RLPNC 17-12 Lighting Decision Making

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SUBMITTED TO:
The Massachusetts Energy Efficiency Program Administrators and EEAC Consultants

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Executive Summary

The Massachusetts Energy Efficiency Program Administrators and EEAC Consultants contracted with NMR Group, Inc. to investigate what factors influence consumers' decisions to purchase efficient lighting and what barriers lead some consumers to continue purchasing inefficient alternatives. Our results show that program support for efficient bulbs is continuing to have a positive influence on the retail lighting market in Massachusetts. The results also provided insights into how the program can most effectively market itself going forward.

Objectives and Research Questions

The objectives of the current research were to determine what motivated consumers to purchase efficient lighting and what factors influenced consumers to instead purchase inefficient lighting in Massachusetts and portions of New York (namely, Upstate New York excluding New York City and Long Island, referred to in this report as *New York*). More specifically, the research was designed:

- To identify factors that influenced consumers' decisions to purchase efficient lighting and the barriers that led some consumers to continue to purchase inefficient alternatives.
- To determine the role of retail program support in purchases of efficient lighting.
- To elucidate consumers' lighting decision-making processes and identify effective program strategies to support efficient lighting.

The primary research goal was to understand the factors that influence efficient lighting purchases and why some consumers persist in purchasing inefficient alternatives.

Methods

NMR analyzed 2016 and 2017 lighting purchase data and administered surveys to recent shoppers in 2016 and 2017 in Massachusetts and portions of New York from a panel of lighting purchasers provided by InfoScout. InfoScout is a research company that has a nationwide panel of customers who upload their receipts from retail and restaurant shopping trips in exchange for various rewards. The InfoScout data allowed us access to many details about the type of lighting purchased by the panelists during the study period.

Overall Assessment

Between 2016 and 2017 the proportion of panelists who selected an efficient bulb increased in both states by approximately twenty percentage points; however, LED market share in Massachusetts remained higher than in New York.

KEY FINDINGS

Purchase Data

Here we discuss top-level key findings from an examination of the InfoScout purchase data from 2016 and 2017. Note: the purchase data across the two states revealed a key difference in shopping behavior between the two samples, which may make it more difficult to compare shopping patterns between areas. Namely, New York panelists were much more likely to shop at Walmart compared to the Massachusetts panelists. In 2017, one-half of New York, New York lighting purchase trips occurred at Walmart compared to 29% for Massachusetts (unweighted). In 2016, 37% of New York lighting purchase trips occurred at Walmart compared to 22% for Massachusetts (unweighted).

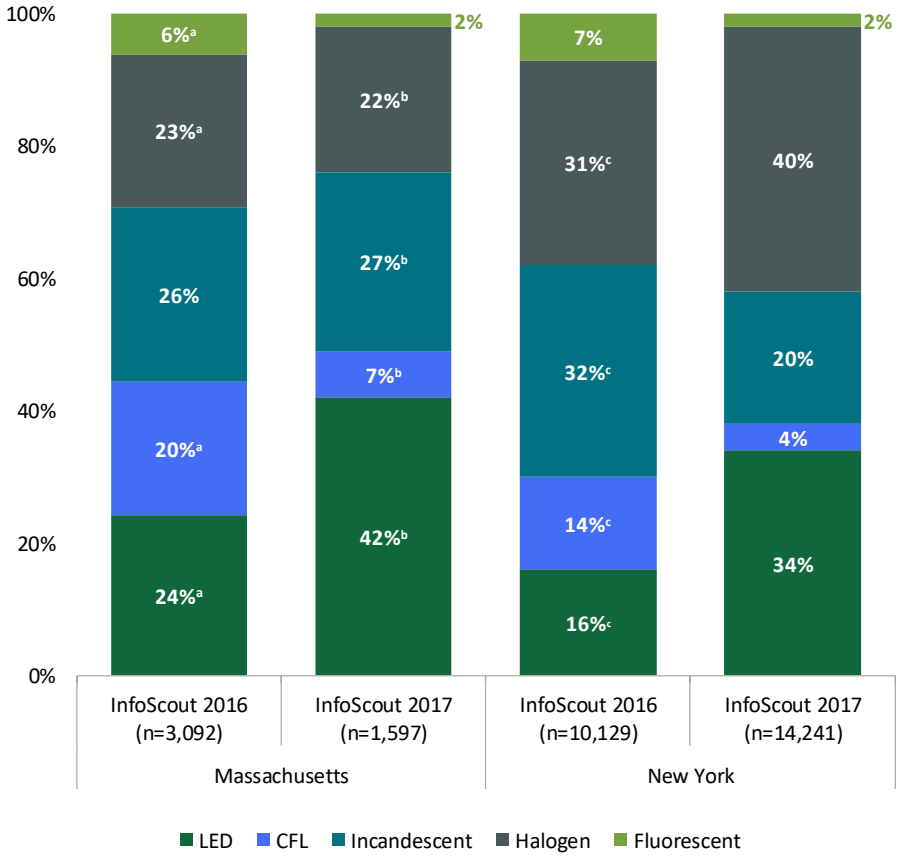
Market Share

Market share for LEDs increased substantially in both states between 2016 and 2017 – 20 percentage points in Massachusetts and 18 in New York. LED gains in both states appear to have been driven in large part due to a rapidly decreasing CFL market share.

Over the same period, halogen market share **decreased** in Massachusetts and **increased** in New York – lending further to the theory that in the absence of the program, households in Massachusetts would be more likely to purchase halogen lamps.

Incandescent market share remained flat in Massachusetts and **decreased** substantially in New York (from 32% to 20%). Based on this recent shift, incandescent market share is now lower in New York than in Massachusetts.

Figure 1: Market Share by Lighting Technology

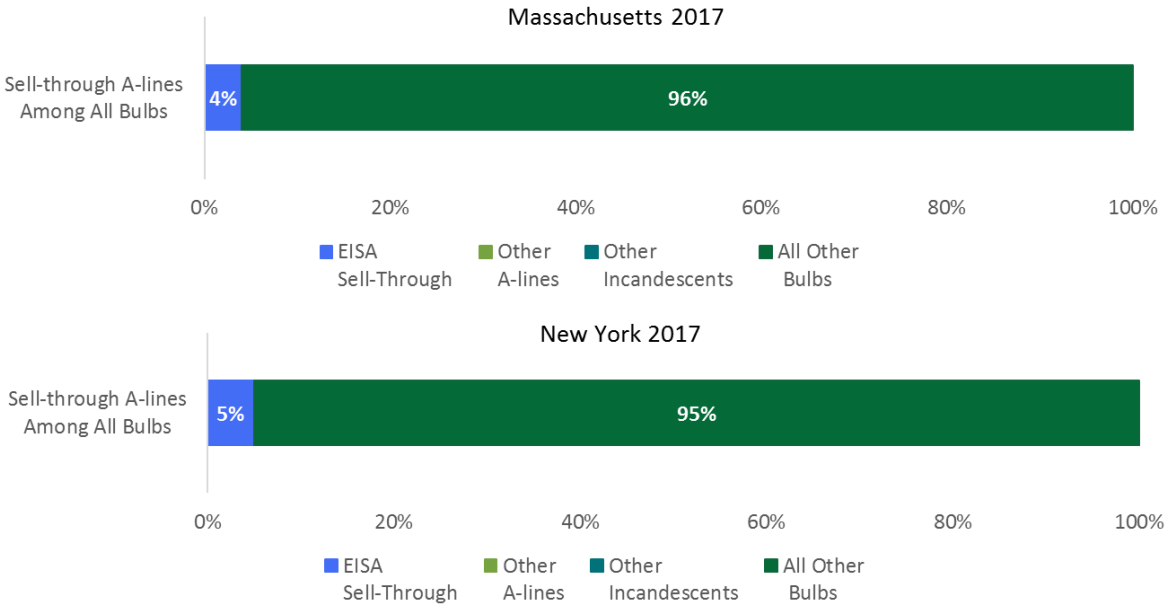


[a] Significantly different from Massachusetts 2017 sample at the 90% confidence level.
[b] Significantly different from the New York 2017 sample at the 90% confidence level.
[c] Significantly different from the New York 2017 sample at the 90% confidence level.

EISA Sell Through

As discussed in detail in the body of the report, evidence from the InfoScout data set shows a substantial sell through period for non-compliant bulbs covered by EISA Phase I. We found incandescent bulbs likely covered by EISA in the more popular wattage categories of 100, 60, and 40 watts were still being purchased in both states in 2016 and 2017 – up to five years after standards went into effect. To place these sell-through bulbs in context, we examined the market share of likely sell-through bulbs as a percent of total market share in 2017 (Figure 2). Overall, in Massachusetts, sell-through A-line incandescent bulbs accounted for 4% of total market share (across all lamp types) in 2017. In New York, sell-through A-line incandescent bulbs accounted for 5% of total market share in 2017.

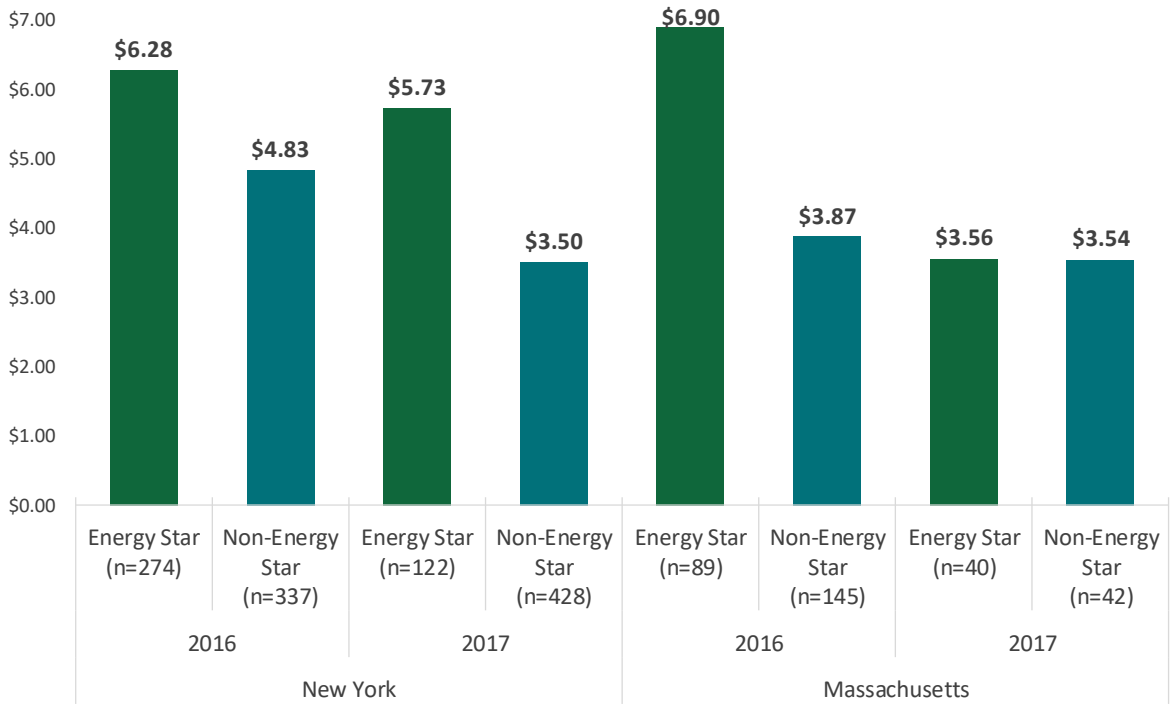
Figure 2: Market Share Statistics for Sell-through A-line Incandescent Bulbs



Lighting Technology and Price

Unfortunately, the majority of product descriptions in the 2017 InfoScout data were insufficient to identify ENERGY STAR status. Despite efforts to match the purchase records against internal NMR databases of ENERGY STAR-certified LED bulbs, we were only able to identify the ENERGY STAR status of 36% of LEDs in the 2016 data and only 12% in the 2017 data. Limiting our focus to just those bulbs for which we had sufficient data, in 2017 we found that ENERGY STAR® LEDs were $2.17 cheaper in Massachusetts compared to New York – reflecting the incentives provided by the Massachusetts program (Table 8).

Figure 3: LED Price by ENERGY STAR Status



When looking at all LEDs purchased, regardless of ENERGY STAR status, those purchased in New York initially appeared $0.40 cheaper than in Massachusetts on average – a surprising finding. Upon further inspection, we discovered this price difference was influenced by a New York sample that was comprised of a much larger proportion of value-priced store brand LEDs, which are approximately half the price, on average, of GE LED bulbs and are the most popular premium brand purchased by the panelists in both areas. When we examined LED price by brand, we found that LEDs were less expensive in Massachusetts than in New York – comparing brand-to-brand. Still, the data show that New York panelists are much more likely to purchase less expensive store brands (particularly from Walmart). **This highlighted the importance of performing pricing analysis at a more granular level to better understand the patterns that emerge and develop appropriate conclusions from the data.**

Table 1: A-Line LED Price by Brand

Bulb Type	Massachusetts 2017		New York 2017	
	Price	# Bulbs	Price	# Bulbs
A-Line	*$2.73*	*312*	*$2.20*	*2,694*
Great Value (Walmart)	$1.37	23%	$1.56[a]	52%
GE	$2.78	21%	$3.34[a]	17%
EcoSmart (Home Depot)	$1.31	10%	$2.17[a]	7%
Other*	$3.71	46%	$2.75[a]	24%

*Includes Feit Electric, Sylvania, Philips, Cree, and Globe Electric.
[a] Significantly different from the Massachusetts 2017 sample at the 90% confidence level.

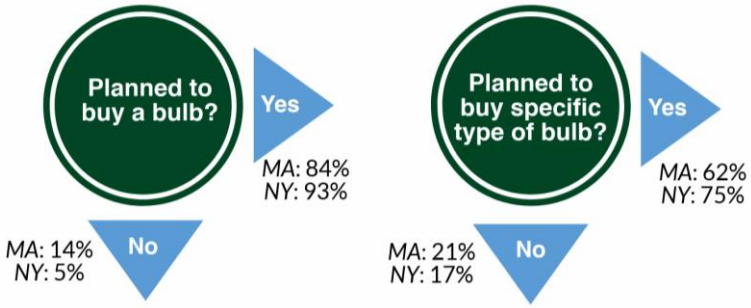
Survey Results

Here we discuss top-level key findings from an examination of survey responses from 2016 and 2017.

Pre-Purchase Planning

According to survey respondents, the majority of lighting purchases were planned in advance (84% of respondents in Massachusetts and 93% in New York). Slightly more than three-fifths of Massachusetts purchasers and three-quarters of New York purchasers also determined which type of bulb to purchase in advance. Figure 4 provides an overview of the 2017 respondent decision-making process.

Figure 4: Overview of Purchase Planning*



*Respondents who answered "don't know" to questions about purchase planning are not displayed.

Sources of Influence

Among those who determined what type of bulb to purchase in advance, around one-quarter said at least one of the factors inquired about in the survey influenced their purchasing decision – that is, 20% of all Massachusetts respondents and 25% of all New York respondents. In-store signage on this or a previous trip was the most common factor that influenced bulb selection in both states. Coupons were the second most often cited factor in Massachusetts, and third in New York. Because the subset of respondents who was asked this question said they determined in advance what type of bulb to purchase, it could be that

respondents are referring to in-store information from a previous trip, or a coupon discovered before heading to the store, in their responses to this question.[1]

About one-quarter of these same purchasers in both states who decided in advance what type of bulb to purchase said they had researched lighting before making their purchase (25% in Massachusetts and 24% in New York). Purchasers in both states most commonly performed online research followed by relying on family or friends, and conversations with store employees.

In-Store Purchase Decisions

A larger proportion of respondents who decided what type of bulb to purchase while at the store in 2017 ultimately selected an LED bulb than their 2016 counterparts. A larger proportion of LED purchasers in both states affirmed that they had considered another bulb before making a purchase as compared to those who had selected other bulb types (16% in Massachusetts and 14% in New York). The fact that many shoppers considered another bulb and ultimately selected an LED could suggest that the information available in the store was persuasive or informative enough to lead these shoppers to select an efficient bulb, or that the price of efficient lighting was lower than shoppers' expectations.

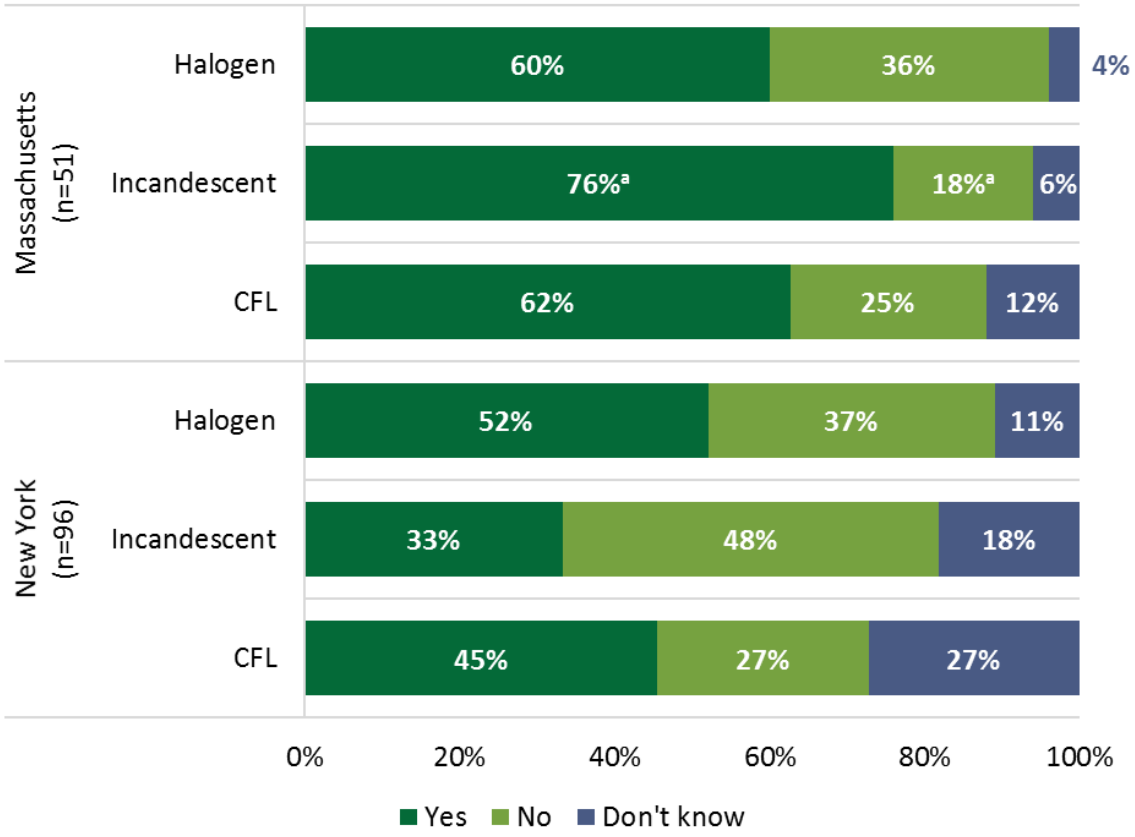
If their desired bulb type had not been available, most would not have purchased a bulb (41% in Massachusetts and 34% in New York) or would have selected whatever was cheapest (21% in Massachusetts and 26% in New York). One-half of all LED bulb purchasers were committed to buying an LED bulb and would not have purchased a bulb if an LED was not available. Many incandescent purchasers would have selected an LED bulb if an incandescent bulb had not been available (21% in Massachusetts and 36% in New York).

Awareness of Efficient Choices

Around three-quarters (76%) of Massachusetts incandescent purchasers said they were aware that more efficient choices were available, compared to only one-third (33%) of New York incandescent purchasers. Greater knowledge of energy efficiency may indicate that educational campaigns are having some success, but given that incandescent purchasers selected an incandescent bulb despite their awareness of more efficient choices, education alone may not be enough to influence decision-making. When asked why they purchased a less efficient bulb, the most common responses in both states were "wanted this specific bulb type," "it's the same bulb type that burned out," and "it's my preferred bulb type." Again, this suggests that there exists a subset of bulb purchasers that are less flexible in their purchasing behavior. Just under one in ten respondents in Massachusetts and 16% in New York said that price was the reason they selected a less efficient bulb. Additional details on reasons can be found in Figure 28 in the main body of the report.

[1] A study conducted by KRC Research on behalf of Sylvania in March of 2016 found that 42% of Americans obtained information about light bulb purchases from in-store displays/employees and 39% from product packaging. Our findings differ from this report in several ways. First, our findings only reflect individuals in Massachusetts and New York. Second, we only surveyed those who said they had decided what type of bulb to purchase in advance of going to the store about what information influenced their decision. Future studies should consider surveying all respondents about what sources of information that influenced their decision-making.

Figure 5: Aware More Efficient Choices Available



CONSIDERATIONS AND GUIDANCE

In this section, NMR offers considerations and guidance for future study planning based on the findings discussed in this report. For each consideration or point of guidance, we offer a rationale based on the findings from evaluation activities conducted as part of this study.

Considerations

Consideration 1: The PAs should consider increasing the emphasis on the improved quality of LED bulbs in the areas of color and light quality. Such bulb characteristics might include light quality, appearance, or shape (wider availability of specialty bulbs).

> *Rationale: Among customers who selected an inefficient bulb but were aware more efficient choices were available, a key barrier to purchasing efficient lighting was the perception that the lighting quality or the appearance or shape of efficient bulbs did not compare favorably to their selected bulbs. Only a small number of this group said price was the reason they did not select a more efficient bulb. It is possible that some of these customers are unaware of the improved light quality of LEDs and may have experienced the technology early in its product development, before LEDs were available that mimicked traditional lighting more closely.*

Consideration 2: The PAs should make sure to continue leveraging numerous communication channels to extol the virtues of efficient lighting to customers, including, but not limited to, social media, email, in-store signage, in-store employee education, advertising (online, print, radio, and tv), and content on Mass Save or PA websites. Casting a wide net will help ensure customers are educated about efficient lamps prior to making a decision to visit a retailer to purchase a bulb.

Rationale: While the large majority of customers in Massachusetts planned their lighting purchase in advance (84%), nearly three-quarters of those who did also planned to buy a specific bulb (74%). However, customers indicated a variety of factors influenced their bulb selection, including in-store signage on this or a previous trip, coupons, advice from store employees, online or email ads, radio ads, and television ads. In addition, among those customers who said they conducted research before purchasing, the majority (78%) said they performed online research, followed by speaking with family or friends (30%), and conversations with in-store employees (15%).

Guidance for Future Study Planning

Guidance 1: If this study is repeated, respondents should be given the option, "it's the same type of bulb that I purchased last time," in a question that asks the reason for their purchase.

> *Rationale: Some purchasers may have been influenced by past program efforts, and upon returning to the store to purchase additional lighting, may default to the same efficient bulb technology. In this study, we asked respondents if they chose the bulb they did because it was the same type that burned out. However, as lifetime of efficient lighting is such that fewer efficient bulb purchasers are likely to select this option, we may be better able to capture past program efforts by asking if they chose the bulb they did as it was the same as last bulb purchased.*

Guidance 2: If this study is repeated, respondents should be given the option, "product packaging," in a question that asks for information that influenced their purchase decision, and all respondents should be asked to specify what information influenced their decision.

> *Rationale: Other studies have found that product packaging is an important source of information for consumers when selecting lighting; thus, we should include this as an option in future work. Additionally, as we only asked those who planned in advance what type of bulb to purchase for their sources of information, our ability to investigate the issue is limited.*

Guidance 3: If this study is repeated, evaluators should consider analyzing purchase data based on calendar year, which more closely aligns with program operations and sales data obtained for other evaluation efforts.

> *Rationale: While requesting the most recent data provides the ability to interview customers closer to their purchasing decisions, analyzing data from mid-year limits the ability to compare data across studies. Evaluators could provide analysis based on full calendar years in addition to partial years to aid with this in the future.*

Guidance 4: If this study is repeated, evaluators should consider a more complex weighting scheme to ensure comparability between Massachusetts and New York purchase data.

