e.g., bulbs that were flagged as low cost LEDs but were really LED nightlights, so they needed to be moved under the *other* category) and misclassification of bulb counts that represented box shipments (e.g., a package identified as having 36 bulbs was really a six-pack of CFLs that was shipped with six packages per box).

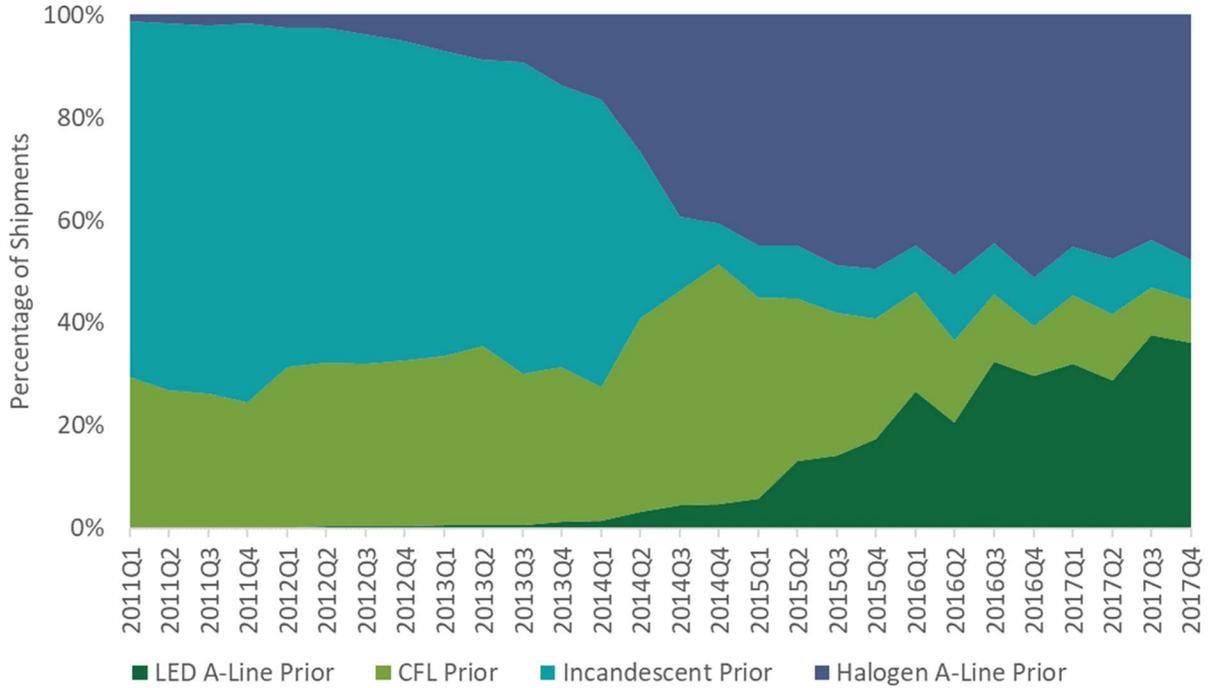
Key aspects of the final lighting dataset include the following:

- 2018 sales volume and pricing for CFLs, LEDs, halogens, and incandescent bulbs for all channels combined, and broken out by the POS and non-POS channels
- Data reporting by state (with 45 states included) and bulb type
- Inclusion of all bulb shapes (e.g., candelabra, globe, etc.) and controls (e.g., three-way, dimmers, etc.)