> *Rationale: In order to use New York as a comparison area, it is important that the data are weighted to reflect Massachusetts consumers. Given differences in purchasing behavior displayed by the two samples (likely due to the larger number of Walmarts present in New York), it will be important to develop weighting schemes that account for these differences.*

1 Section 1 Introduction

The residential lighting market is shifting rapidly due to program efforts, technological advances, and increases in efficiency standards stemming from the Energy Independence and Security Act of 2007 (EISA). Program Administrators nationwide have sought to understand consumers' decision-making processes in this changing market and to gauge the value of continued retail support of efficient lighting. In Massachusetts, previous research on these topics has relied on telephone or web-based consumer surveys, or limited in-person interviews conducted during on-site saturation visits that are kept to just a few questions. While providing some useful insights into factors that impact bulb sales, these efforts have fallen short of true causal inferences because they rely on respondent self-reporting on a low-cost, low-interest product, which continually shows recall error and bias.

The RPLNC: 16-3 Lighting Decision Making Report introduced a novel data source, InfoScout, which provides details of recent lighting purchases by a panel comprising a broad range of consumers across all retail channels in both Massachusetts and New York (which does not have a retail lighting program)[2], along with a survey of known lighting purchasers about their choices and preferences.[3] The results allow us to characterize purchasers of efficient and inefficient lighting, gauge the effects of retail program support on lighting choices, and recommend strategies to increase efficient lighting purchases. This report updates this analysis and uses a refined lighting purchaser survey for 2017 InfoScout panelists, allowing comparison across Massachusetts and New York as well as between 2016 and 2017 purchase decisions.

1.1 OBJECTIVES

The primary research questions seek to understand the factors that influence efficient lighting purchases and why some consumers persist in purchasing inefficient alternatives. Evaluation objectives include:

- To identify factors that influenced consumers' decisions to purchase efficient lighting and the barriers that led some consumers to continue to purchase inefficient alternatives.
- To determine the role of retail program support in purchases of efficient lighting.
- To elucidate consumers' lighting decision-making processes and identify effective program strategies to support efficient lighting.

[2] While NYSERDA has ended its state-level retail lighting program, PSEG Long Island continues to support a program there. Long Island lighting purchasers and survey respondents have been excluded from this study.
[3] The InfoScout panel should not be confused with the separate panels of on-site saturation households in Massachusetts and New York. Unless otherwise noted, this report refers only to the InfoScout panelists.

2 Section 2 Purchase Data

This section reviews the bulb purchase data provided by InfoScout for panelist purchases covering a 24-month period between August 24, 2015 and July 23, 2017. We examined the first 12-month period as part of the RLPNC: 16-3 Lighting Decision Making memo. In the interest of examining purchasing trends over time, we treat the data as two separate twelve-month periods and throughout this report refer to them as the 2016 and 2017 data sets.

Table 2 provides the sample sizes of unique purchasers, shopping trips, and bulb purchase records.[4]

Table 2: InfoScout Purchase Statistics

	MA 2016	MA 2017	NY 2016	NY 2017
Purchasers	406	244	1,226	2,117
Total Trips	816	368	2,838	3,171
Total Bulbs	3,094	1,597	10,130	12,241
Purchase Period	Aug 2015-July 2016	July 2016-July 2017	Aug 2015-July 2016	July 2016-July 2017

2.1 Key Difference in Shopping Behavior Between Areas

While examining the detailed purchase data, it became apparent that one retailer (Walmart) was responsible for the bulk of lighting purchase trips among the New York panelists. In 2017, Walmart accounted for one-half of purchase trips in New York compared to 29% in Massachusetts. In 2016, Walmart accounted for 37% of purchase trips in New York compared to 22% in Massachusetts. Unfortunately, weighting by demographic characteristics does not adjust this disparity.

Table 3: Percent of Walmart Purchase Trips

	MA 2016	MA 2017	NY 2016	NY 2017
Unweighted	22%	29%	37%	50%
Weighted	23%	27%	39%	50%

[4] It is important to note that the entire sample of bulbs is not utilized for the analysis of bulb pricing due to data inconsistencies in some records.

2.2 MARKET SHARE

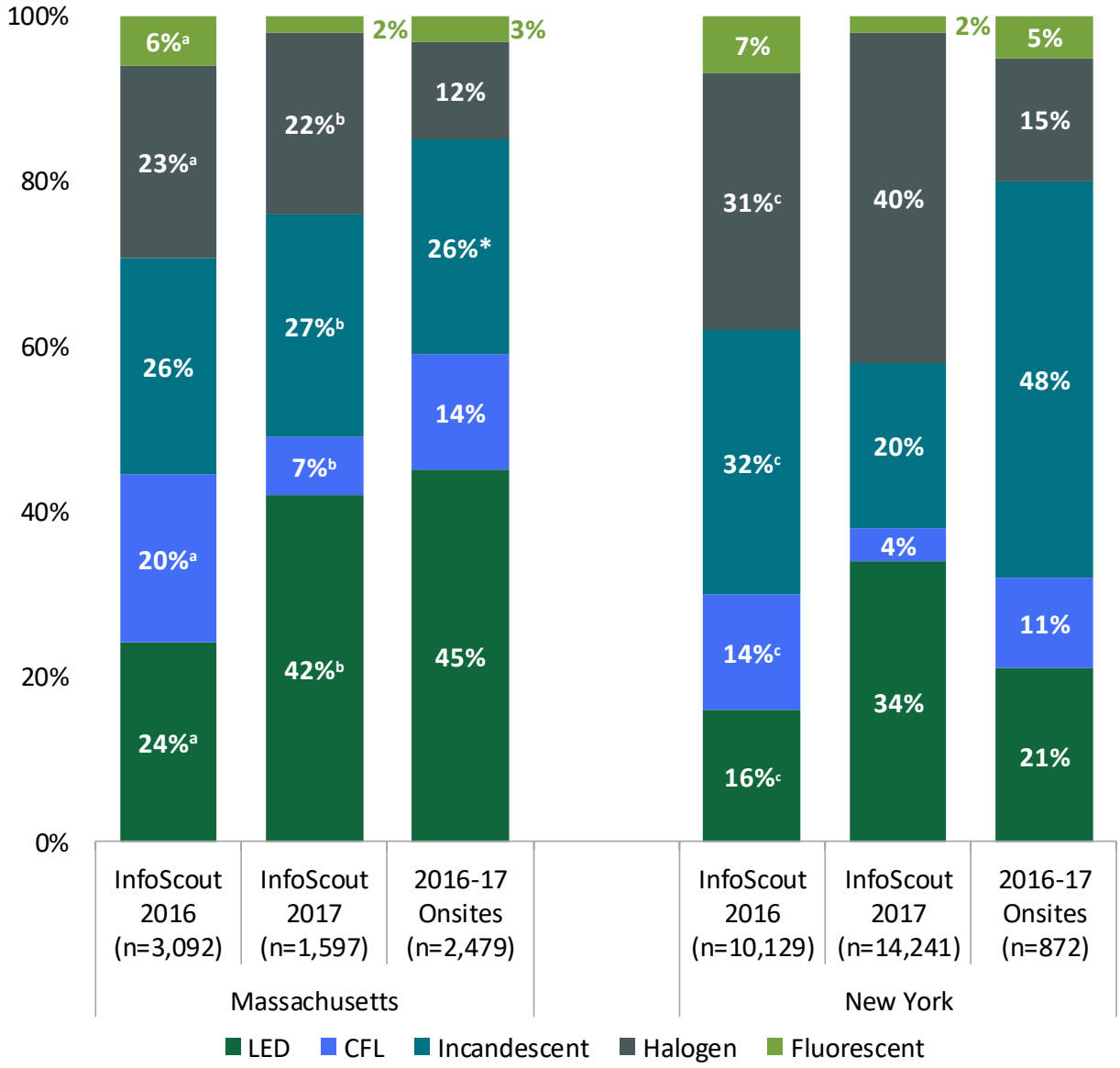
Throughout this section we explore the lighting technology types InfoScout panelists purchased in Massachusetts and New York in 2016 and 2017. When appropriate, we supplemented those results with recent purchase data derived from on-site visits completed in Massachusetts and New York as part of the 2016-17 Lighting Market Assessment.[5]

Figure 6 compares purchased bulbs by lighting technology in Massachusetts and New York for the 2016 and 2017 InfoScout panelists and on-site participants. Key findings include:

- **LEDs** – LED market share rose significantly in each state – increasing from 24% to 44% in Massachusetts and from 16% to 34% in New York. While Massachusetts maintained a higher market share and showed a higher increase in market share between years than New York, the substantial gains in New York provide further evidence that LEDs are gaining momentum in non-program areas.
- **CFLs** – Somewhat offsetting LED market share increases, CFL purchases dropped to about one-third of 2016 levels in both states.
- **Halogens** – Halogen market share **decreased** slightly in Massachusetts (from 23% to 22%) and **increased** significantly in New York (from 31% to 40%) between 2016 and 2017.
- **Incandescent** – While incandescent market share was essentially unchanged in Massachusetts at approximately 27%, New York saw a significant drop in market share between 2016 and 2017 (from 32% to 20%).

[5] Note that, while we use the on-site data as a comparison, the timing of the on-site data collection does not line up perfectly with the InfoScout data from 2017, but rather straddles the timelines of the two InfoScout samples.

Figure 6: Market Share by Lighting Technology Type



[a] Significantly different from Massachusetts 2017 sample at the 90% confidence level.
[b] Significantly different from the New York 2017 sample at the 90% confidence level.
[c] Significantly different from the New York 2017 sample at the 90% confidence level.
*Significantly different from the New York on-sites at the 90% confidence level.

Table 4 compares the InfoScout market share data to the sales data analyzed as part of the RLPNC 16-5 Sales Data Analysis. Importantly, the sales data from RLPNC 16-5 covers calendar year 2016 in Massachusetts whereas the 2016 InfoScout data covers part of 2015 and 2016. It is important to keep this in mind when comparing the data from these sources. As the table shows, LED and CFL bulbs hold a greater market share in the InfoScout data in both 2016 and 2017 when compared to the sales data, while in New York the sales data shows higher shares of LEDs and CFLs than the InfoScout data in both years. In addition, incandescent sales appear much higher in the InfoScout data compared to the sales data.

Table 4: Comparison of Market Share Data by Source[1]

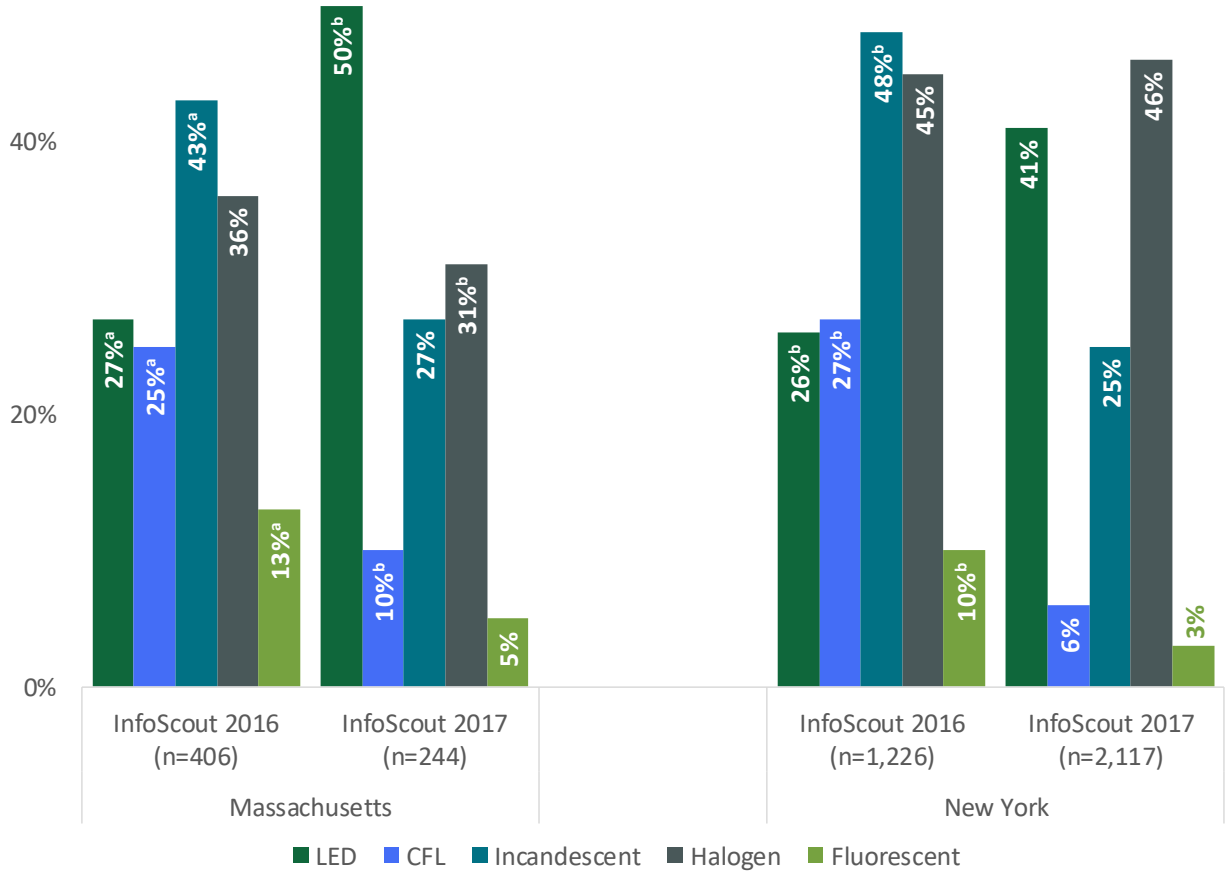
	2016 Sales Data (MA)	MA InfoScout 2016	MA InfoScout 2017	NY InfoScout 2016	NY InfoScout 2017
n (Bulbs per home)	--	*7.6*	*6.6*	*8.3*	*6.7*
LED	26%	24%	42%	16%	34%
CFL	16%	20%	7%	14%	4%
Incandescent	15%	26%	27%	32%	20%
Halogen	43%	23%	22%	31%	40%
Combined LED and CFL	42%	44%	49%	30%	38%

[1]Excludes fluorescents, so totals will not sum to 100%.

Figure 7 shows the percentage of households that purchased at least one bulb of a given type. The results of this analysis largely mirror those for market share with large gains in LED penetration and decreases in CFL penetration observed in both states.

- **LEDs** – The likelihood of households purchasing an LED increased in both states in 2017 but the increase in Massachusetts (27% to 52%; a 25-percentage point increase) outpaced that of New York (26% to 41%; a 15-percentage point increase).
- **CFLs** – As expected, the likelihood of households purchasing a CFL decreased substantially in both states, from 25% to 10% in Massachusetts and 27% to 6% in New York.
- **Halogens** – the likelihood of purchasing a halogen decreased in Massachusetts (35% to 29%) and was essentially unchanged in New York (44% to 45%)
- **Incandescents** – the likelihood of purchasing an incandescent decreased in both states, from 45% to 27% in Massachusetts and down from 49% to 25% in New York.

Figure 7: Sales Penetration by Bulb Type at the Household Level*



[a] Significantly different from the Massachusetts 2017 sample at the 90% confidence level.
[b] Significantly different from the New York 2017 sample at the 90% confidence level.
*Percentages will sum to greater than 100% due to households purchasing more than one bulb type.

2.3 EISA Sell Through

EISA 2007 set maximum wattage levels by lumen output for medium screw-base bulbs ranging from 310 to 2,600 lumens and operating at a range from 110 to 130 volts. The standards took effect through a phased process, beginning in 2012 (Phase I). Table 5 shows the schedule for Phase I.

Phase I of EISA 2007 prohibits the manufacture and import of non-compliant bulbs but does not affect the sale or use of such bulbs. For this reason, as observed in other studies, standard incandescent bulbs have remained available to consumers on retailers' shelves long after the implementation of EISA 2007 (NMR 2015).[6]

[6] MA EEAC, Lighting Market Assessment and Saturation Stagnation Overall Report, 2015. http://ma-eeac.org/wordpress/wp-content/uploads/Lighting-Market-Assessment-and-Saturation-Stagnation-Overall-Report.pdf.

Table 5: EISA Phase I Schedule

Rated Lumen Ranges	Typical Incandescent Lamp Wattage	Maximum Rated Wattage	Effective Date
1,490–2,600	100	72	1/1/12
1,050–1,489	75	53	1/1/13
750–1,049	60	43	1/1/14
310–749	40	29	1/1/14

The InfoScout data provided a great opportunity to examine bulb purchases and observe the EISA sell through period. While the InfoScout purchase records did not provide sufficient detail to determine with absolute certainty if incandescent bulbs purchased were covered by EISA or exempt, the records did include bulb shape and wattage. Bulb shape and wattage can be used as a proxy for EISA coverage since any A-line lamp between 40 and 100 watts was mostly likely covered by the standards. Note: EISA Phase I included 22 exempt categories of lamps, including reflectors, rough service, shatter-resistant, 3-way, vibration resistant, T-shape, and several specialty shapes. While we are able to generally identify some of these characteristics in the InfoScout data (shape and 3-way), we are not able to identify rough service, shatter-resistant, and vibration-resistant bulbs.

Table 6 examines A-line incandescent bulbs purchased by wattage. As the data show, incandescent bulbs likely covered by EISA in the more popular wattage categories of 100, 60, and 40 watts were still being purchased in both states in 2016 and 2017. Interestingly, we found no 75-watt A-line incandescent lamps in the purchase data in either year.

Combined covered bulbs accounted for 57% and 31% of A-line incandescent bulb purchases in Massachusetts in 2016 and 2017, respectively, compared to 39% and 40% in New York.

100 Watt – With an effective date of January 1, 2012, the 100-watt standards went into effect three to four years before the 2016 purchase data and four to five years before the 2017 data. These lamps accounted for 9% and 5% of A-line incandescent bulb purchases in Massachusetts in 2016 and 2017, respectively, compared to 5% and 6% in New York.

60 Watt – With an effective date of January 1, 2014, the 60-watt standards went into effect about one to two years before the 2016 purchase data and two to three years before the 2017 data. These lamps accounted for 25% and 2% of A-line incandescent bulb purchases in Massachusetts in 2016 and 2017, respectively, compared to 19% and 14% in New York. This was a rapid decline between 2016 and 2017 – which may indicate the sell through is nearing its end.

40 Watt – With an effective date of January 1, 2014, the 40-watt standards went into effect about one to two years before the 2016 purchase data and two to three years before the 2017 data. These lamps accounted for 23% and 16% of A-line incandescent bulb purchases in Massachusetts in 2016 and 2017, respectively, compared to 15% and 14% in New York.

With no real change between 2016 and 2017 – it is likely the sell through period for this wattage category has not yet reached its end.

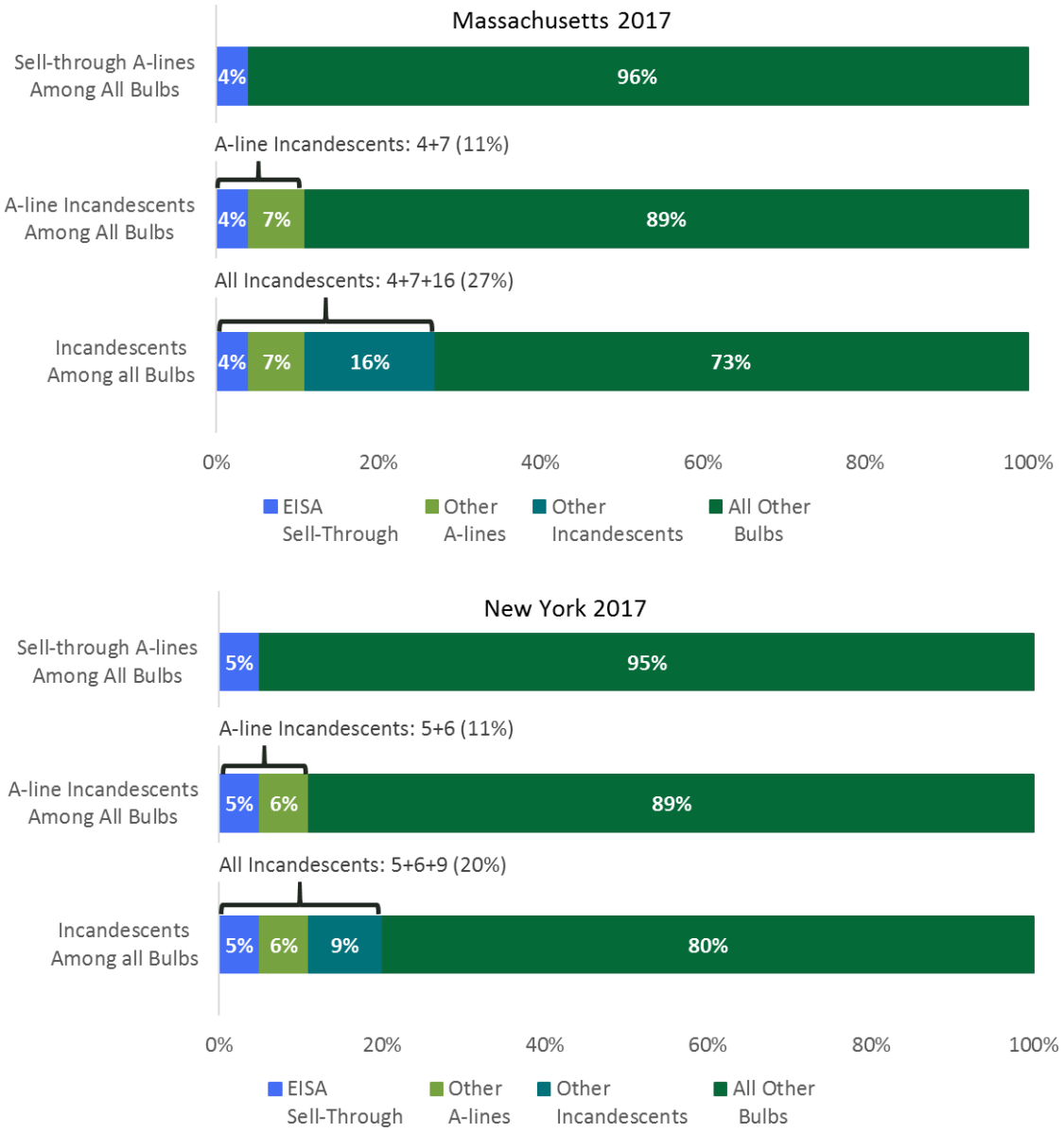
Table 6: Likely Sell-through Bulbs (A-line only) *

Wattage	Effective Date	Percent of 2016 A-line Incandescent Purchases		Percent of 2017 A-line Incandescent Purchases	
		MA	NY	MA	NY
n	n/a	299	1,272	173	1,617
100	1/1/12	9%	5%	5%	8%
75	1/1/13	--	--	--	--
60	1/1/14	25%	19%	2%	14%
40	1/1/14	23%	15%	16%	14%
40-100 Combined[2]	**Varies**	**57%**	**39%**	**31%**	**40%**
>100[1]	Depends	6%	5%	8%	6%
<40[1]	Depends	4%	5%	6%	6%
3-Way	Exempt	31%	51%	54%	47%

*Proportions in table are weighted.
[1] Bulbs in these wattage ranges may or may not be covered by EISA depending on lumen output. Unfortunately, we have insufficient data to determine coverage.
[2]This row includes other bulbs within this wattage range not included in rows above.

To place these sell-through bulbs in context, we examined the market share of likely sell-through bulbs in relation to the larger samples of incandescents and all bulb types (Figure 8). For example, as Table 6 shows, likely sell-through A-lines represent 31% of A-line incandescents in the Massachusetts 2017 sample, then zooming out further using Figure 8 we see that these sell-through lamps are 4% of all bulbs. A-line incandescents represent 11% of all bulbs (4% sell-through and 7% other non-sell-through A-lines) and as a category incandescents represent 27% of all bulbs (4% sell-through, 7% other A-lines, and 16% other non-A-line incandescents). The figure provides the same breakdowns for New York.

Figure 8: Market Share Statistics for Sell-through A-line Bulbs



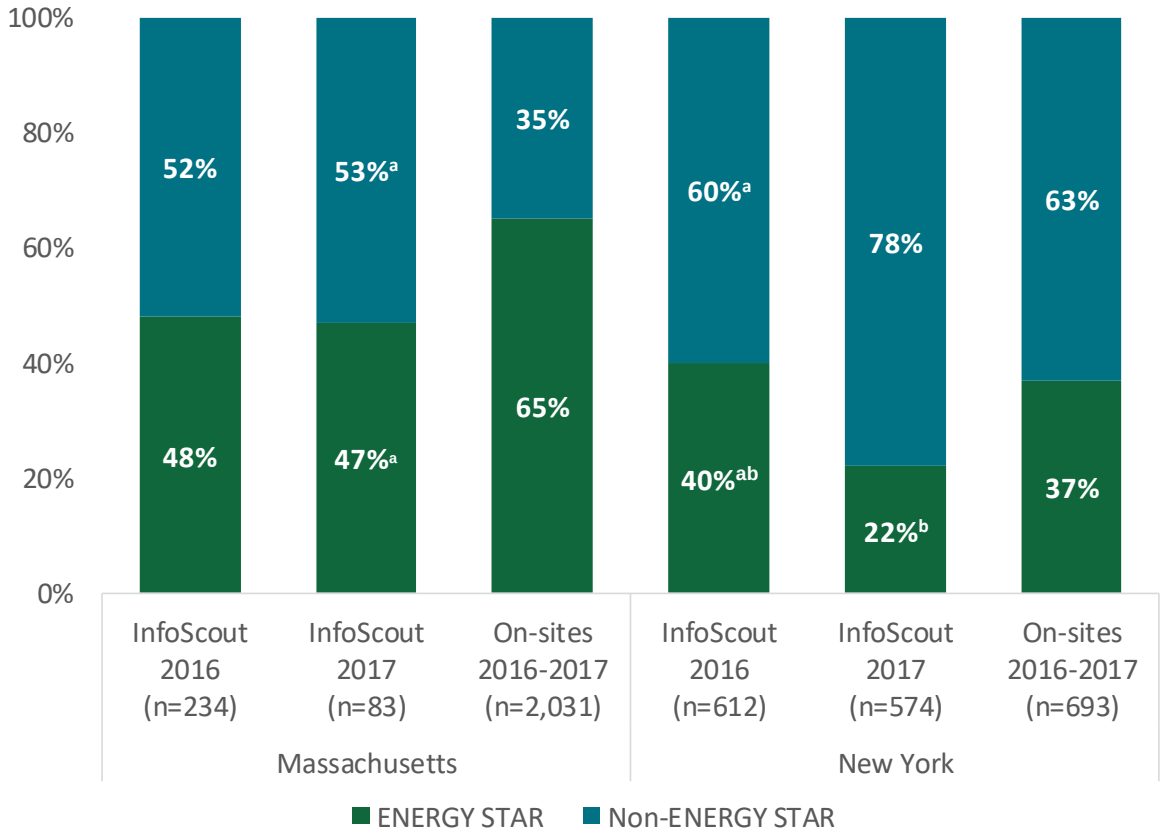
2.4 ENERGY STAR®

Unfortunately, the majority of product descriptions in the 2017 InfoScout data were insufficient to identify ENERGY STAR status. Despite efforts to match the purchase records against databases of ENERGY STAR-certified LED bulbs, we only were able to identify the ENERGY STAR status of 36% of LEDs in the 2016 data and only 12% in the 2017 data.

Limiting our focus to just those bulbs for which we had sufficient data, we found that across the 2016 and 2017 InfoScout data, as well as the on-site data, Massachusetts had a higher percentage of ENERGY STAR certified bulbs than New York. The percentage of ENERGY

STAR LEDs remained static in Massachusetts between 2016 and 2017, at just under one-half, while New York saw a large drop between 2016 (40%) and 2017 (22%).

Figure 9: ENERGY STAR-Certified LED Bulbs



[a] Significantly different from New York 2017 at the 90% confidence level.
[b] Significantly different from Non-ENERGY STAR for this state and year at the 90% confidence level.

2.5 LIGHTING TECHNOLOGY AND PRICE

In this section, we examine purchase price differences between Massachusetts and New York. Figure 10 displays the difference in LED price by ENERGY STAR status in both 2016 and 2017. Again, data on ENERGY STAR status for LEDs were limited, but the numbers in 2017 reflected the impact of the program on Massachusetts ENERGY STAR certified LEDs relative to the price of bulbs with the certification in New York. ENERGY STAR bulbs in Massachusetts were more than $2.00 cheaper than those in New York in 2017. The numbers were much closer for non-ENERGY STAR bulbs, where average price was about the same in both states.

As shown in Figure 10, 2016 ENERGY STAR LED prices for Massachusetts LEDs stand out because they have a high average price when compared to New York, and when compared to the Massachusetts sample from the following year. This is likely a by-product of limited sample sizes. Looking deeper into the sample of 89 ENERGY STAR certified bulbs, we saw that about one-third are A-line lamps and an equal proportion are reflectors. The proportion of (usually more expensive) reflectors is higher in this sample than in the larger sample, but A-line bulbs are the most expensive subset. About one-half of the ENERGY STAR A-line LEDs in the Massachusetts 2016 sample are Cree® bulbs with a price of $14 or $16, which pulls the average price of A-lines up to $12.60.

Figure 10: ENERGY STAR vs. Non-ENERGY STAR LED Price Comparison

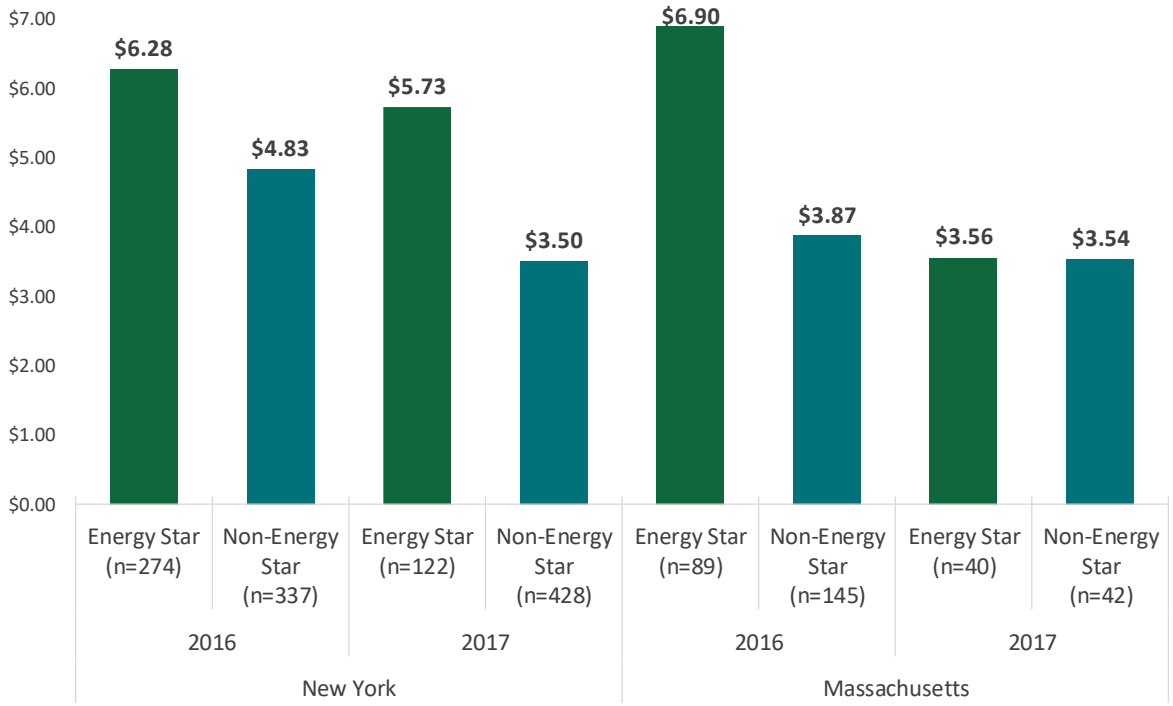
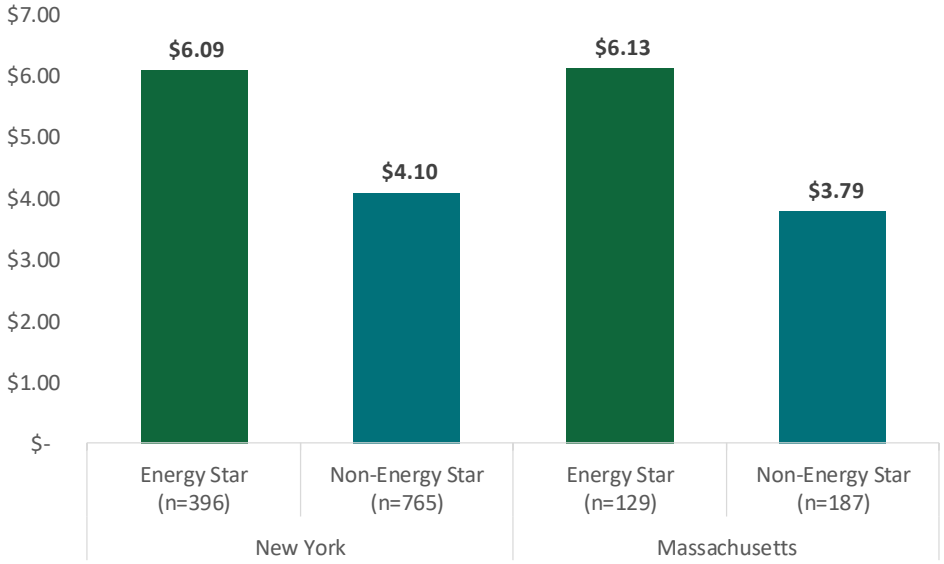


Figure 11: Average LED Price for ENERGY STAR and Non-ENERGY STAR Bulbs (Combined 2016-2017)



When we look at the full market, not limited to just ENERGY STAR bulbs, we see a different trend. Table 7 compares the average price per bulb for each lighting technology in Massachusetts and New York for both InfoScout panel years. Aside from CFLs, the average price dropped for each bulb type in Massachusetts and New York between 2016 and 2017.

- **LED** purchasers paid $0.40 less per lamp in New York than in Massachusetts on average, which appears to represent a major shift from the 2016 findings. While LEDs in Massachusetts saw a price drop of over $1 between 2016 and 2017, the average price paid per LED in New York dropped more than $2 in 2017 compared to 2016 prices.[7] However, this difference disappears when comparing LED purchases by channel and brand (see Table 10 and Table 11).
- **Halogens** were more expensive in Massachusetts than in New York in both 2016 (+$0.40) and 2017 (+$0.80).
- **Incandescents** were about $0.35 more expensive in Massachusetts than in New York in 2016. In 2017, that price gap decreased, resulting in similar prices in both states in 2017.

[7] Due to limited data on ENERGY STAR status, this analysis does not incorporate differences between ENERGY STAR and non-ENERGY STAR LEDs or any differences in shopping patterns based on bulb features.

Table 7: Price by Lighting Technology

Bulb Type	Massachusetts 2016	Massachusetts 2017	New York 2016	New York 2017
n (bulbs)	*3,090*	*1,258†*	*10,128*	*12,527†*
LED	$4.42[a]	$3.16[b]	$5.04[b]	$2.81[a]
CFL	$1.70[a]	$2.88	$2.63	$2.66
Incandescent	$1.77[a]	$1.30	$1.45[b]	$1.27
Halogen	$2.41	$2.14[b]	$2.03[b]	$1.52[a]
Fluorescent	$5.09[a]	$4.20[b]	$3.49	$3.31[a]

[a] Significantly different from the Massachusetts 2017 sample at the 90% confidence level.
[b] Significantly different from the New York 2017 sample at the 90% confidence level.
† 2017 bulb sample sizes are lower here due to filtering out bulbs with unreliable price data.

The key driver of this shift in LED prices among InfoScout purchases in New York was the drop in average bulb price among the two main store channels used by panelists in the state. As shown in Figure 13, 81% of bulbs in New York were purchased in mass merchandise or home improvement stores in 2017 and 84% of bulbs were purchased through these channels in 2016. LED prices in New York mass merchandise and home improvement stores averaged $4.88 and $5.11 in 2016, respectively, but dropped to $2.21 and $3.74 in 2017.

Table 8 breaks down the change in LED prices only between 2016 and 2017 for all store channels and shows considerable drops in LED prices across most channels for both states. A glance at the 2017 values shows that after this considerable drop, average prices are similar across many channels between states. This indicates that more granular comparisons are necessary to draw appropriate conclusions and answer questions, such as the one at hand regarding what looks like LED price imbalances in a program vs. a non-program state. The remainder of the pricing analysis below examines LED shape and brand to isolate the reasons why LEDs in the sample are showing up at lower prices in New York than in Massachusetts.

Table 8: Average LED Price by Store Channel

	Massachusetts 2016	Massachusetts 2017	New York 2016	New York 2017
n (LED Bulbs)	*678*	*619*	*1,640*	*4,084*
Mass Merchant	$2.08	$2.21	$4.88	$2.21
Club	$4.41	$3.90	$4.40	$4.08
Improvement	$5.74	$3.77	$5.11	$3.74
Online	$3.49	$4.17	$4.99	$3.68
Other	--*	$5.18	$7.89	$7.44
Discount	--	$1.00	$3.00	$3.48
Grocery	$11.49	--	$9.85	$1.62

A-Line LEDs were the dominant bulb shape in both 2017 samples, making up 85% of LEDs in Massachusetts and 83% of LEDs in New York. The price of A-Line LED bulbs dropped by

nearly $2.00 in Massachusetts between 2016 and 2017, while in New York the price drop was $1.68 between the two samples (Table 9).

Table 9: LED Price by Bulb Shape*

	Massachusetts 2016	Massachusetts 2017	New York 2016	New York 2017
n (LED Bulbs)	*678*	*516*	*1,639*	*3,610*
A-Line	$4.62[a]	$2.74	$4.37	$2.20[ab]
Reflector	$5.83	$5.83	$8.36[c]	$6.64[ab]
Other	$2.36	$2.77	$4.08[c]	$6.76[ab]

[a] Significantly different from the Massachusetts 2017 sample at the 90% confidence level.
[b] Significantly different from the New York 2016 sample at the 90% confidence level.
[c] Significantly different from the Massachusetts 2016 sample at the 90% confidence level.
*Excludes bulbs with no shape data, "smart" bulbs, and three-way bulbs.

In Table 7 and Table 9, an average LED (in particular, A-Line LED bulbs) appeared to be more expensive in Massachusetts than New York. This finding was surprising, because LEDs are incentivized in Massachusetts. When the average price of A-Line LED bulbs was compared by store channel, these price differences were corrected (Table 10). When compared by brand, A-Line LEDs were less expensive, on average, in Massachusetts, which can be attributed to the rebate (Table 11). Great Value and EcoSmart are store brands at Wal-Mart and Home Depot, respectively. While some of these bulbs are indeed ENERGY STAR-certified and eligible for a rebate, they are less expensive overall than higher-quality brands, such as GE. Over two-thirds of A-Line LEDs in the New York sample were purchased at mass merchandise retailers, which includes Walmart, compared to one-third of the sample in Massachusetts. This imbalance, plus the relative size of the New York sample compared to the Massachusetts sample, caused LEDs to appear more expensive overall in Massachusetts, contrary to expectations.

Table 10: A-Line LED* Price by Channel

	Massachusetts 2017		New York 2017	
Channel	Price	# Bulbs	Price	# Bulbs
All A-Line LEDs	*$2.74*	*312*	*$2.20*	*2,694*
Home Improvement	$2.28	90	$2.70	716
Mass Merchant	$1.92	114	$1.85	1,834
Membership Club	$3.85	88	$3.54	104

*Excludes "smart" bulbs and three-way bulbs.

Table 11: A-Line LED Price by Brand

Bulb Type	Massachusetts 2017		New York 2017	
	Price	# Bulbs	Price	# Bulbs
A-Line	*4*	*312*	*$2.20*	*2,694*
Great Value (Walmart)	$1.37	71	$1.56[a]	1,401
GE	$2.78	65	$3.34[a]	467
EcoSmart (Home Depot)	$1.31	32	$2.17[a]	187
Other*	$3.71	144	$2.75[a]	639

*Includes Feit Electric, Sylvania, Philips, Cree, and Globe Electric.
[a] Significantly different from the Massachusetts 2017 sample at the 90% confidence level.

2.6 Purchase Trips and Channels

Based on unique purchaser IDs in the InfoScout data, we were able to determine the number of purchase trips each panelist made between August 2015 and July 2017 (the date range covered by the two InfoScout samples). The 2017 panelists in both Massachusetts and New York were more likely to make a single trip than panelists in the 2016 sample (Figure 12). The proportion of panelist making two trips was similar between states and years, but 2016 panelists were more likely to make more than two trips when compared to 2017 panelists in both Massachusetts and New York. Just 11% of 2017 panelists in Massachusetts and New York made more than two trips, while in 2016 these percentages were 24% and 31%, respectively. In 2017, the average panelist made 1.5 trips over the period covered by the data, while in 2016 the average panelist took a little over two trips.

Figure 12: Lighting Purchase Trips per Panelist

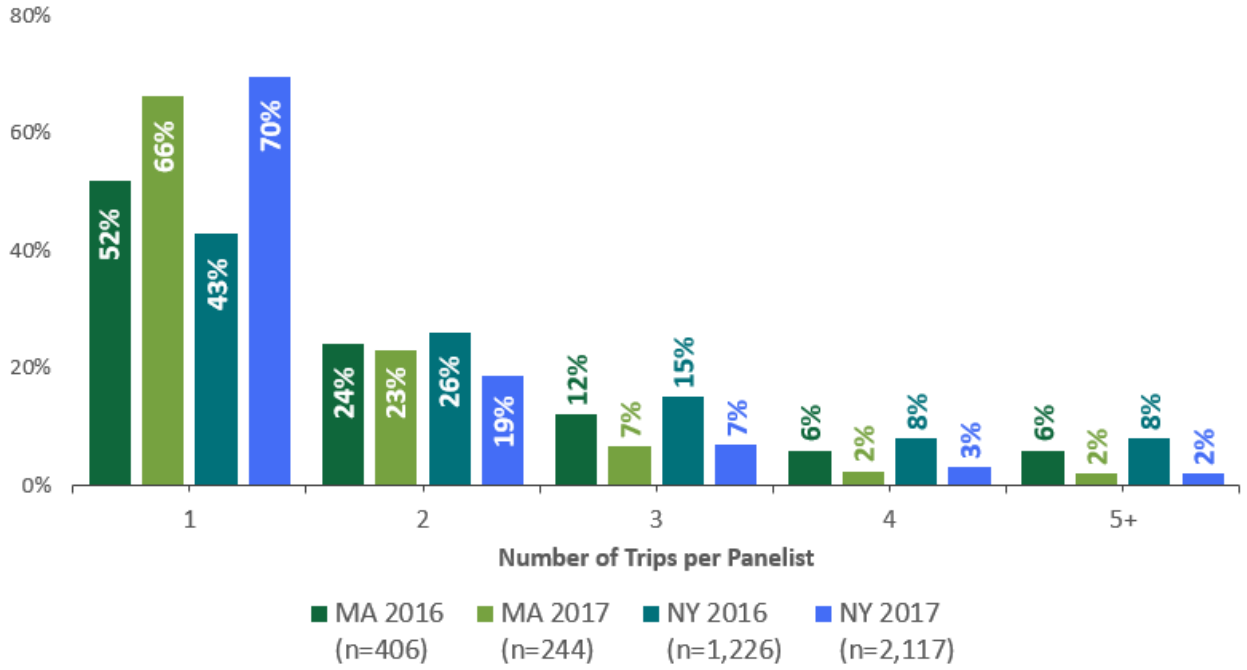


Table 12 details the number of bulbs purchased on average by InfoScout panelists (based on analysis of purchase records). In both New York and Massachusetts, panelists purchased fewer bulbs on average than in 2016. Looking at individual lighting technologies, trends by and large mirror the market share data above. Both Massachusetts and New York see similar drops in the average number of CFLs purchased and increases in the average number of LEDs purchased.

Table 12: Average Number of Purchases per Panelist

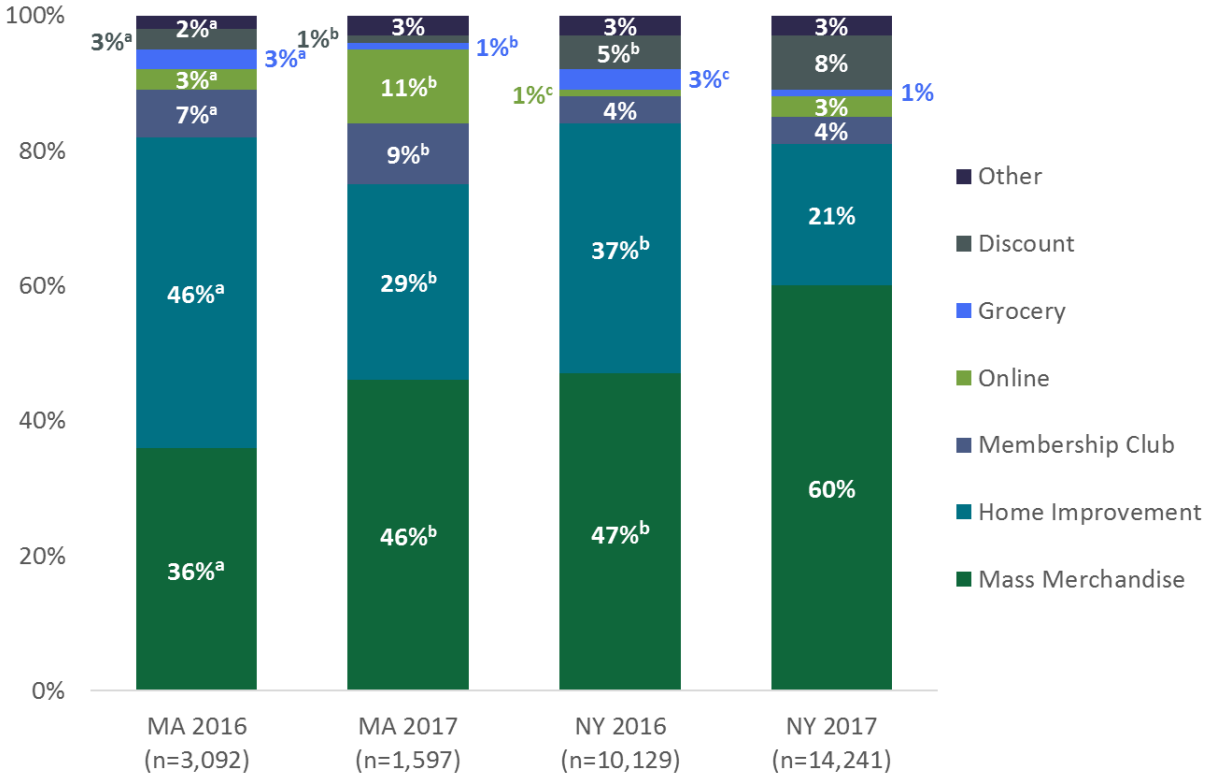
	Massachusetts 2016	Massachusetts 2017	New York 2016	New York 2017
n (Bulbs)	*3,092*	*1597*	*10,129*	*14,241*
LED	1.7	3.0	1.3	2.3
CFL	1.8	0.5	1.2	0.3
Incandescent	2.0	1.6	2.7	1.5
Halogen	1.7	1.3	2.5	2.5
Fluorescent	0.4	0.2	0.6	0.1
Overall Average	**7.6**	**6.6**	**8.3**	**6.7**

A distinct advantage of the InfoScout data is that it includes records of purchases at a broad range of retail channels, including (but not limited to) large home improvement and mass merchandise stores as well as chain grocery, drug, and hardware stores. The dataset also included discount and other retailers that the PAs target for the hard-to-reach (HTR) component of the program.[8,9] Figure 13 provides a comparison of the proportion of bulbs purchased at each store channel in 2016 and 2017. Note that as discussed above in regard to pricing, the New York sample includes a significantly higher proportion of Walmart shoppers compared to Massachusetts. This is likely due to Walmart's larger presence in New York (116 – for the entire state) compared to Massachusetts (50 stores).[10] This is important to keep in mind when comparing shopping patterns between the two states.