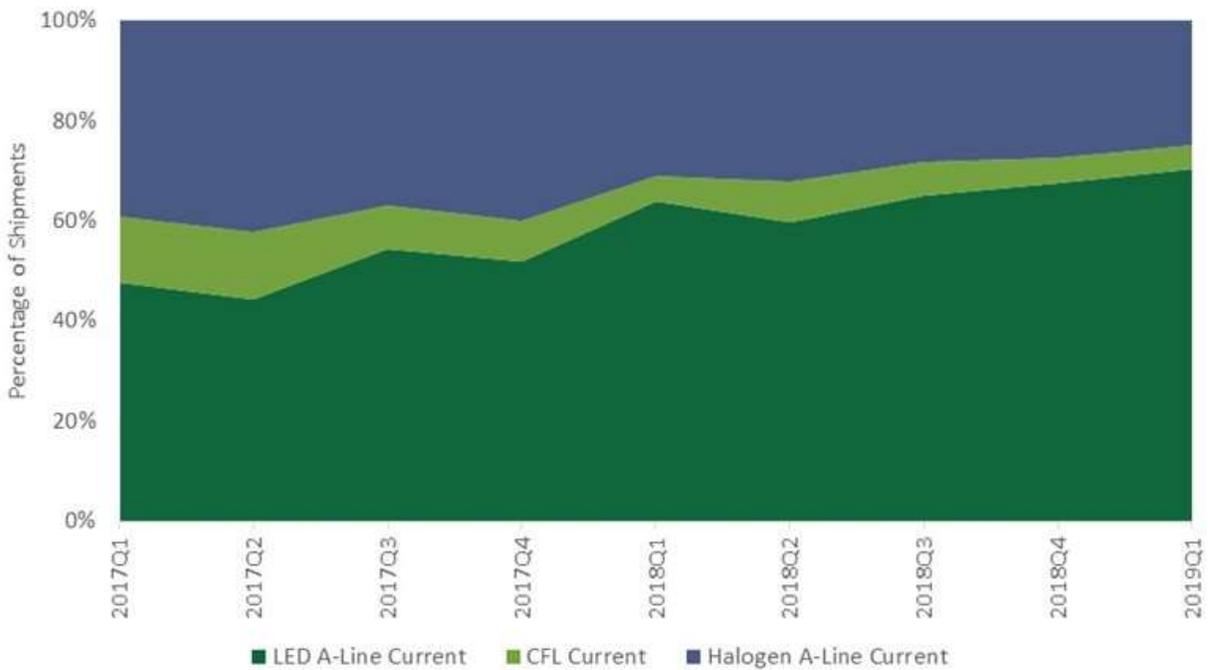
## A.2 NEMA SHIPMENT DATA

[Section 1.2.2](#) of the main body of the report describes the NEMA shipment data and discusses the recent change NEMA made to its method of calculating shipment shares. [Section 2.1.1](#) presents data on LED shipment shares using the prior and current NEMA estimation methods and compares the shipment shares to sales shares. [Figure 15](#) and [Figure 16](#) present the shipment shares over time for all bulb types, from 2011 to 2017 using the prior NEMA calculation method and including incandescents ([Figure 15](#)) and from 2017 to Q1 2019 for LEDs, halogens, and CFLs ([Figure 16](#)). Both figures demonstrate the shrinking CFL share. [Figure 15](#) also shows the decline in incandescent shares. [Figure 15](#) and [Figure 16](#) differ in that the former suggests relatively steady market share for halogens from late 2015 through 2017, with LEDs encroaching on CFLs and incandescent. The latter figure suggests that LEDs are also encroaching on halogen shares.

**Figure 15: NEMA Shipment Share, All Bulb Types  
(Prior Calculation Method)**



**Figure 16: NEMA Shipment Share All Bulb Types  
(Current Calculation Method, Excludes Incandescents)**



### A.3 PROGRAM ACTIVITY

To research program activity, the LightTracker team used internal resources and conducted a literature review of publicly available reports that were found on the internet or provided by PAs or their evaluators.<sup>40</sup> The team contacted local utilities in each given area when reports with the relevant information were not available. Additionally, the team accessed DSM Insights, an E Source product that provides a detailed breakdown of program-level spending, including incentives, marketing, and delivery for over 100 PAs around the country.<sup>41</sup>

The team collected the following program data:

- Total number of claimed LED upstream program bulbs reported by each program
- Upstream LED incentives
- Total upstream program budget

Where available, the team used actual program data. In other cases, the team turned to DSM Insights, ENERGY STAR reported expenditures, or planning values as proxies.<sup>42</sup>

All states with at least some program activity in 2018 were designated *program states*; the remaining states were designated *non-program states*, as shown above in [Table 7](#).

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<sup>40</sup> Specifically, the team began by searching the ENERGY STAR Summary of Lighting Programs website <https://www.energystar.gov/ia/partners/downloads/2017%20ENERGY%20STAR%20Summary%20of%20Lighting%20Programs.pdf> and referenced the Database of State Incentives for Renewables & Efficiency ([www.dsireusa.org](http://www.dsireusa.org)).

<sup>41</sup> E Source. "DSM Insights." April 2018.

<sup>42</sup> Note that because the ENERGY STAR report only included expenditure ranges, the midpoints of the ranges were used to represent the expenditures.