- The share of bulbs purchased at mass merchandise stores increased significantly in both Massachusetts and New York between 2016 and 2017.
- The percentage of bulbs purchased at home improvement stores decreased significantly in both Massachusetts and New York between 2016 and 2017.
- While online purchases were grouped within the "other channels" category in 2016, the sample size of online purchases was large enough to break out separately in 2017. Online purchases became far more common in Massachusetts in 2017, increasing from 3% to 11%; while the growth in New York was far more modest – from 1% up to 3%.

[8] The discount store channel includes dollar store chains.
[9] Other retailers aggregated include online, hardware, drug store, lighting and electronics, and "other" (e.g., ethnic grocers and bodegas) store channels deemed by InfoScout data.
[10] https://corporate.walmart.com/our-story/our-locations#/

Figure 13: Bulbs Purchased by Channel



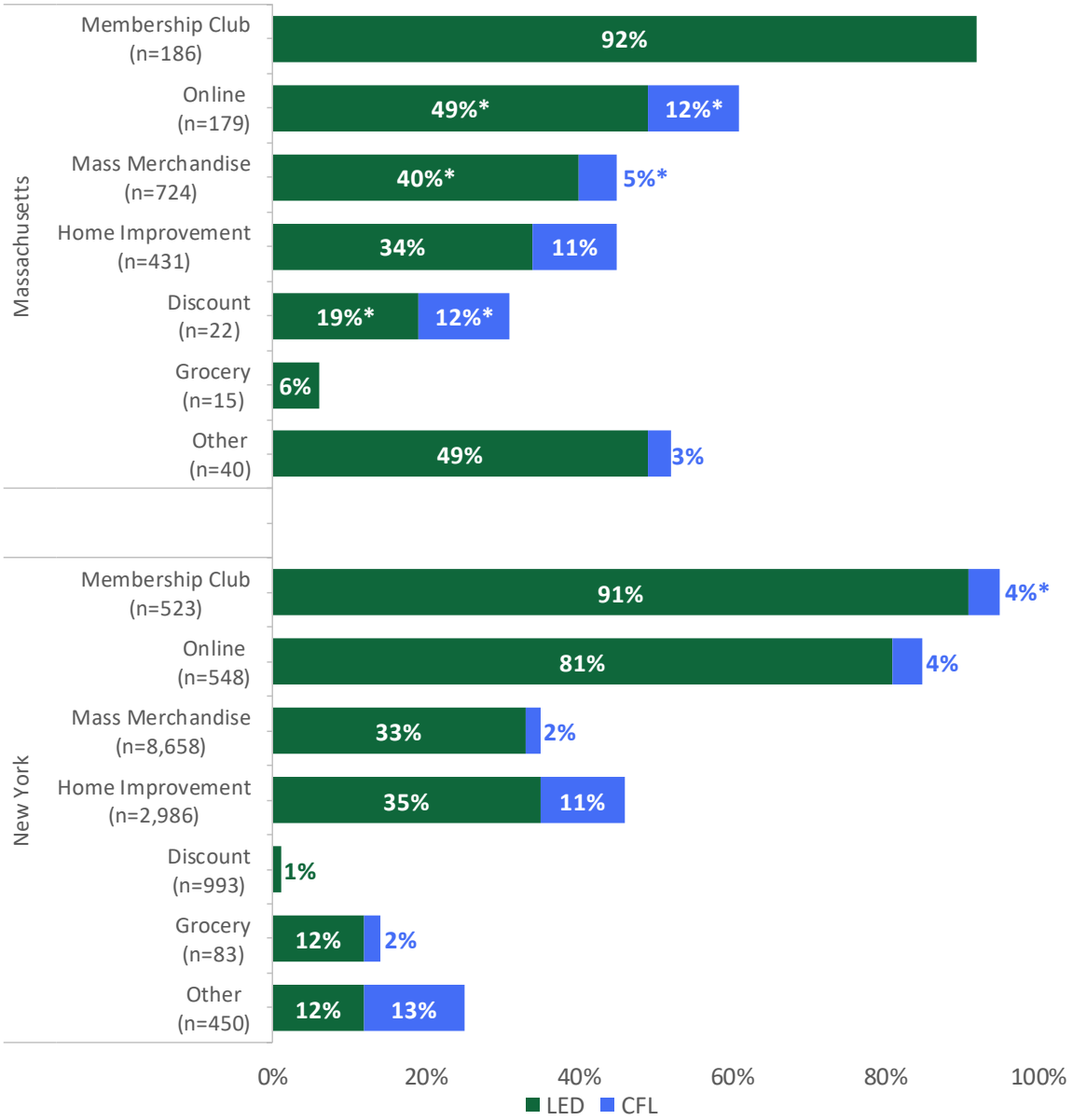
[a] Significantly different from the MA 2017 sample at the 90% confidence level
[b] Significantly different from the NY 2017 sample at the 90% confidence level

Examining the share of lighting technology types purchased through different store channels in 2017 shows some key similarities and differences between the Massachusetts and New York InfoScout purchasers (Figure 14). While it would have been useful to also explore the breakdown of ENERGY STAR versus non-ENERGY STAR by store channel, we lacked sufficient data on ENERGY STAR status to show that here.

- Membership clubs sold a greater share of LED bulbs than any other channel in both Massachusetts and New York, though it should be noted that some membership clubs have shifted to only carrying efficient lamps
- Panelists in both Massachusetts and New York purchased LEDs online at greater percentages than any channel outside of membership clubs, though a significantly higher percentage of LEDs were purchased online in New York.
- Home improvement stores in both Massachusetts and New York had sold each bulb type at nearly identical rates.
- Mass merchandise stores in Massachusetts are the most heavily used channel by InfoScout purchasers and sold a significantly higher percentage of LEDs than their New York counterparts.

- Inefficient bulb types (halogens and incandescents) remained heavily favored at discount and grocery stores in both states, pointing to heightened potential for program impact.

Figure 14: Bulb Market Share by State and Channel



*Significantly different between Massachusetts and New York for this lighting technology type at the 90% confidence level.

3 Section 3 Survey Results

After cleaning and preparing the InfoScout purchase data, NMR submitted the reduced set back to InfoScout to form our sample pool for a survey on lighting decision making. InfoScout administered the survey via the same mobile device apps that the panelists use to upload their receipts. InfoScout sent the survey to potential respondents in waves in September 2017 until the survey response quota was met, with the most recent purchasers receiving the survey first. The survey presented respondents with the details of their lighting purchase (date, store, bulb type, amount); the respondents who demonstrated a clear memory of their purchases then answered a series of 15 to 17 questions (depending on the type of bulbs purchased). Survey respondents were asked about purchases that they made between July 25, 2016 and July 23, 2017. The average amount of time between purchase and survey was 215.6 days.

The 27 respondents who were not sure if they remembered the purchase answered only a subset of seven questions on their general lighting purchase decisions. Of the 2,361 New York and Massachusetts InfoScout panelists who purchased lighting, 260 successfully completed our survey - 100 from Massachusetts and 160 from New York. As with the purchase data analysis, the survey results are weighted according to the weighting scheme described in Appendix A.

3.1 Shopping Frequency and Consistency

As discussed in Purchase Trips and Channels (above), InfoScout panelists made an average of 2.3 lighting purchase trips in 2016 and 1.9 lighting purchase trips in 2017. In addition, panelists frequently purchased more than one bulb technology over the course of a year. Of the 100 users in Massachusetts who responded to the survey, 67 had logged multiple shopping trips where they purchased lighting; the same is true of 105 out of 160 survey participants in New York.[11] Of those survey respondents who made multiple trips, 43% in Massachusetts and 25% in New York and were loyal to one lighting technology.[12] Among respondents loyal to one lighting technology, 59% in Massachusetts and 38% in New York were loyal to LEDs in 2017.

[11] The survey provides details about their decision-making on a specific shopping trip. In the data reported in the rest of this section that references bulb type purchased refers to the bulb type from the shopping trip record referenced in the survey.

[12] We determined the percentage of panelists loyal to one technology, isolating only those panelists who made multiple shopping trips and then determining the weighted proportion of this group of multiple trip panelists that only purchased bulbs of one lighting technology, according to the same weighting scheme applied to the rest of the analysis.

Table 13: Respondents Who Made More Than One Shopping Trip to Purchase Lighting and were Loyal to One Technology

	2016		2017	
	Massachusetts *(n=22)*	New York *(n=31)*	Massachusetts *(n=26)*	New York *(n=20)*
LED	34%	43%	59%	38%
CFL	24%	9%	--	4%
Incandescent	26%	16%	19%	29%
Halogen	6%	27%	22%	30%
Fluorescent	11%	5%	--	--

Table 14 provides a summary of bulbs purchased by survey respondents for which we can determine the type of lighting technology. On shopping trips made by Massachusetts survey respondents to purchase lighting,

- 44% of trips reflected respondents selecting LED bulbs.
- 27% of trips reflected respondents selecting incandescent bulbs.
- Fewer trips with CFL purchases were made in 2017 (7%) than in 2016 (16%).

In New York,

- 39% of trips reflected respondents selecting LED bulbs.
- 25% of trips reflected respondents selecting incandescent bulbs.
- Fewer trips with CFL purchases were made in 2017 (4%) than in 2016 (15%).

Table 14: Bulbs Purchased by Respondents Who Completed the Survey

	2016		2017	
	Massachusetts *(n=385)*	New York *(n=418)*	Massachusetts *(n=236)*	New York *(n=383)*
LED	24%	21%	44%	39%
CFL	16%	15%	7%	4%
Incandescent	29%	28%	27%	25%
Halogen	23%	29%	21%	28%
Fluorescent	8%	6%	2%	4%

The survey asked respondents to report about only their most recent shopping trip where they purchased lighting. As shown in Table 14, 2017 shoppers recorded fewer trips to purchase CFLs than 2016 shoppers and more trips to purchase LEDs.

Table 15: Bulbs Asked about in Survey

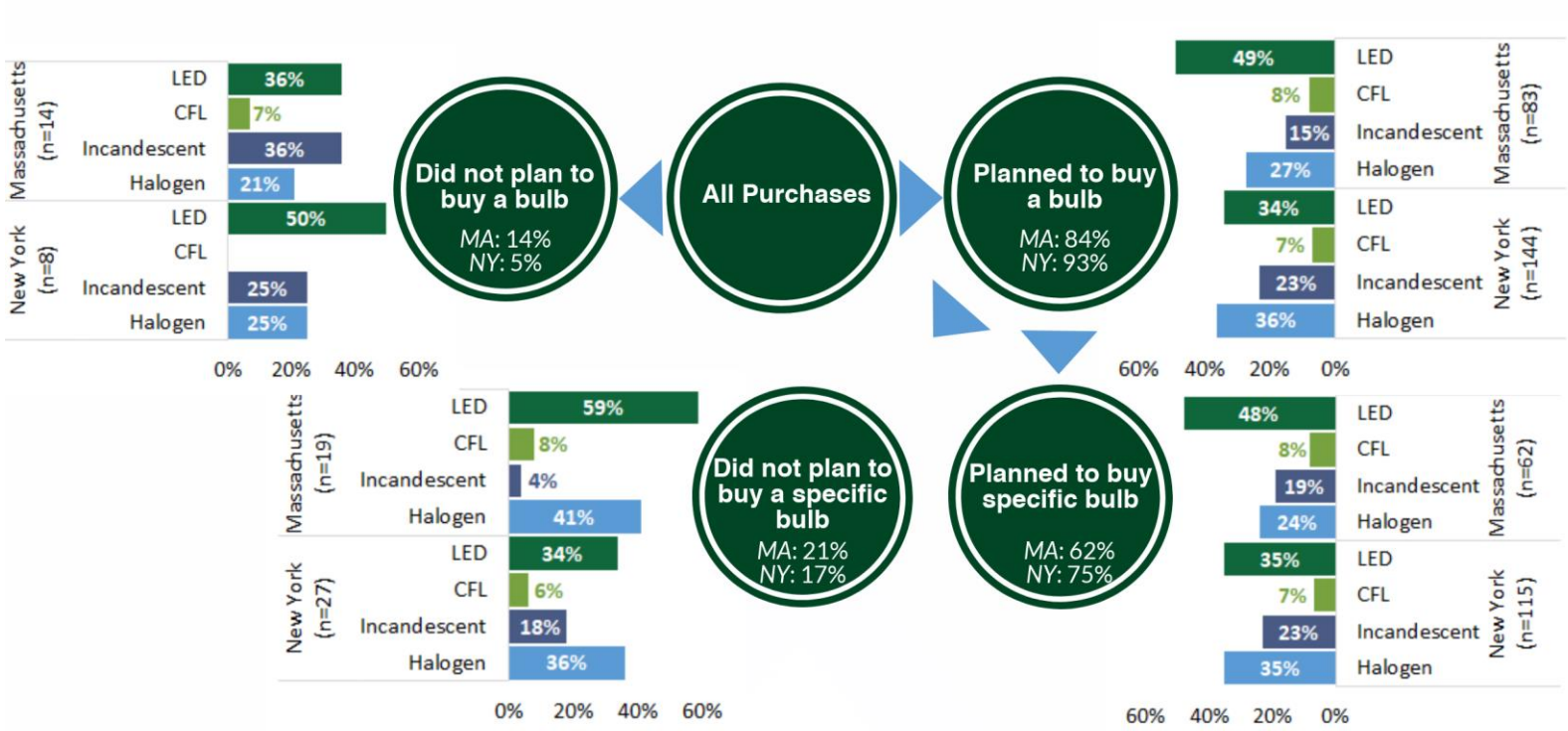
	2016		2017	
	Massachusetts *(n=175)*	New York *(n=176)*	Massachusetts *(n=100)*	New York *(n=160)*
LED	18%	24%	48%	33%
CFL	18%	14%	8%	7%
Incandescent	33%	29%	18%	22%
Halogen	19%	24%	27%	39%
Fluorescent	13%	9%	--	--

3.2 Survey Results

3.2.1 Pre-Purchase Planning

Figure 15 provides an overview of the 2017 respondent decision-making process. As the flow chart shows, the great majority of lighting purchases were planned in advance (84% in Massachusetts and 90% in New York). Almost two-thirds (62%) of all shoppers in Massachusetts and three-quarters (74%) of all shoppers in New York had also determined which type of bulb to purchase in advance. The graphs included in the flowchart provide the ultimate purchase behavior of respondents based on observations from the InfoScout purchase data. More detailed findings regarding purchase planning are provided in Appendix D.

Figure 15: Purchase Planning Flow Chart



3.2.2 In-Store Purchase Decisions

When we examined just the subset of purchasers who decided which bulb type to purchase while in a store, some interesting patterns emerged. The ratio of bulbs selected by those who decided what type of bulb to purchase at the store appears to align both with how the MassSave program operates and with increasing acceptance (and falling prices) of LEDs in general.

LED bulbs increased in popularity among those who decided what bulb type to buy at the store in 2017.

- 52% of Massachusetts respondents decided at the store to purchase an LED bulb in 2017, compared with only 3% in 2016.
- 35% of New York respondents decided at the store to purchase an LED bulb in 2017, compared with only 9% in 2016.

Halogen continued to be a prevalent choice among those who decided what to purchase at the store, whereas incandescent bulbs largely disappeared.

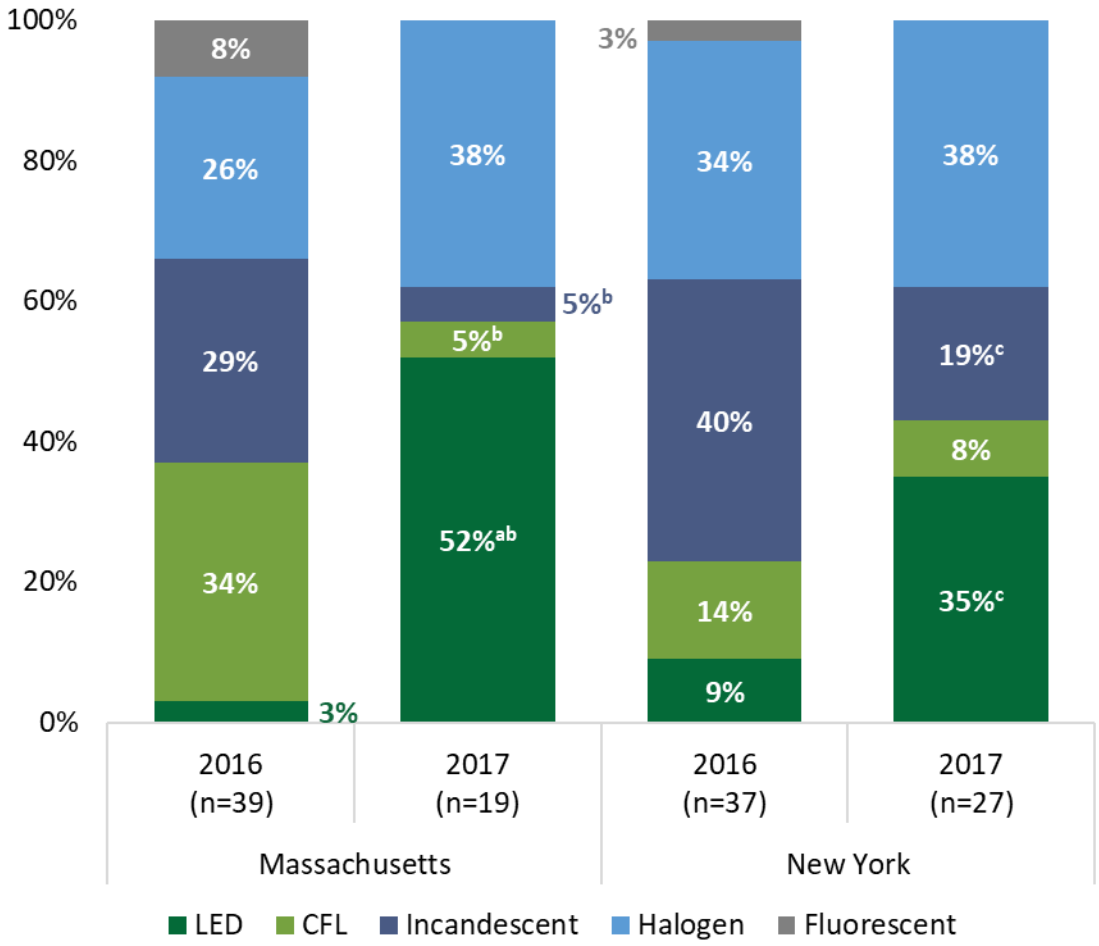
- 38% of Massachusetts respondents decided at the store to buy a halogen bulb in 2017, compared with 26% in 2016. Similarly, 38% of New York respondents decided at the store to buy a halogen bulb in 2017, compared with 34% in 2016.
- Only 5% of Massachusetts respondents decided at the store to buy an incandescent bulb in 2017, compared with 29% in 2016. Nineteen percent of New York respondents decided at the store to buy an incandescent bulb in 2017, compared with 40% in 2016.

Based on updates to the ENERGY STAR standards, as of January 1, 2017, the vast majority of CFLs no longer meet the ENERGY STAR standards.[13] In addition, the market for CFLs has declined as LED prices and availability has increased. The greater availability of halogens has also contributed to the decline in the market for CFLs. These changes likely account for the precipitous drop in the proportion of shoppers who selected CFL bulbs at the store.

- Only 5% of Massachusetts respondents decided at the store to buy a CFL, compared with 34% in 2016.
- 8% of New York respondents decided at the store to buy a CFL, compared with 14% in 2016.

[13] In response to changes in ENERGY STAR standards, the Massachusetts PAs discontinued support for CFLs beginning on January 1, 2017. The study period does include a portion of 2016, during which CFL incentives were still in place (July 2016-July 2017). However, because the survey asks respondents about their most recent purchase, very few responses reflect purchases made in 2016.

Figure 16: In-Store Decisions



[a] Significantly different from NY 2017 purchasers at the 90% confidence level.
[b] Significantly different from MA 2016 purchasers at the 90% confidence level.
[c] Significantly different from NY 2016 purchasers at the 90% confidence level.

3.2.3 Sources of Influence

To help us understand the decision-making process of those respondents who planned their purchases in advance, we asked respondents to select from a list of factors that may have influenced their bulb selection. The majority of respondents in both states said none of these factors influenced their decision (73% in Massachusetts and 65% in New York). Among those factors influencing purchasers, the in-store signage on this or a previous trip was the most common for bulb selection in both states. Coupons were the second most often cited factor in Massachusetts and third in New York. A study conducted by Sylvania in 2016[14] found product packaging to be a common source of information consulted by lighting consumers. Future studies should consider adding product packaging and price to the list of possible

[14] KRC Research. "SYLVANIA Socket Survey 8.0 Research Results: Research among Americans ages 18+ on lighting topics including bulb use, LED knowledge, and smart lighting." Report prepared for Osram Sylvania, March 2016.

factors that influence bulb selection, and should also ask this question to all survey respondents.

Table 16: Factors that Influenced Bulb Selection

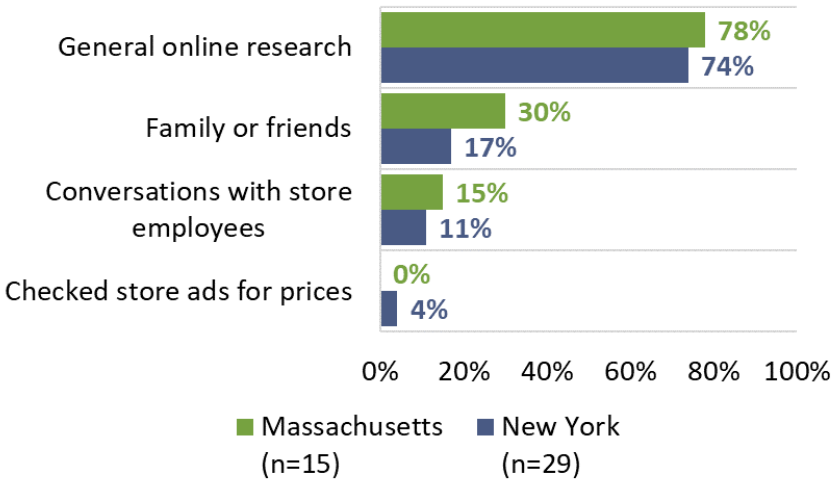
(multiple response)

	MA	NY
n	62	115
In-store signage on this or a previous shopping trip	11%	13%
Coupon	7%	7%
Advice from a store employee	5%	9%
Online or email advertisement	2%	3%
Radio advertisement	1%	1%
Television advertisement	1%	2%
Print advertisement	0%	6%
None of these	73%	65%

We also asked respondents who had planned in advance to purchase a specific type of bulb if they had done any research on light bulbs to help with their decision. About one-quarter of these purchasers in both states said they had researched lighting before making their purchase (25% in Massachusetts and 24% in New York). Purchasers in both states mostly commonly performed online research followed by relying on family or friends, and conversations with store employees (Figure 17).

Figure 17: Resources Used to Make Decision*

(multiple response)



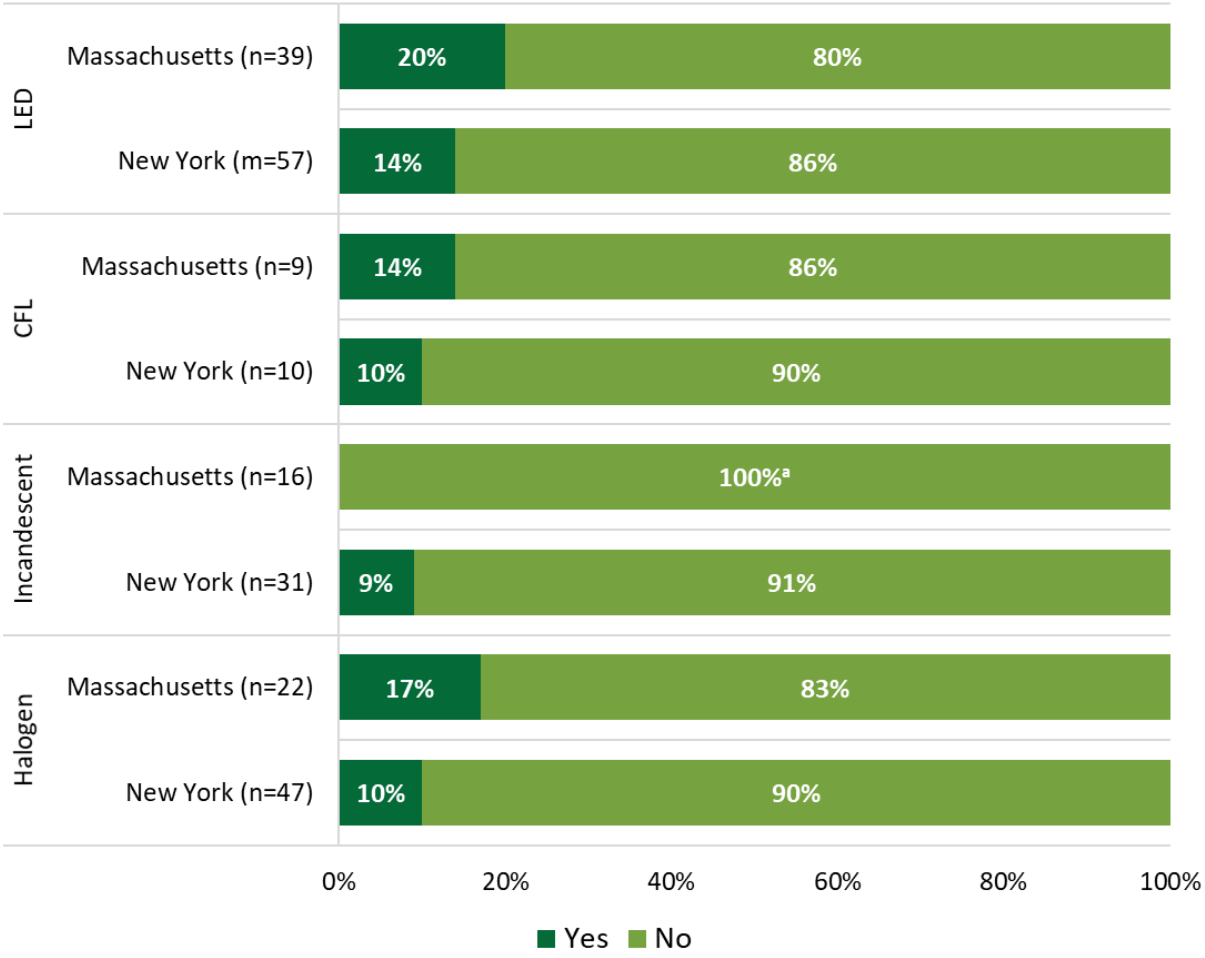
*Percentage of the 25% in Massachusetts and 24% in New York who said they did research prior to making their lighting purchase.

3.2.4 Deliberations While Shopping

In both states, only a small percentage of purchasers who had pre-determined what bulb type they were going to buy said they had considered another bulb type on their shopping trip

(11% in Massachusetts and 12% in New York). While there were subtle differences in the percentages across states and by bulb type, there was one category that stood out. All pre-determined incandescent purchasers in Massachusetts said they had not considered another bulb type (Figure 18). This is in line with the findings in Section 3.2.6, where inefficient purchasers mostly selected a bulb because it was the same as the one that had burned out and did not consider the merits of other bulb types.

Figure 18: Considered Another Bulb Type*



[a] Significantly different than NY LED bulb purchasers at the 90% confidence level.
* "Don't know" responses removed from the data.

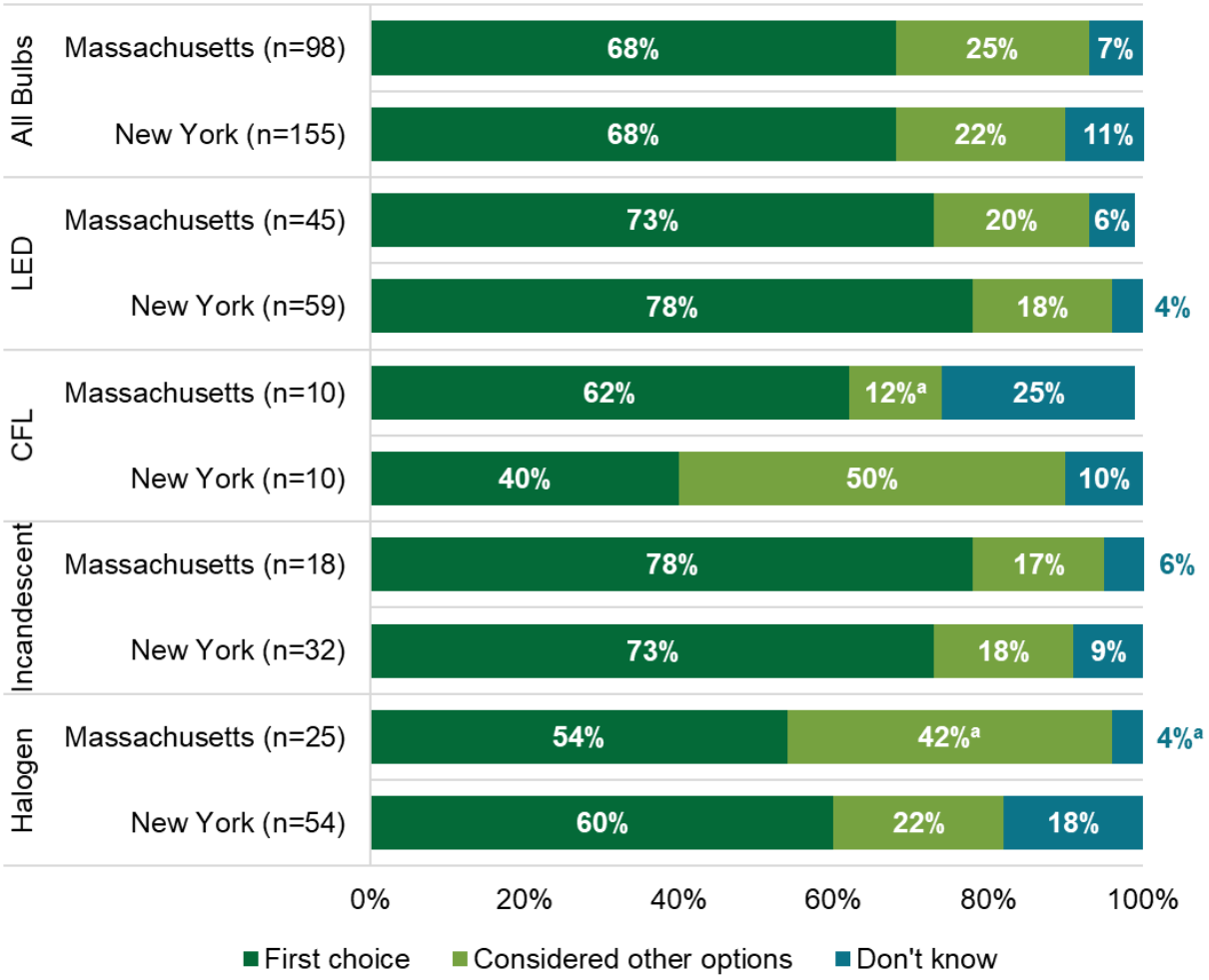
Shoppers also revealed whether the bulb they ultimately selected had been their first choice. The majority of bulb purchasers in both states and among most bulb types (except for New York CFL purchasers) said their ultimate selection had also been their first choice. Only about one out of five LED or incandescent purchasers said they had considered another option.

Halogen purchasers were more likely to have considered other options before making their final selection. It may be that the *energy-efficient* messaging that some halogen bulbs are often marketed with, along with the lower price point, influenced shoppers to select a halogen

bulb when they compared different bulbs in the store.[15] It also is possible that incandescent bulb purchasers may be trying to purchase a new bulb that exactly matches the bulb they are replacing. They could lack the confidence to select an alternative bulb type that will adequately serve their needs and are susceptible to "efficient incandescent" marketing campaigns.

- 42% of Massachusetts halogen purchasers considered other options.
- 22% of New York halogen producers considered other options.

Figure 19: Whether Bulb Was First Choice



[a] Significantly different from NY at the 90% confidence level.

[15] The stated first choice of those halogen producers who considered other options vary across the board, but due to the small sample size of shoppers who fall into this category, it was difficult to draw meaningful conclusions.

Table 17 provides a summary of customers' first choice by their ultimate purchase. While the small sample sizes prevented us from drawing strong conclusions, there were a few interesting items of note.

- An incandescent was the most common first choice in Massachusetts (8 out of 17, excluding "Don't knows"). Those who could not find their first choice most frequently ended up purchasing a halogen (10 of 23) or an LED (9 of 23).

- An LED was the most common first choice in New York (11 out of 20; excluding "Don't knows"). Those who could not find their first choice most frequently ended up purchasing a LED (10 of 33) or a halogen (10 of 33).

Table 17: First Choice Bulb Type

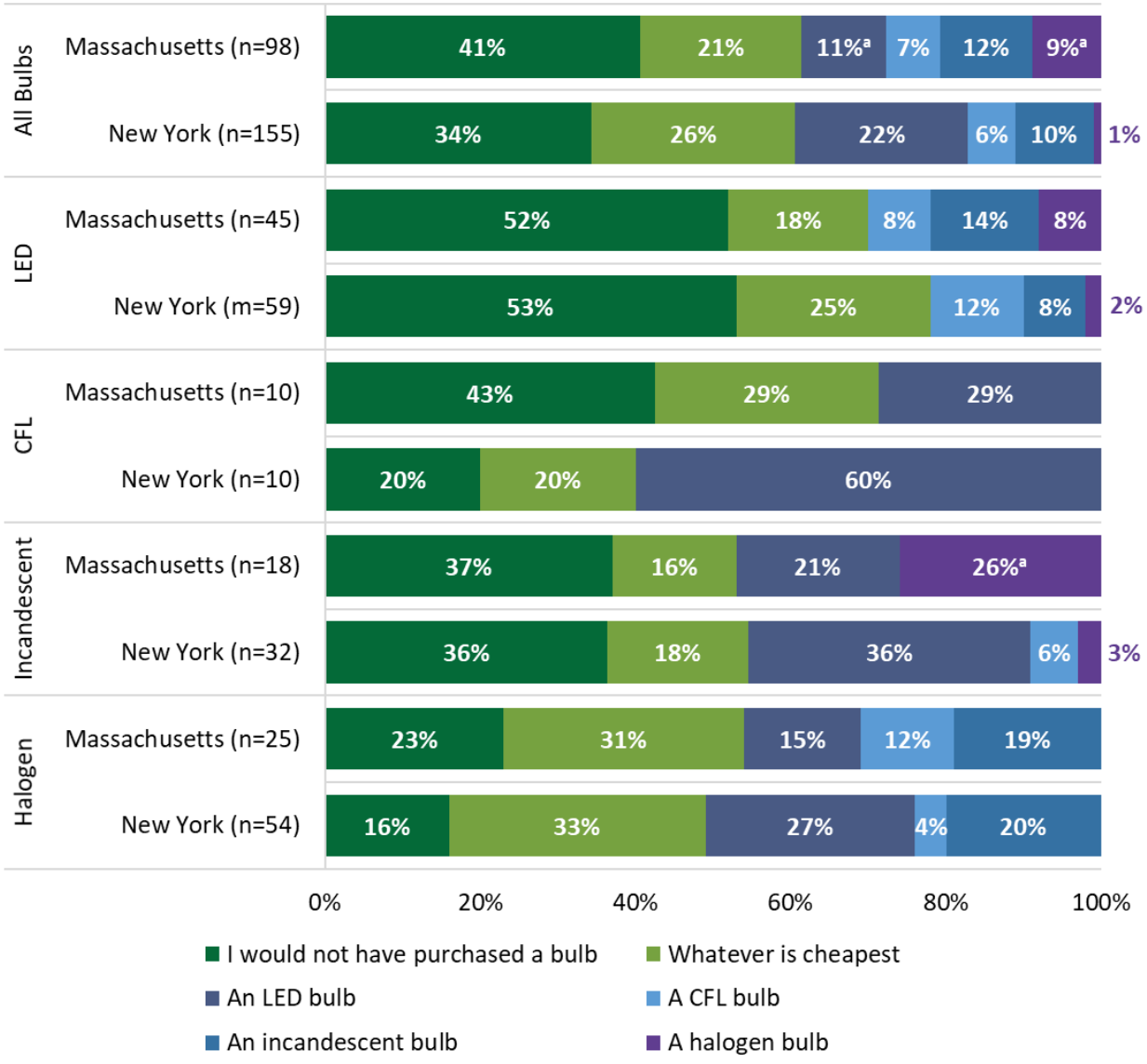
First Choice	Massachusetts				
	n	Bulb purchased			
		LED	CFL	Halogen	Incandescent
n		9	2	10	2
LED	4	-	0	3	1
CFL	2	1	-	1	0
Halogen	3	2	0	-	1
Incandescent	8	4	2	2	-
Don't know	6	2	0	4	0
First Choice	**New York**				
	n	Bulb purchased			
		LED	CFL	Halogen	Incandescent
n		10	5	10	8
LED	11	-	3	3	5
CFL	3	2	-	1	0
Halogen	2	1	0	-	1
Incandescent	4	1	0	3	-
Don't know	13	6	2	3	2

Respondents who purchased their first choice were asked what they would have purchased if their first-choice bulb had not been available. The most common action would have been to not purchase a bulb at all (41% in Massachusetts and 34% in New York). This finding suggests that our sample is potentially biased towards those who were able to purchase their first-choice bulb, and may be a limitation of this survey effort. The next most common reported action would have been to select whatever had been cheapest (21% in Massachusetts and 26% in New York).

Examining responses by bulb type purchased, some interesting differences emerged among how survey respondents would have made their bulb selection if their choice had not been available:

- About one-half of LED purchasers (52% in Massachusetts and 53% in New York) indicated they were committed to buying an LED and not another type of bulb, saying that they would not have purchased a bulb at all if an LED bulb was not available.
- Many incandescent purchasers would have selected an LED bulb if an incandescent bulb had not been available, including more New York respondents than Massachusetts respondents (36% and 21% respectively).
- Overall, more than one out of five (22%) purchasers in New York and one out of ten (11%) purchasers in Massachusetts would have selected an LED if their first choice had not been available.

Figure 20: Bulb Choice if First Choice Unavailable



[a] Significantly different from NY at the 90% confidence level.

The reasons shoppers gave for what bulb would have been their second choice were varied. Energy efficiency/had ENERGY STAR label, lighting quality, and long life were popular reasons, but differences emerged among those who would select an LED, CFL, or inefficient bulb.

- In Massachusetts, 7 out of 12 respondents would have selected an LED as a second choice and 10 out of 27 New York respondents said the reason they would have chosen an LED was that it was energy efficient or had ENERGY STAR labeling.
- Ten out of 27 respondents in New York who would have chosen an LED as a second choice also mentioned the long life of the bulb as a reason for their choice; eight out of 27 mentioned lighting quality as a reason for choosing an LED.
- Massachusetts respondents who would have selected an inefficient bulb type as their second choice most often noted lighting quality as the main reason for this selection.

Figure 21: Reason Why Respondent Would Select Stated Bulb Type as Second Choice

(multiple response)

Reason	Massachusetts			New York		
	An LED bulb	A CFL bulb	An inefficient bulb	An LED bulb	A CFL bulb	An inefficient bulb
n	12	7	18	27	8	16
It's energy efficient/had ENERGY STAR label	7	2	2	10	5	2
Lighting quality	4	1	7	8	-	5
Long life	4	2	1	10	4	-
It's the same bulb type that burned out	1	-	4	1	1	5
Good/better value	1	2	5	9	1	2
It was on sale/discounted	-	1	1	-	-	3
It's my preferred bulb type	-	1	1	2	-	2
Appearance/shape	-	-	3	1	1	1
Information or labeling on package	-	2	1	2	1	-
Wanted this specific bulb type	-	-	1	2	-	-

[a] Significantly different from those who would chose an LED bulb as a second choice in New York at the 90% confidence level.
[b] Significantly different from those who would chose an inefficient bulb as a second choice in Massachusetts at the 90% confidence level.
[c] Significantly different from those who would chose an inefficient bulb as a second choice in New York at the 90% confidence level.

3.2.5 Difficulty of Choosing Bulb Type

Only one out of ten respondents in each state (10% in Massachusetts and 11% in New York) said selecting a bulb was “difficult” or “very difficult” (on a five-point scale where one is “not difficult at all” and five is “very difficult”) (Figure 22). Focusing on LED purchasers only, while respondents generally had no difficulty selecting an LED, purchasers in New York were more likely to find selecting a bulb “difficult” or “very difficult” (14%) than Massachusetts LED purchasers (4%) (Figure 23).[17]

Figure 22: Lighting Purchase Difficulty

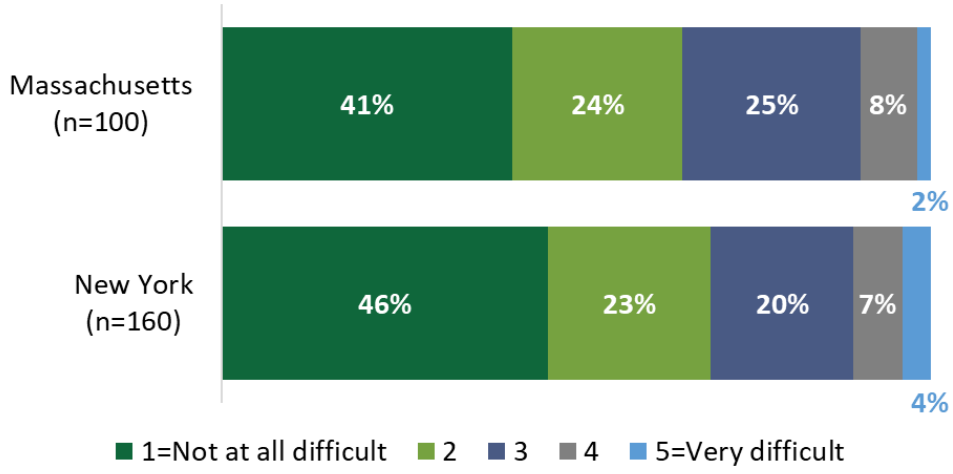
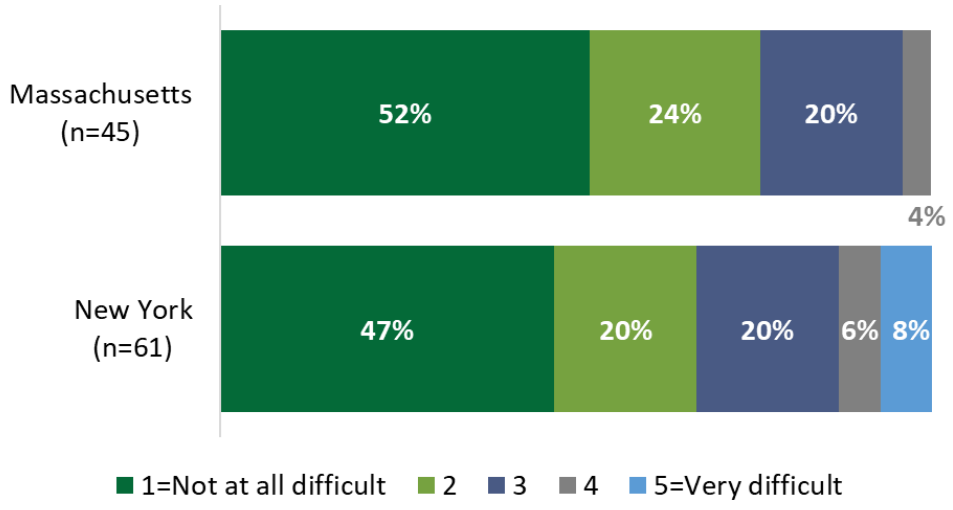


Figure 23: LED Purchase Difficulty



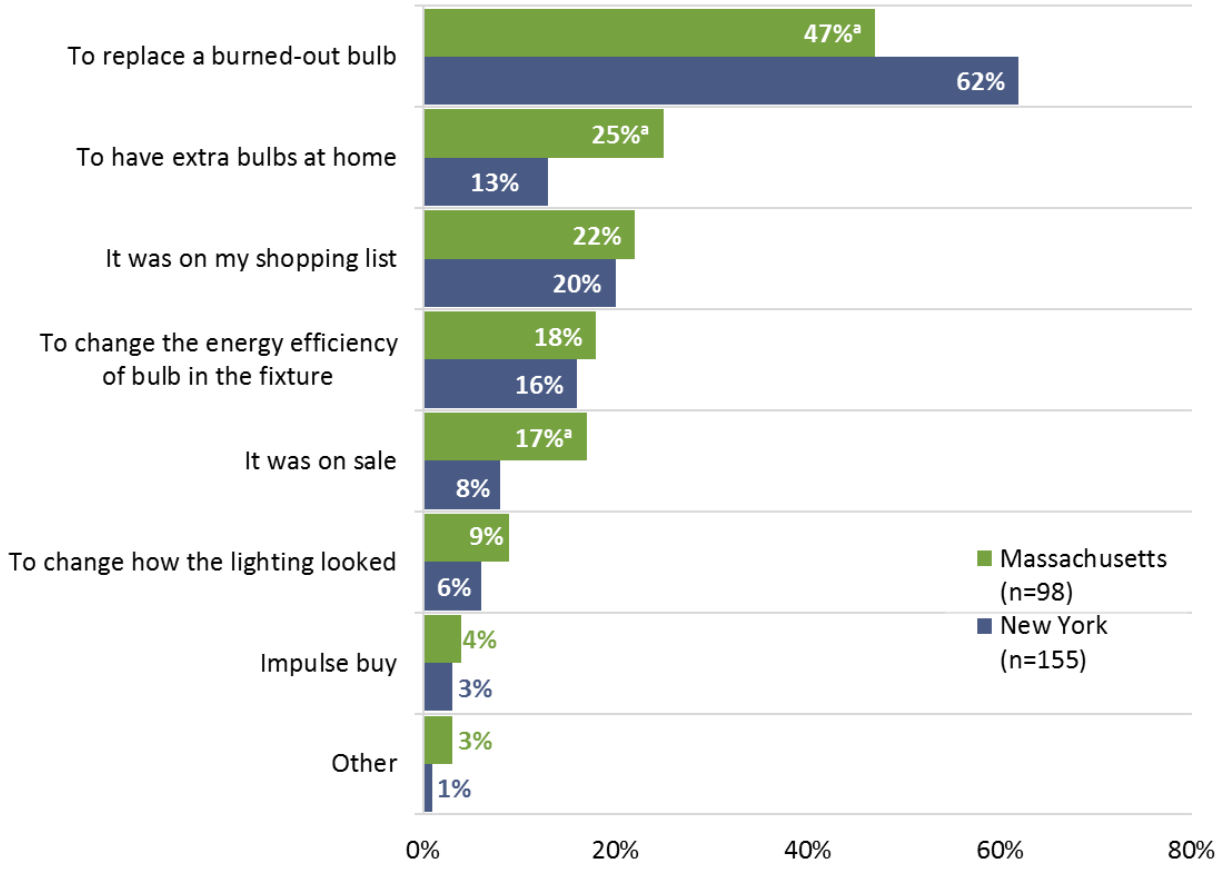
[a] Significantly different than NY at the 90% confidence level.

[17] This question was not asked in 2016; therefore, we are unable to compare results to the previous year’s responses.

3.2.6 Reasons for Purchase

The main reason that respondents purchased a bulb was to replace one that had burned out; a significantly larger proportion of New York respondents than Massachusetts respondents cited this reasoning (62% and 47% respectively). In Massachusetts, the second most common reason for purchasing lighting was to have extra bulbs at home (25% in Massachusetts vs. 13% in New York, a significant difference). The second most common reason in New York (20%) and the third most common reason in Massachusetts (22%) for purchasing lighting was that it was on their shopping list.

Figure 24: Why Purchased any Light Bulb
(multiple response)

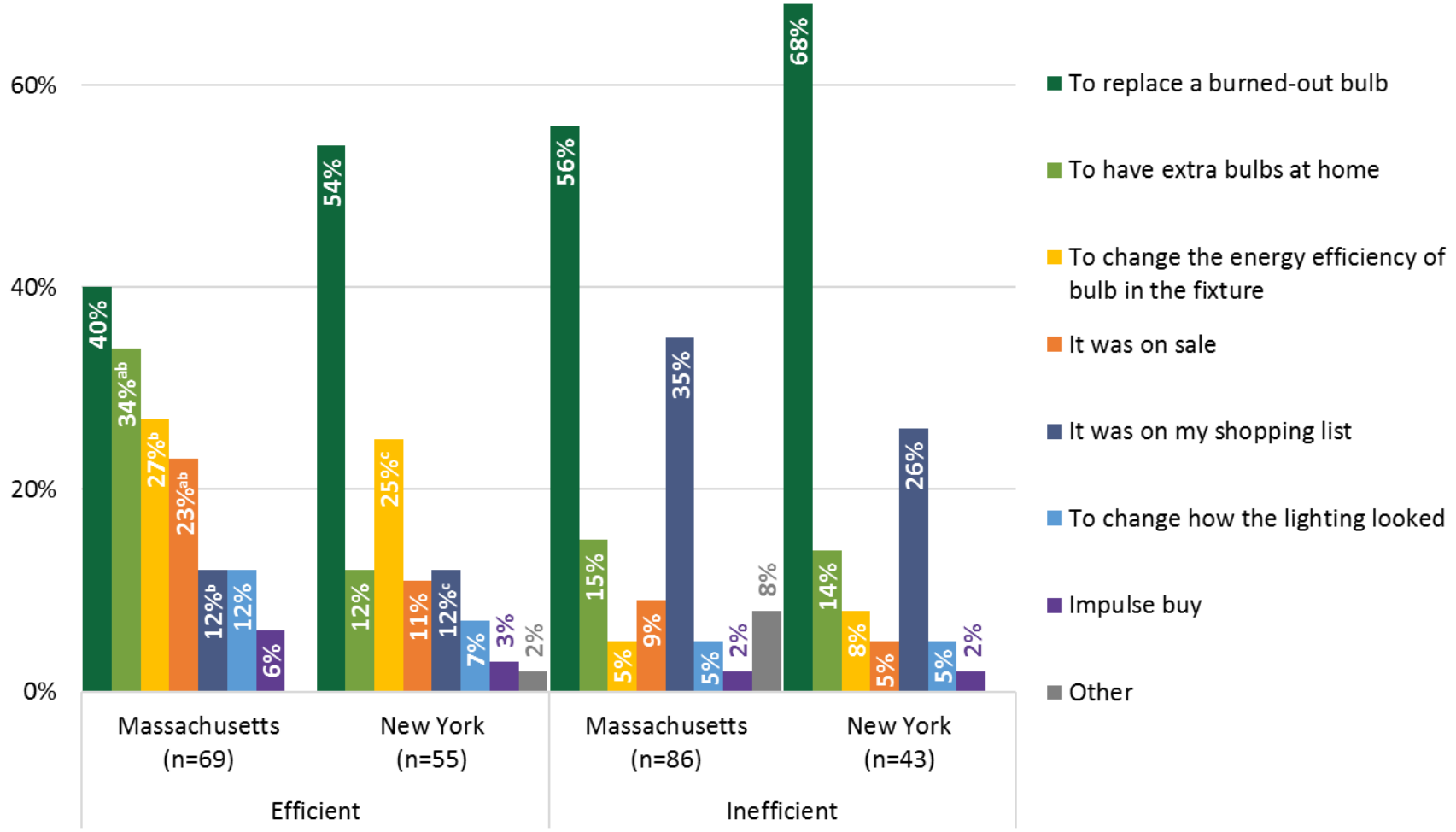


[a] Significantly different from NY at the 90% confidence level.

Additionally, a significantly larger proportion of efficient bulb purchasers in Massachusetts as compared to inefficient bulb purchasers in the state said their purchase was to change the efficiency of the bulb in the fixture (27% and 5% respectively). Of course, inefficient bulb purchasers are unlikely to state changing the efficiency of the bulbs in the fixture as the reason for their purchase. However, this finding might represent an opportunity for program administrators to engage in marketing or outreach to encourage shoppers to purchase LEDs to replace *working* inefficient lamps in their homes. Efficient bulb purchasers in Massachusetts were also more likely to buy a bulb because it was on sale (23%) or to have

extra bulbs at home (34%) compared with inefficient bulb purchasers in Massachusetts (9% and 15%, respectively).

Figure 25: Why Purchased any Light Bulb
(multiple response)

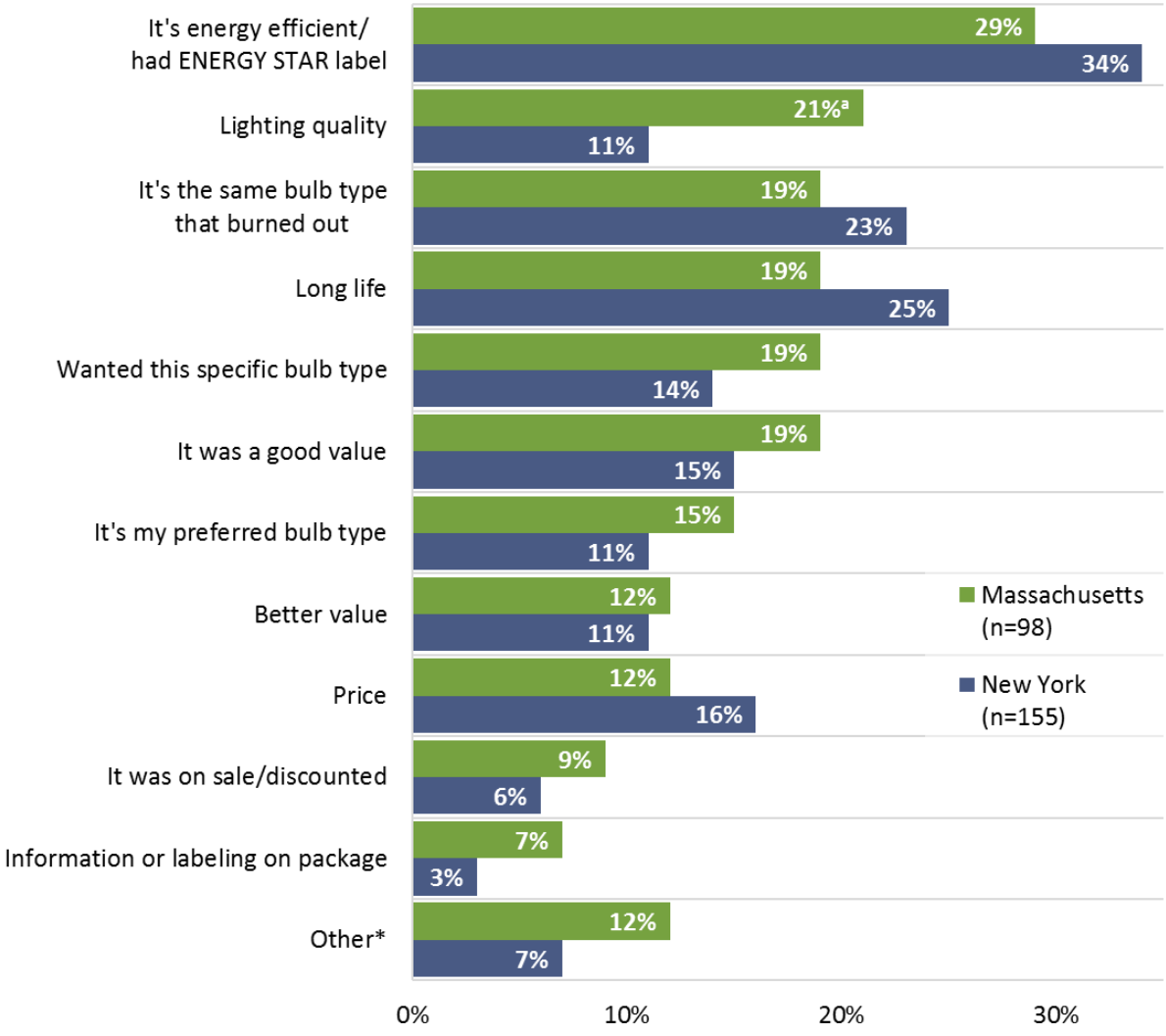


[a] Significantly different from NY efficient purchasers at the 90% confidence level.
[b] Significantly different from MA inefficient purchasers at the 90% confidence level.
[c] Significantly different from NY inefficient purchasers at the 90% confidence level.

Survey respondents also indicated why they had selected the type of bulb that they did. The most popular reasons, selected by more than 20% of all respondents in each state, were "it's energy efficient/had ENERGY STAR label," "long life," or "it's the same type of bulb that burned out." The only significant difference between New York and Massachusetts respondents was in the proportions that selected "lighting quality": 21% in Massachusetts said they chose the bulb they did because of lighting quality , as opposed 11% in New York. Approximately one out of five shoppers defaulted to the same bulb choice made on a previous shopping trip (19% in Massachusetts and 23% in New York).

Figure 26: Why Purchased Specific Type

(multiple response)



[a] Significantly different from NY at the 90% confidence level.
*Includes "Appearance or shape," "advice from a store employee," "Signs or marketing of the product at the store," and "no particular reason"

Efficient purchasers in Massachusetts were significantly more likely than inefficient purchasers to say that they had purchased the type of lighting they did because it offered a "better value" (17% vs 5%, respectively) hinting that some purchasers were considering the unit price over the life of the bulb. Efficient bulb purchasers in Massachusetts were also significantly more likely to say they had chosen the bulb they did because "it's energy efficient/had ENERGY STAR label." On the other hand, inefficient purchasers in both states were more likely to say they had chosen the bulb they did because "it's the same bulb type that burned out" than efficient purchasers.

Survey respondents' choice of bulb may have been influenced by prior program efforts. In an attempt to observe the impact of previous influence, we examined bulbs selected by those who bought the same type that burned out. Among the respondents who said they purchased the type of bulb they did because it was the same as the one that burned out, most were halogen purchasers (44% in Massachusetts and 41% in New York); incandescent bulbs were also a popular selection among this group. Future studies should include the option "it was the same bulb type that I purchased last time" to better capture the influence of prior program efforts.

Table 18: Bulbs Type Selected was Same Type that Burned Out

	MA	NY
n	20	37
LED	17%	22%
CFL	11%	5%
Incandescent	28%	32%
Halogen	44%	41%

Table 19: Reasons Why Survey Respondents Purchased the Type of Lighting They Did (MA n=98, NY n=155)

(multiple response)

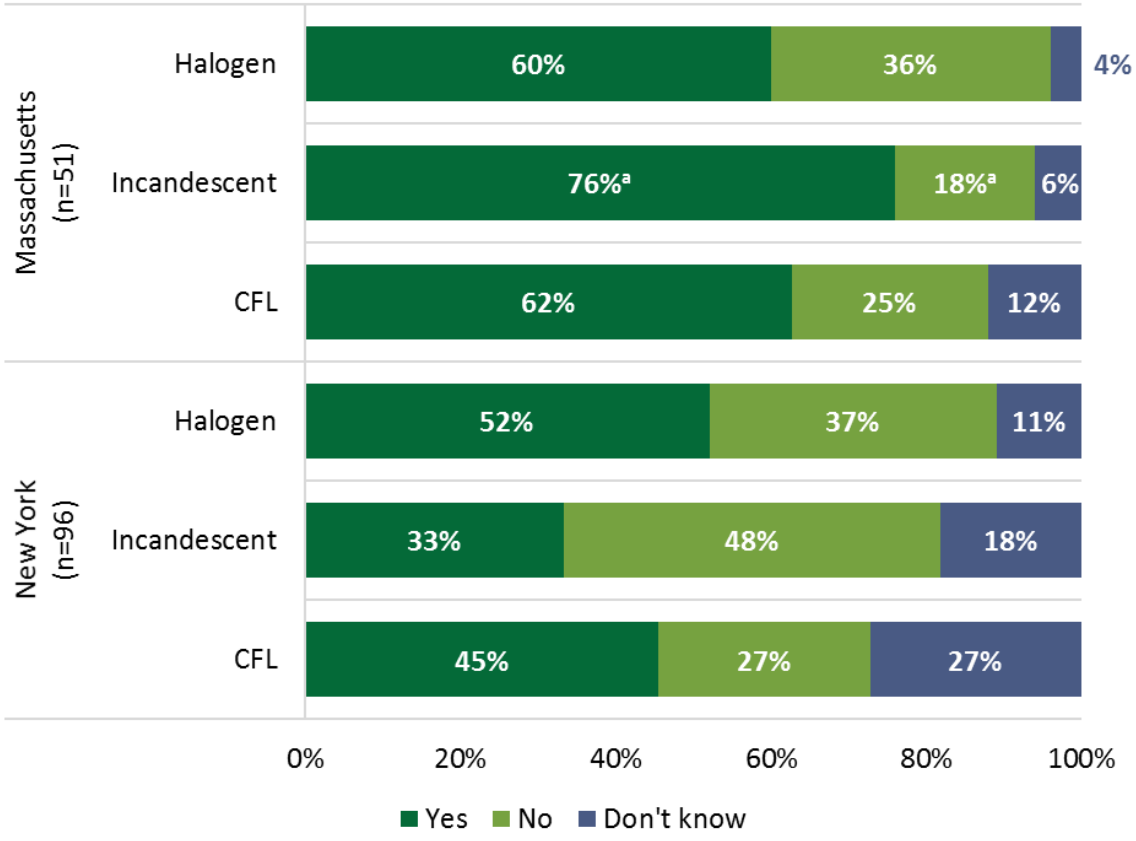
	Massachusetts		New York	
Reason	**Efficient**	**Inefficient**	**Efficient**	**Inefficient**
n	*55*	*43*	*69*	*86*
It's energy efficient/had ENERGY STAR label	40%[b]	16%[d]	40%	29%
Better value	17% [b]	5%	8%	13%
It's the same bulb type that burned out	10% [b]	31%	14%[c]	30%
Lighting quality	26%[a]	15%	12%	11%
Long life	24%[a]	13%	41%[c]	13%
Wanted this specific bulb type	19%	20%	10%	18%
It was a good value	18%	20%	12%	18%
Price	14%	9%	18%	14%
It was on sale/discounted	11%[a]	3%	10%	3%
It's my preferred bulb type	10%	20%	14%	9%
Appearance/shape	9%	4%	1%	3%
Information or labeling on package	7%	7%	3%	3%
Signs or marketing of the product at the store	1%	0%	4%	1%
Advice from a store employee	1%	6%	1%	3%
No particular reason	1%	3%	1%	2%
3-way	0%	0%	1%	0%

[a] Significantly different than NY purchasers of corresponding efficiency bulbs.
[b] Significantly different than MA inefficient bulb purchasers.
[c] Significantly different than NY inefficient bulb purchasers.

Bulb purchasers who had not purchased an LED bulb were asked if they had been aware that more efficient bulb choices were available. Overall, significantly more Massachusetts non-LED bulb purchasers were aware that more efficient choices were available than New York purchasers (66% vs. 45%), but the difference was most striking among incandescent purchasers. Around three-quarters (76%) of Massachusetts incandescent purchasers said they were aware that more efficient choices were available, compared to only one-third (33%) of New York incandescent purchasers. Greater knowledge of energy efficiency may indicate that the program has been successful in reaching shoppers in Massachusetts. That being said, given that incandescent purchasers did not select an LED bulb despite their awareness of more efficient choices, education alone may not be enough to influence decision-making.

As in 2016, a large proportion of halogen purchasers said they were not aware that more efficient choices were available (36% in Massachusetts and 37% in New York), perhaps due to the efficiency messaging that bulb producers often use to market their halogen general service bulbs.

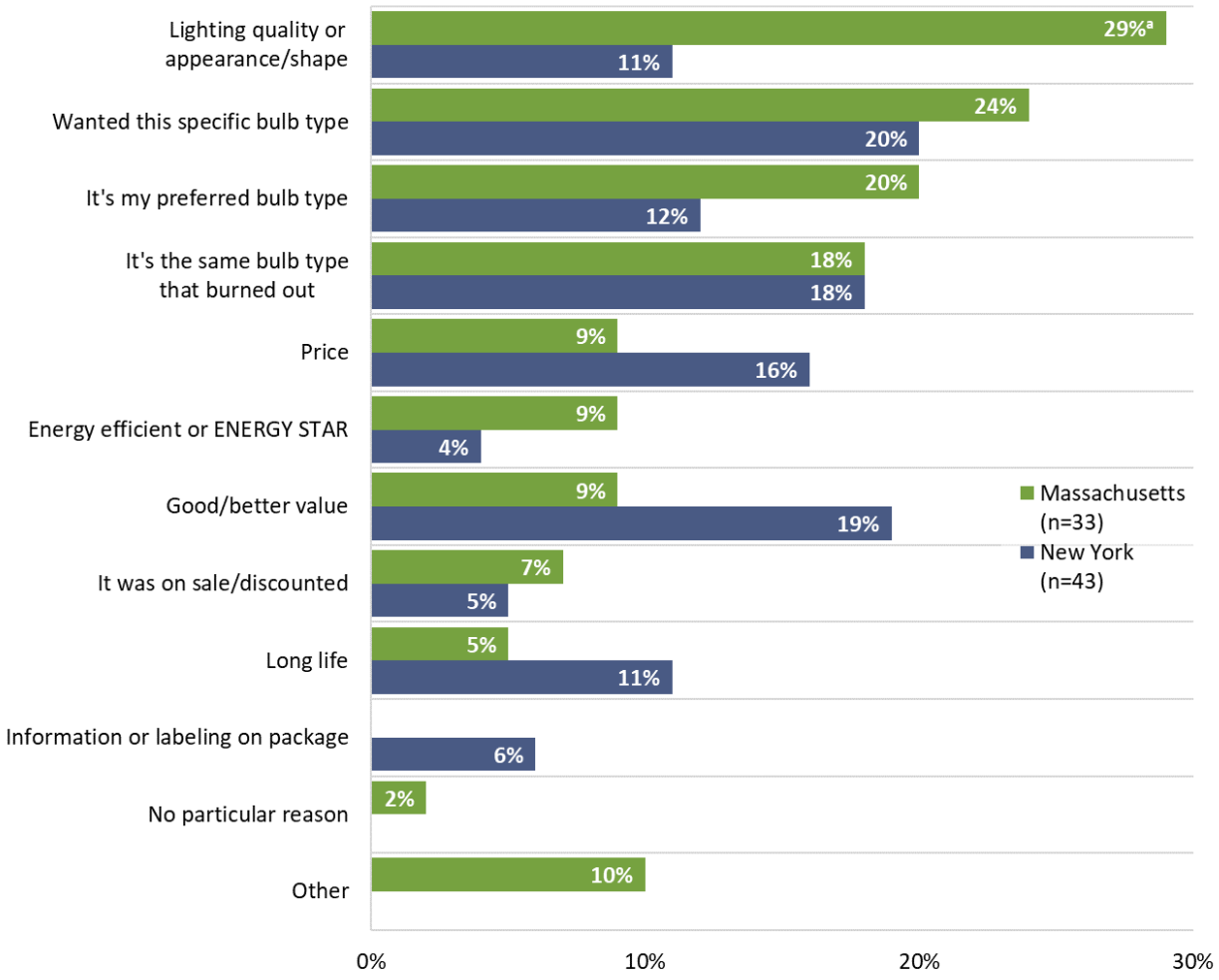
Figure 27: Aware More Efficient Choices Available



Non-LED bulb purchasers who said they had been aware that more efficient choices were available were then asked why they had elected to purchase a less efficient bulb. The most common responses in both states were "wanted this specific bulb type," "it's the same bulb type that burned out," and "it's my preferred bulb type" suggesting again that there exists a subset of bulb purchasers that are less flexible in their purchasing behavior.

Figure 28: Reason Less Efficient Bulb Selected

(multiple response)



[a] Significantly different from NY at the 90% confidence level.

Ultimately, there were many factors that shoppers considered when selecting a lighting product.

- Around one-half of all respondents said they looked at price and energy efficiency when selecting a bulb.
- A significantly larger proportion of inefficient purchasers in New York (50%) said they considered wattage when making their selection (as compared with 37% in Massachusetts).

- A significantly larger proportion of efficient bulb-purchasing Massachusetts respondents said they looked at ENERGY STAR labeling when selecting a bulb than Massachusetts inefficient bulb purchasers (59% vs 36%).
- Forty-five percent of Massachusetts respondents, a significantly larger proportion than the 27% in New York, said they looked at lumens or brightness when shopping for light bulbs.

Table 20: Criteria Considered When Selecting a Bulb
(multiple response)

	Massachusetts			New York		
	Efficient	Inefficient	Total	Efficient	Inefficient	Total
n	55	45	100	71	89	160
Lumens or brightness	51%	38%	45%[a]	26%	28%	27%
Wattage	50%	53%	51%	37%[c]	50%	44%
Price	48%	48%	48%	52%	54%	53%
ENERGY STAR label	59%[b]	36%	48%	40%	36%	38%
Energy efficiency	45%	52%	48%	47%	42%	45%
Bulb life	43%	37%	40%	47%	40%	43%
Wattage equivalency	41%	31%	36%	33%	26%	29%
Shape/style	35%	26%	31%	26%	31%	29%
Don't know	5%	3%	4%	0%	4%	2%

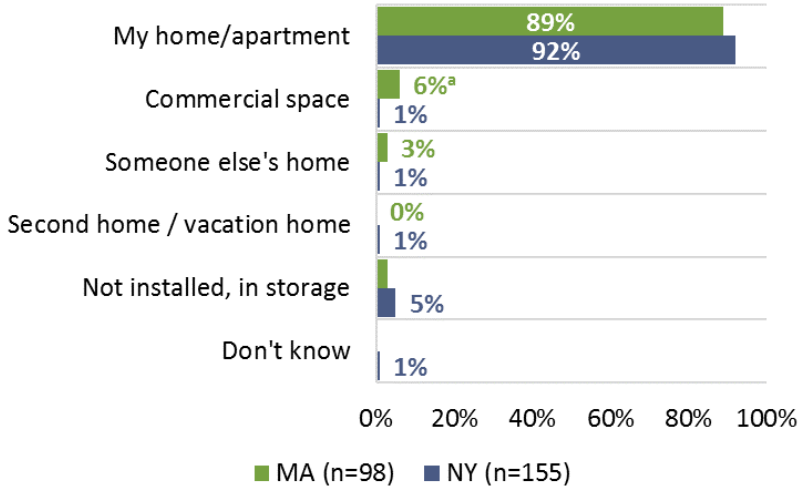
[a] Significantly different from New York bulbs at the 90% confidence level.
[b] Significantly different from inefficient bulbs in Massachusetts at the 90% confidence level.
[c] Significantly different from inefficient bulbs in New York at the 90% confidence level.

3.2.7 Indications of Cross-Sector Sales

Nearly all bulbs purchased were installed in the home or apartment of the respondent (89% in Massachusetts and 92% in New York). Six percent in Massachusetts installed one or more of their purchased bulbs in a commercial space, compared with 1% of New Yorkers. Note that this survey does not capture the number of lamps installed by location, nor does it capture purchases made directly by commercial businesses that were not included in this residential sample.

Figure 29: Installation Location

(Multiple Response)



[a] Significantly different from NY at the 90% confidence level.

Appendix A Methodology

InfoScout

InfoScout is a private market research company that has a nationwide panel of mobile device users who upload their receipts from retail and restaurant shopping trips in exchange for various rewards.[18] They have three apps that are similar in purpose but different in design and reward structure to target different demographic groups and create a demographically representative panel. InfoScout uses character recognition software to extract the text from submitted receipts and provides tailored analysis of this data as well as the opportunity to survey targeted panelists via their mobile devices.

Purchase Data

NMR requested purchase data from InfoScout for all purchase trips by their panelists in Massachusetts and New York that included lighting products and that occurred during the 12-month period from August 2016 to August 2017.[19] NMR then surveyed, through InfoScout's apps, a subsample of these lighting purchasers. NMR chose New York as a comparison area because it presents a unique opportunity to understand how the residential lighting market there has responded to the cessation of standard spiral CFL incentives in 2012 and essentially all upstream lighting incentives in 2014, compared to Massachusetts which has maintained lighting incentives.

The purchase data include the date of purchase; name and location of the store; demographic and geographic data on the purchaser;[20] and details of their purchases, including an item description, price, and quantity of the lighting products. InfoScout's product data are limited to what is contained on the submitted receipt. This varies widely by retailer; one retailer may include a description with many details on the brand and type of product and a unique identifier like a UPC, while another may contain nothing more than "LT BLB."

NMR used various techniques to filter the purchase data to only those purchases for which we could identify at a minimum the lighting technology, wattage, price, and quantity. Where possible, we appended other product details available from internal databases of lighting products, matching by UPC or brand and model.[21] The filtered dataset included the following:

- 244 unique purchasers in Massachusetts who made 368 individual shopping trips that included a lighting purchase, which represent 1,597 light bulbs, and
- 2,117 unique panelists in New York who made 3,171 individual shopping trips that included a lighting purchase, which represent 12,241 light bulbs.

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[18] http://www.infoscout.com

[19] Excluding New York City and Long Island – New York City because its demographics are substantially different from the rest of the state and Long Island because there are still programs there that support retail efficient lighting.

[20] Including age, income, ethnicity, education, household size, and ZIP code

[21] The appended data include over 30 fields that cover bulb shape, base type, lumen output, special features, ENERGY STAR certification, and package and warranty information.

Note that the New York InfoScout panel is considerably larger than the Massachusetts InfoScout panel. Additionally, InfoScout's quality control process led to both states dropping a large number of panelists; thus, the sample size shrunk considerably in both states between 2016 and 2017.

Survey

NMR submitted the filtered data back to InfoScout to form the pool of possible respondents to a survey on their specific lighting purchase(s) and their general preferences around lighting products and retail sources. The quota of respondents was 100 in Massachusetts and 150 in New York.

Weighting

InfoScout's panelists are not a random sample but a self-selected group with access to a mobile device and willingness to submit data on their purchase behavior for various incentives.[22] The panel does under-represent, however, persons with a high school education or less and over-represents persons with some college or associates degree (see Figure 34 in Appendix B). To compensate for minor demographic differences, NMR weighted the results by educational attainment of the panelists (Table 21). We developed the weights to align the InfoScout panelists in Massachusetts and New York (all panelists, not just those who had made a lighting purchase) to the general population of Massachusetts. We present all subsequent results weighted according to the scheme shown in Table 22.

[22] Incentives depend on the app the panelist uses and include entry into cash lotteries, donations for schools, gift cards, and other prizes.

Table 21: 2017 Weighting Scheme

	Census (2015 ACS 5-year Estimates)	InfoScout Core Panel*	Weight
Massachusetts			
High School or Less	1,640,480	36	2.4882
Some College or Assoc Degree	1,102,927	79	0.7499
4-year College Degree	1,049,150	74	0.7611
Graduate Degree	817,953	59	0.7423
Prefer not to answer†	-	-	1
New York			
High School or Less	1,640,480	417	1.6705
Some College or Assoc Degree	1,102,927	740	0.6329
4-year College Degree	1,049,150	472	0.9442
Graduate Degree	817,953	329	1.056
Prefer not to answer†	-	-	1

*The InfoScout panel used for weighting consisted of a core group of purchasers active with the company over time which had undergone major cleaning at the time demographic data was provided; hence the low counts in this table relative to the counts of lighting purchasers in the sample used for analysis.
† All core panelists gave responses to demographic questions on educational attainment, a weight of 1 was chosen for application to lighting purchasers in the analysis sample who did not provide a response.

Table 22 shows the updated weights used for the 2016 InfoScout lighting purchasers analyzed in the previous report and included in select tables or figures below for comparison. Weights were recalculated for each state using updated census data for Massachusetts only.

Table 22: Updated 2016 Weighting Scheme*

	Census (2015 ACS 5-year Estimates)	InfoScout Core Panel*	Weight
Massachusetts			
High School or Less	1,640,480	115	2.4371
Some College or Assoc Degree	1,102,927	253	0.7476
4-year College Degree	1,049,150	268	0.6713
Graduate Degree	817,953	154	0.9098
Prefer not to answer†	-	-	1
New York			
High School or Less	1,640,480	751	1.9233
Some College or Assoc Degree	1,102,927	1,380	0.7036
4-year College Degree	1,049,150	1,213	0.7611
Graduate Degree	817,953	714	1.008
Prefer not to answer†	-	-	1

*The InfoScout panel used for weighting consisted of a core group of purchasers active with the company over time which had undergone major cleaning between 2016 and 2017; hence the high counts in this table relative to the counts used for the 2017 weights.
† All core panelists gave responses to demographic questions on educational attainment, a weight of 1 was chosen for application to lighting purchasers in the analysis sample who did not provide a response.

Appendix B Demographics

This section compares the demographics of four groups in the two states:

- The general population[23]
- The population of the InfoScout core sample of panelists
- The population of InfoScout panelists who purchased lighting products from August 2016 through August 2017
- Lighting purchasers who responded to the decision-making survey

Across all demographic categories, the InfoScout panel, lighting purchasers, and survey respondents were broadly similar within both states. As one would expect, there were divergences in some categories between the InfoScout groups and the general population. To address these differences, we weighted the panelists by scaling education of the total population of InfoScout panelists in both states to the general population, as described in Appendix A. It is worth noting, however, that there is no reliable data source for the demographic characteristics of the population of light bulb purchasers, which could feasibly be more like the InfoScout panel than the general population overall.[24]

B.1 Geographic Distribution

The figures that follow show that the InfoScout lighting purchasers and survey respondents are well distributed throughout both states, although there were higher concentrations of purchasers in areas of greater population.

[23] General MA and NY population data are based on ACS 5-year estimates (2009-2014). NY data exclude New York City and Long Island, except in the case of age and income, where the state level was the smallest geographic unit available that allowed us to match the bins in the demographic data for InfoScout panelists.
[24] That is, some adults have light bulbs provided to them by a landlord or caretaker, while others leave the buying to another family member.

Figure 30: Massachusetts Lighting Purchasers

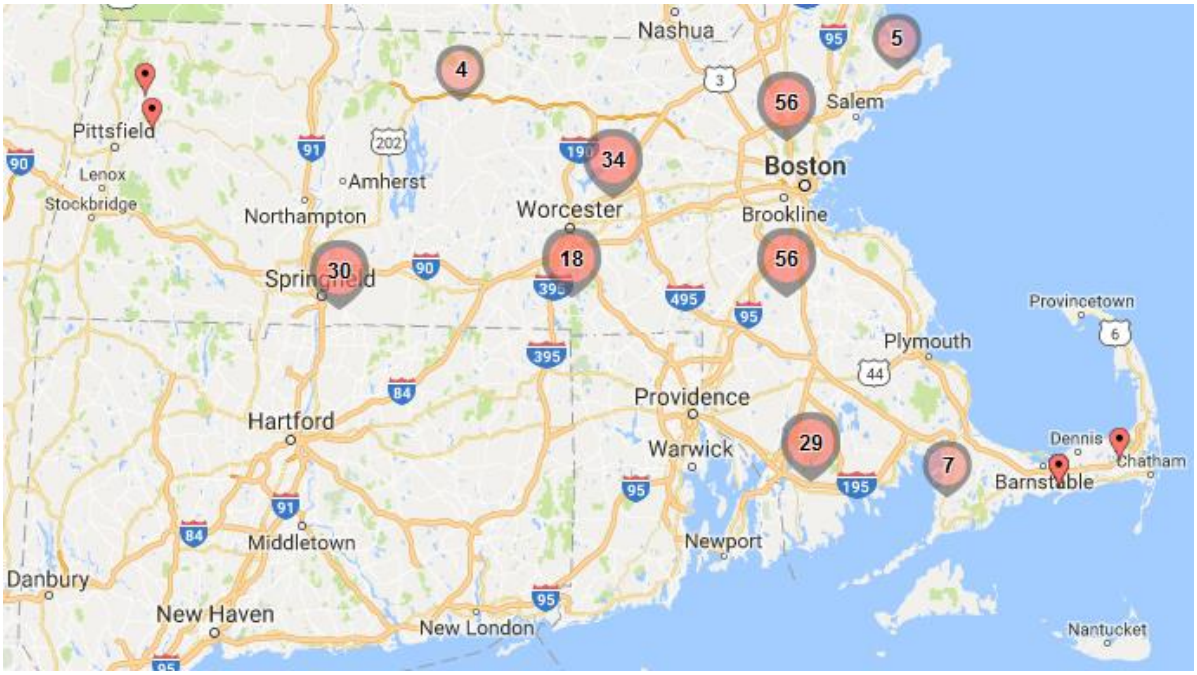


Figure 31: Massachusetts Survey Respondents

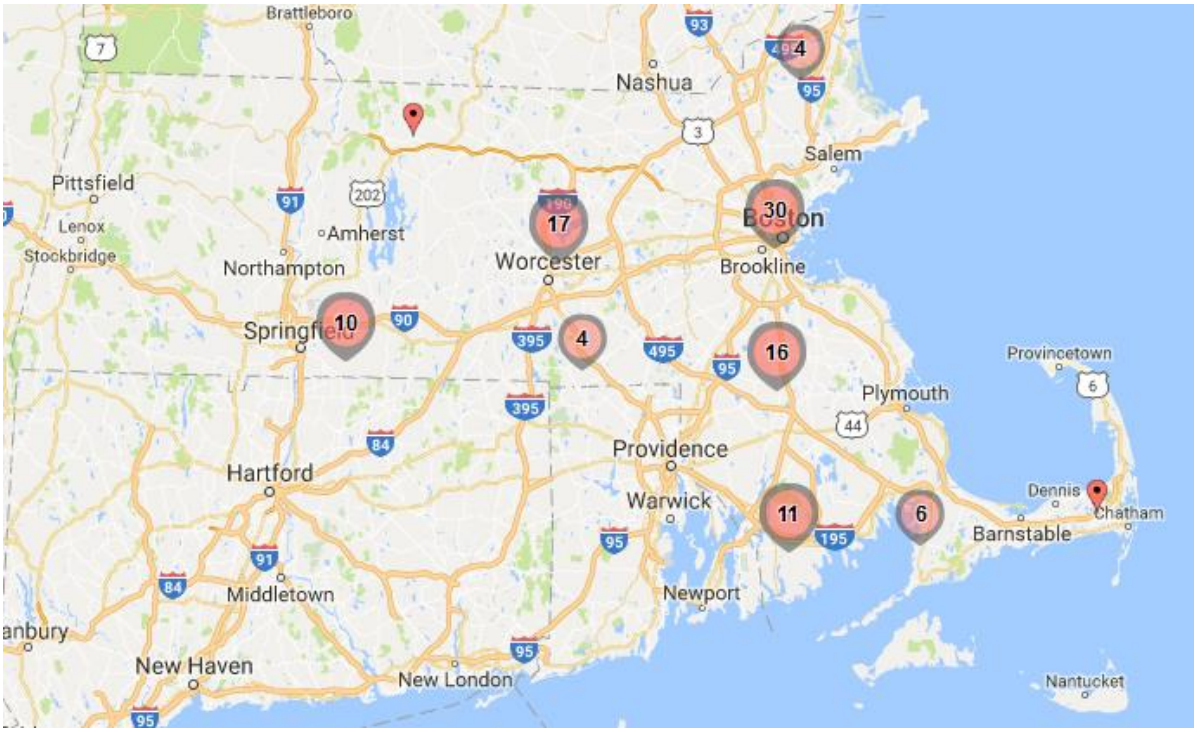


Figure 32: New York Lighting Purchasers

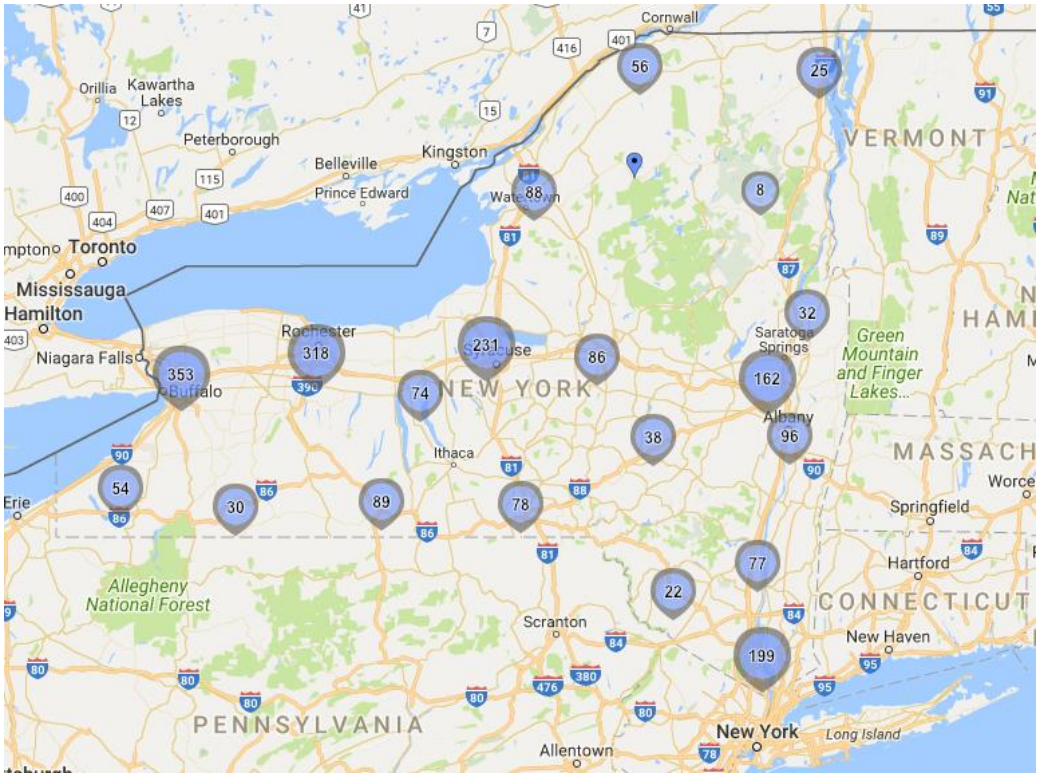
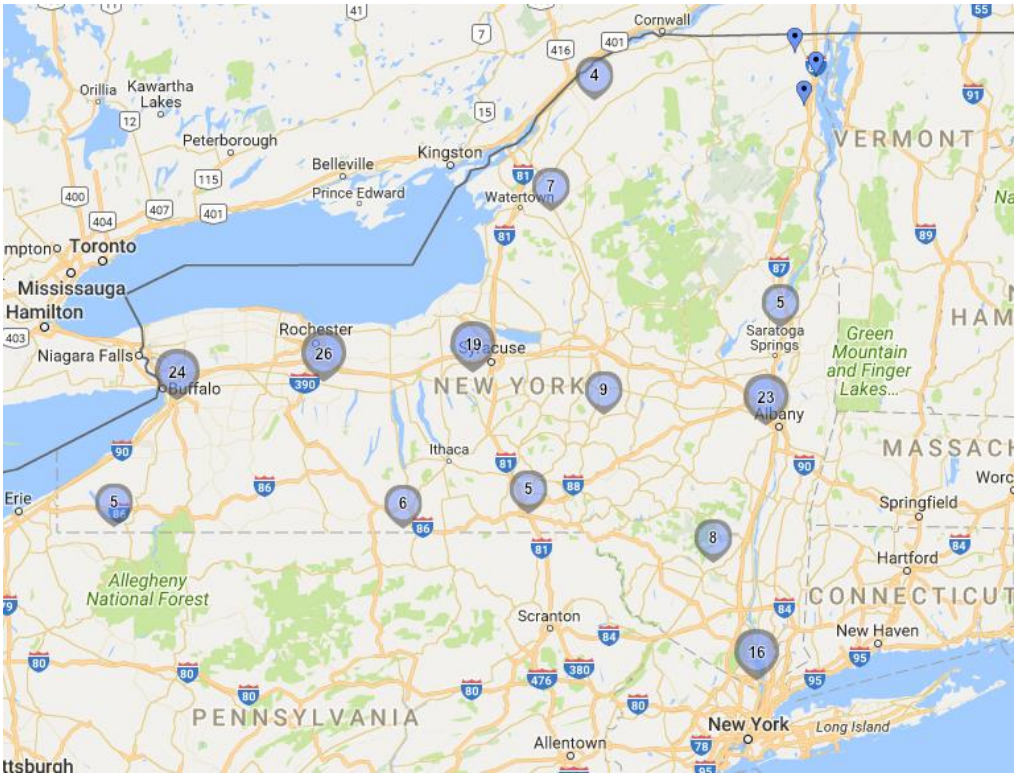


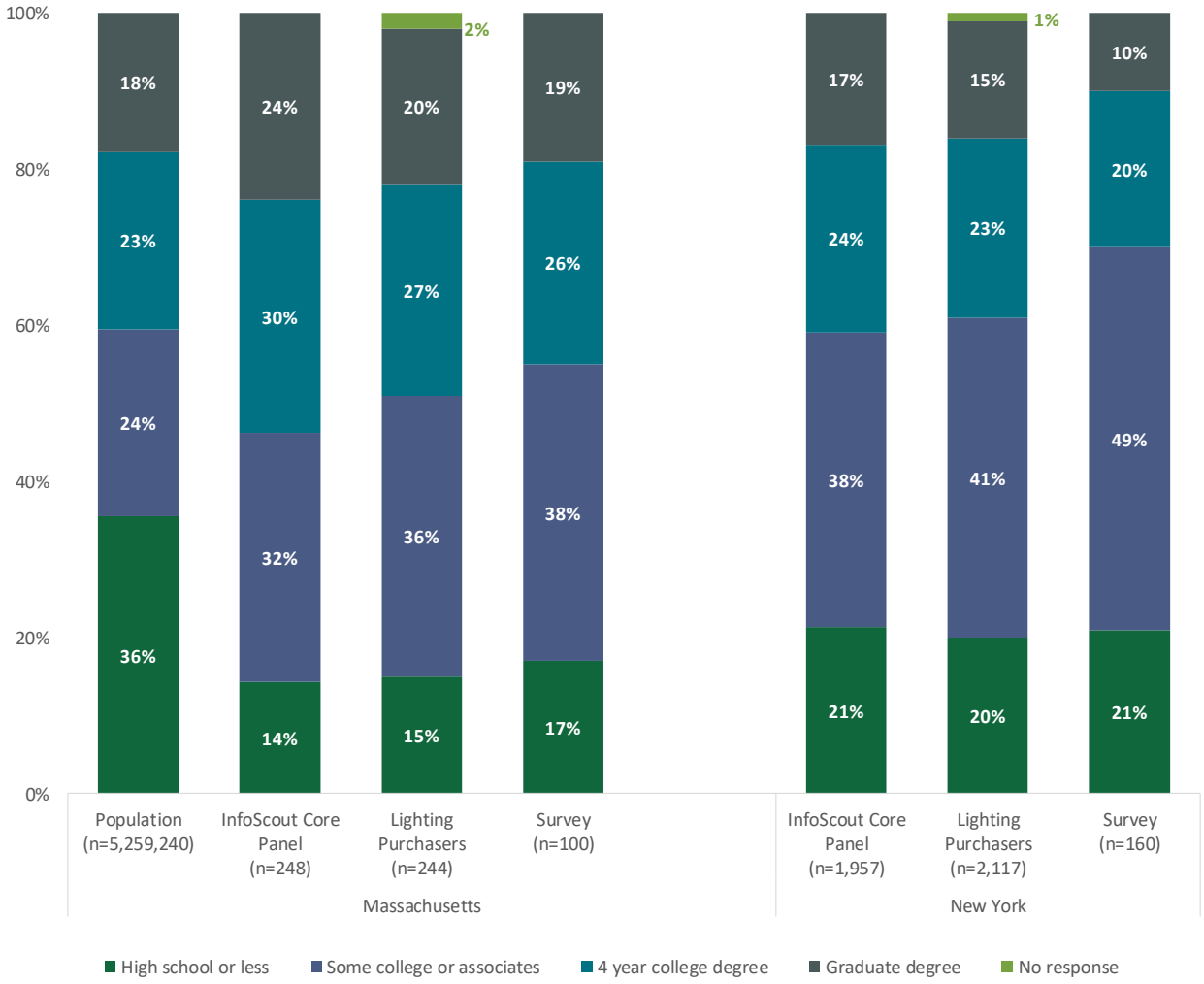
Figure 33: New York Survey Respondents



B.2 EDUCATIONAL ATTAINMENT

In Massachusetts, the InfoScout core panel and the InfoScout lighting purchasers under-represent those with a high school/GED education or less and those with a two-year degree or some college, with the difference largely made up by over-representation of those with a two or four-year college degree (Figure 34). The three InfoScout groups are similar within their respective states; with the exception of survey takers in New York, where there are few individuals with graduate or four-year degrees and more people with two-year degrees or some college.

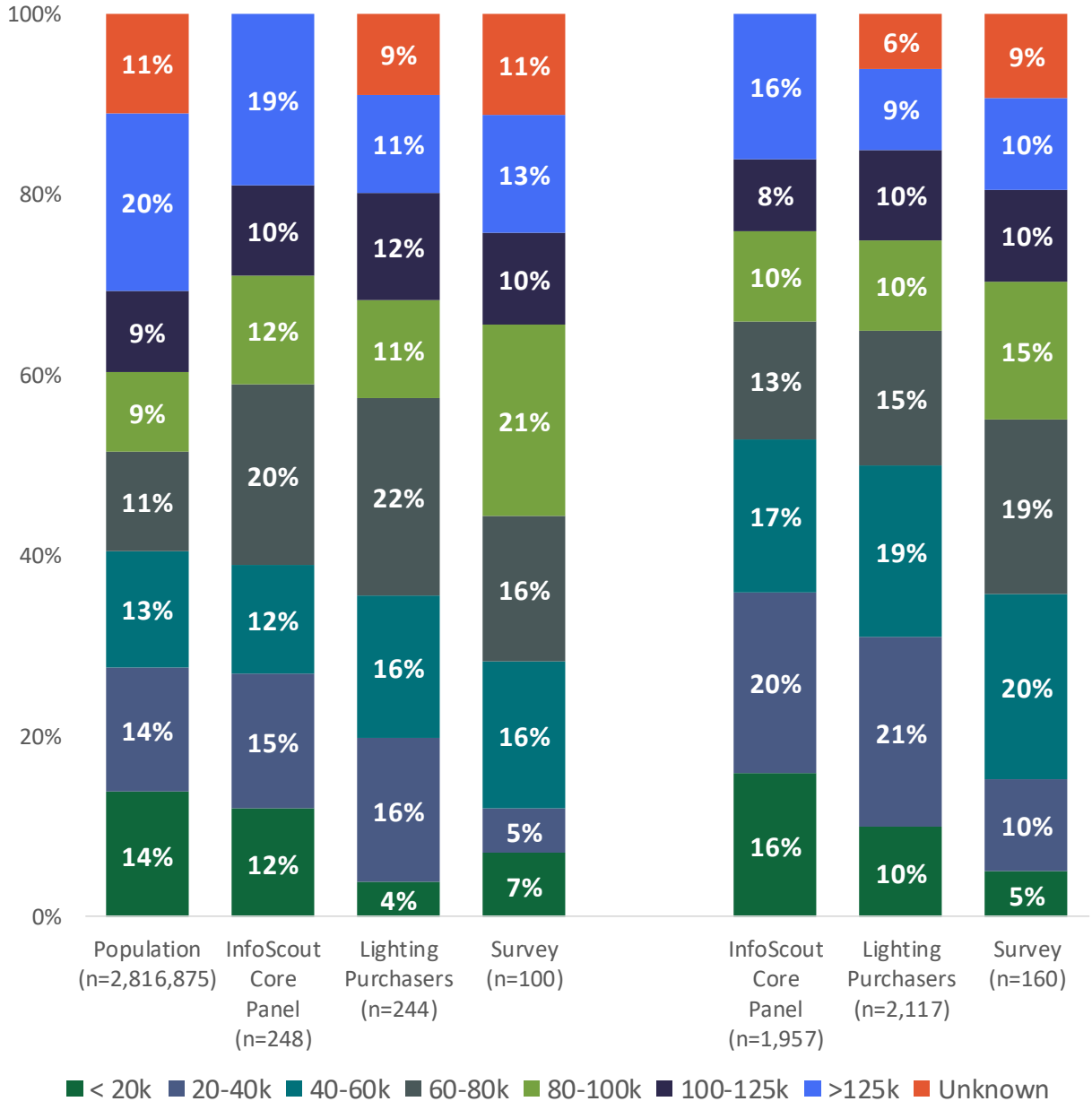
Figure 34: Educational Attainment*



B.3 HOUSEHOLD INCOME

Among InfoScout categories, survey respondents under-represent income groups under $40,000, and over-represent the $80,000-$100,000 income tier in both Massachusetts and New York. There is a fairly consistent proportion of each InfoScout sample in the income tier between $100,000 and $125,000, also a similar proportion to the Massachusetts statewide numbers.

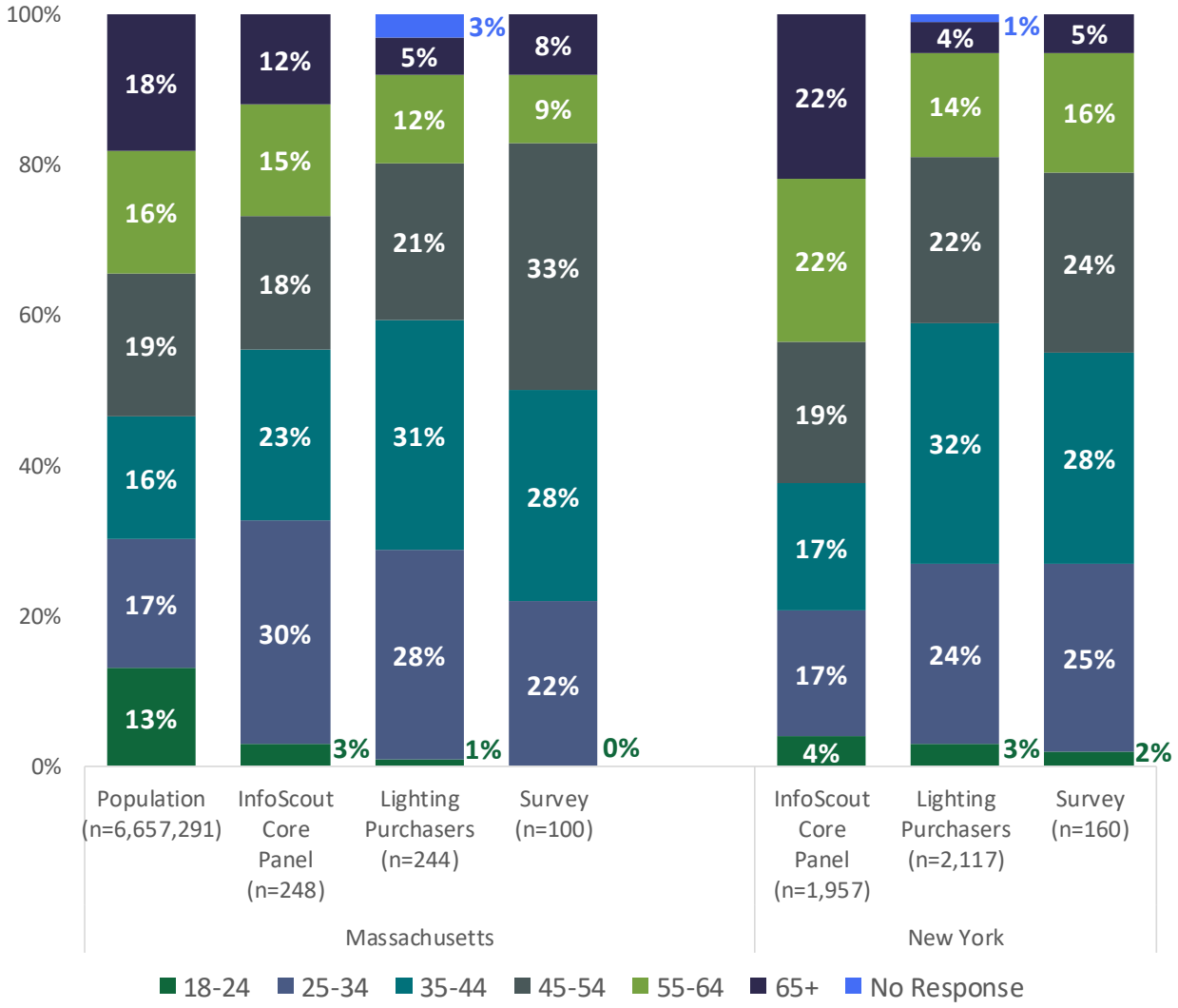
Figure 35: Household Income



B.4 AGE

The Massachusetts InfoScout categories consistently under-represent the youngest age bracket and over-represent the 25-34 and 35-44 groups, relative to the Census numbers (Figure 36). The survey population in Massachusetts over-represents the 45-54 age group, while the core panel and the lighting purchasers line up with the census numbers for that group. In New York, just 38% of the core panel is under 44 years old, while over half of the lighting purchasers and survey samples are under 44 years of age.

Figure 36: Age

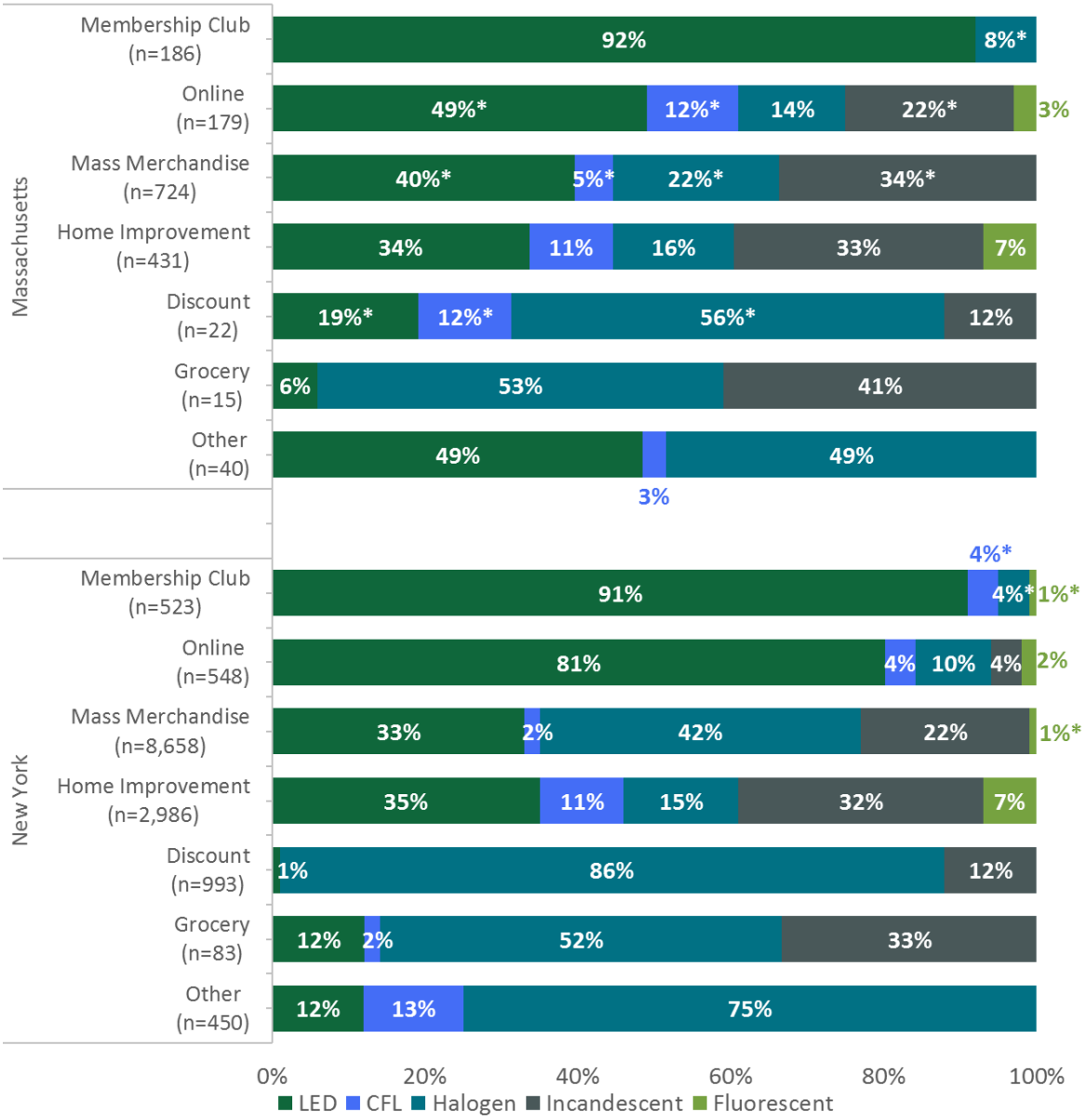


Appendix C Detailed InfoScout Analysis

This section provides detailed market share statistics for all bulb types in the InfoScout data, and then compares the lighting purchases of Massachusetts and New York panelists by the efficiency of the purchased lamp for several key demographic categories provided in the InfoScout data. As mentioned in earlier, the efficient lighting category includes CFL and LED bulbs, while the inefficient category includes incandescent and halogen lamps. We exclude fluorescent lamps since more efficient alternatives are not widely available at comparable prices for these sockets.

Figure 37 breaks down the market share for all bulb types by store channel; examining the share of incandescent, halogen, and fluorescent bulbs that make up the remainder of market share for each store type.

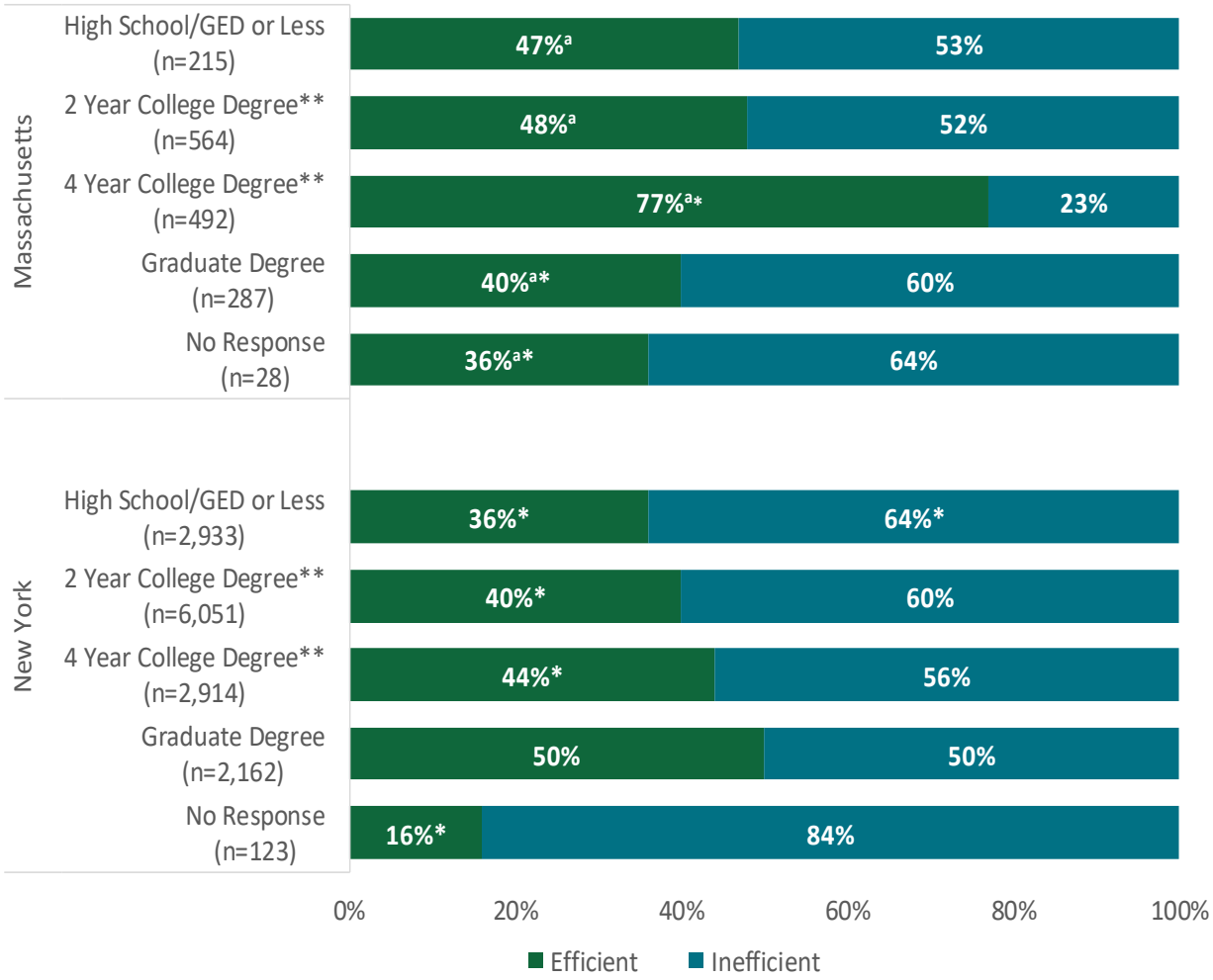
Figure 37: Detailed Market Share Statistics by Channel



C.1 EDUCATION

In Massachusetts, among panelists with a 4-year college degree, more than three out of every four bulbs purchased (77%) were efficient; significantly more than any other education group in Massachusetts and significantly more than New York purchasers with a 4-year college degree.

Figure 38: Efficient vs. Inefficient by State and Educational Attainment

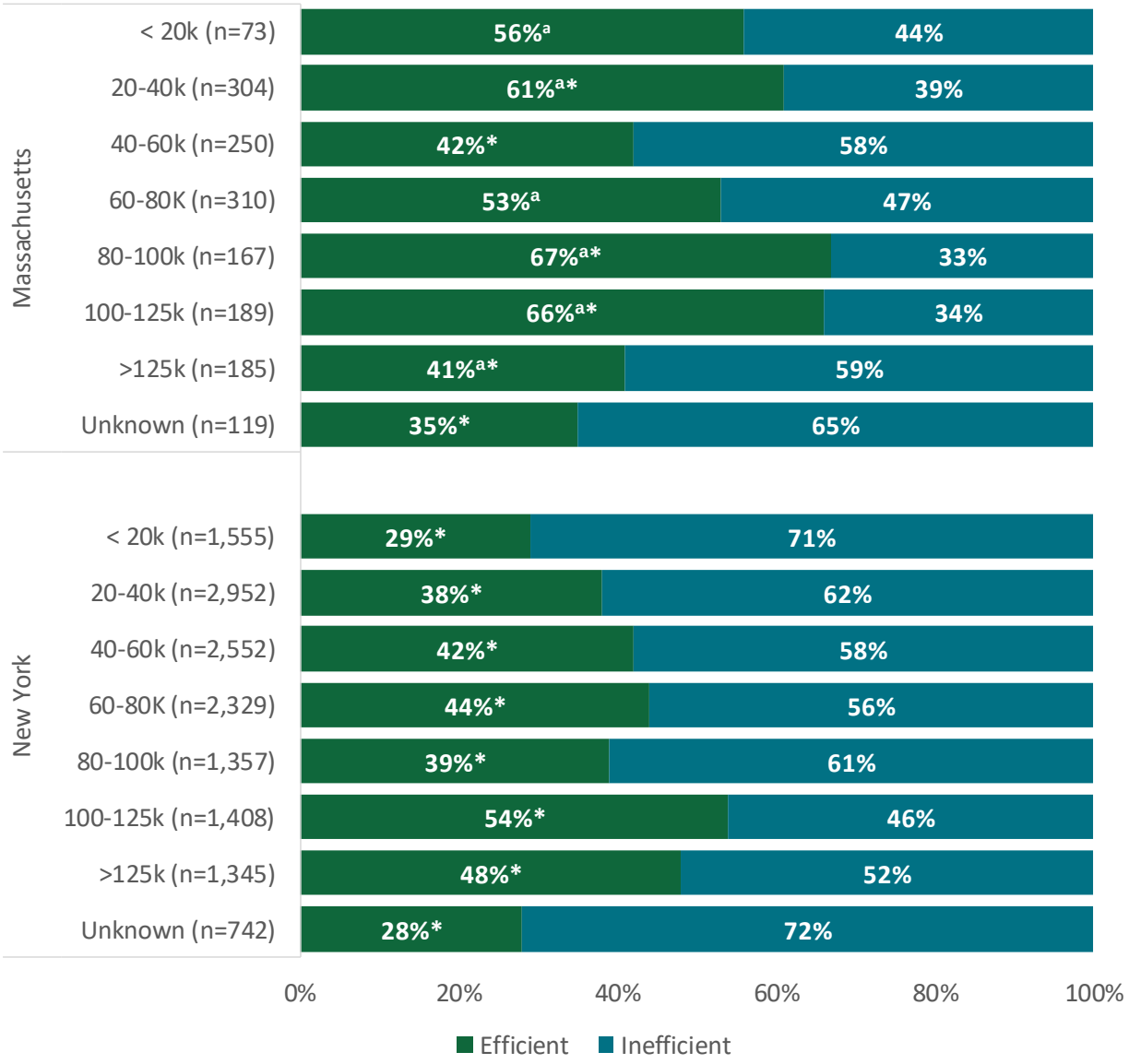


[a] Significantly different from New York 2017 (both efficient and inefficient) at the 90% confidence level.
*Significantly different from inefficient for this state and channel at the 90% confidence level.
**4-year College Degree includes responses of "Some Graduate School", while 2 Year College Degree includes responses of "Trade Technical Degree" and "Some College or University".

C.2 INCOME

In Massachusetts, panelists making between $80,000 and $125,000 and those making between $20,000 and $40,000 bought significantly more efficient bulbs than other income groups in Massachusetts and their counterparts in New York.

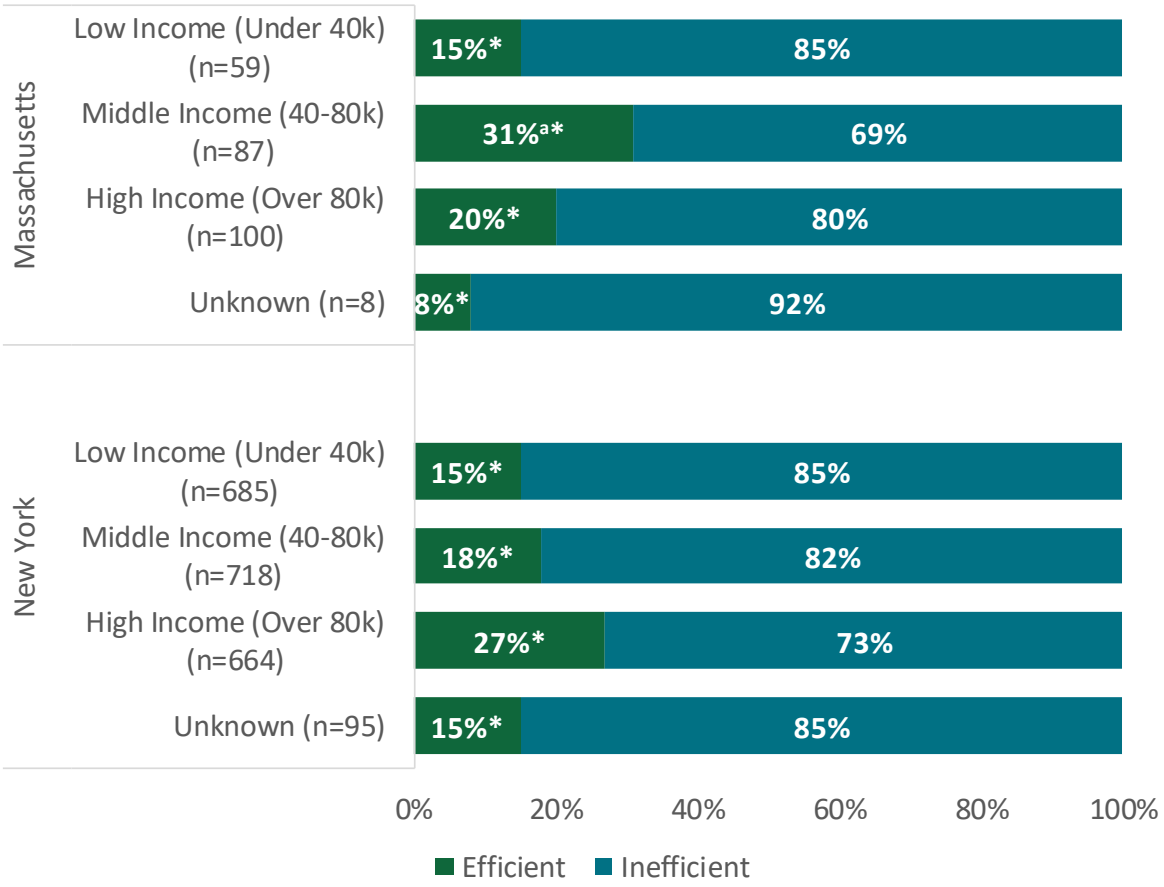
Figure 39: Efficient vs. Inefficient by State and Household Income



[a] Significantly different from New York 2017 (both efficient and inefficient) at the 90% confidence level.
* Significantly different from inefficient for this state and income group.

Figure 40 reveals that, when looking only at specialty bulbs[25], income level is a slightly stronger predictor of efficient bulb preferences in New York, but remains a weak predictor in Massachusetts.

Figure 40: Efficient vs. Inefficient Specialty Bulb Purchases by State and Income Level†



[a] Significantly different from New York 2017 (both efficient and inefficient) at the 90% confidence level.
*Significantly different from inefficient for this state and income group.
† Excludes A-line bulbs except colored bulbs, bug lights, and 3-way or dimmable, and excludes fluorescent tubes.

Table 23 looks at efficient purchases in Massachusetts by income group *and* store channel. All income groups purchased over 75% of lighting products at a combination of mass merchandise and home improvement stores except for those making under $40,000, where membership clubs were the source of 24% of lighting purchases. Mass merchandise stores were the most common channel for all income brackets except those making over $125,000, where hardware stores were the most popular channel.

[25] Specialty bulbs include: three-way bulbs of any kind, dimmable CFLs and fluorescents, circline fluorescents, non-A-line LED, incandescent and halogen bulbs, and non-twist/spiral CFLs.

Some interesting patterns emerged when looking at efficient purchases by each income group and by channel. In mass merchandise stores, the majority of panelists – those making between $40,000 and $125,000, more commonly made inefficient purchases, while mass merchandise stores were more common for those in groups under $40,000 and over $125,000 used mass merchandise store to purchase efficient bulbs more often. This pattern is reversed in hardware stores, where inefficient purchases were more common for low and very high-income panelists.

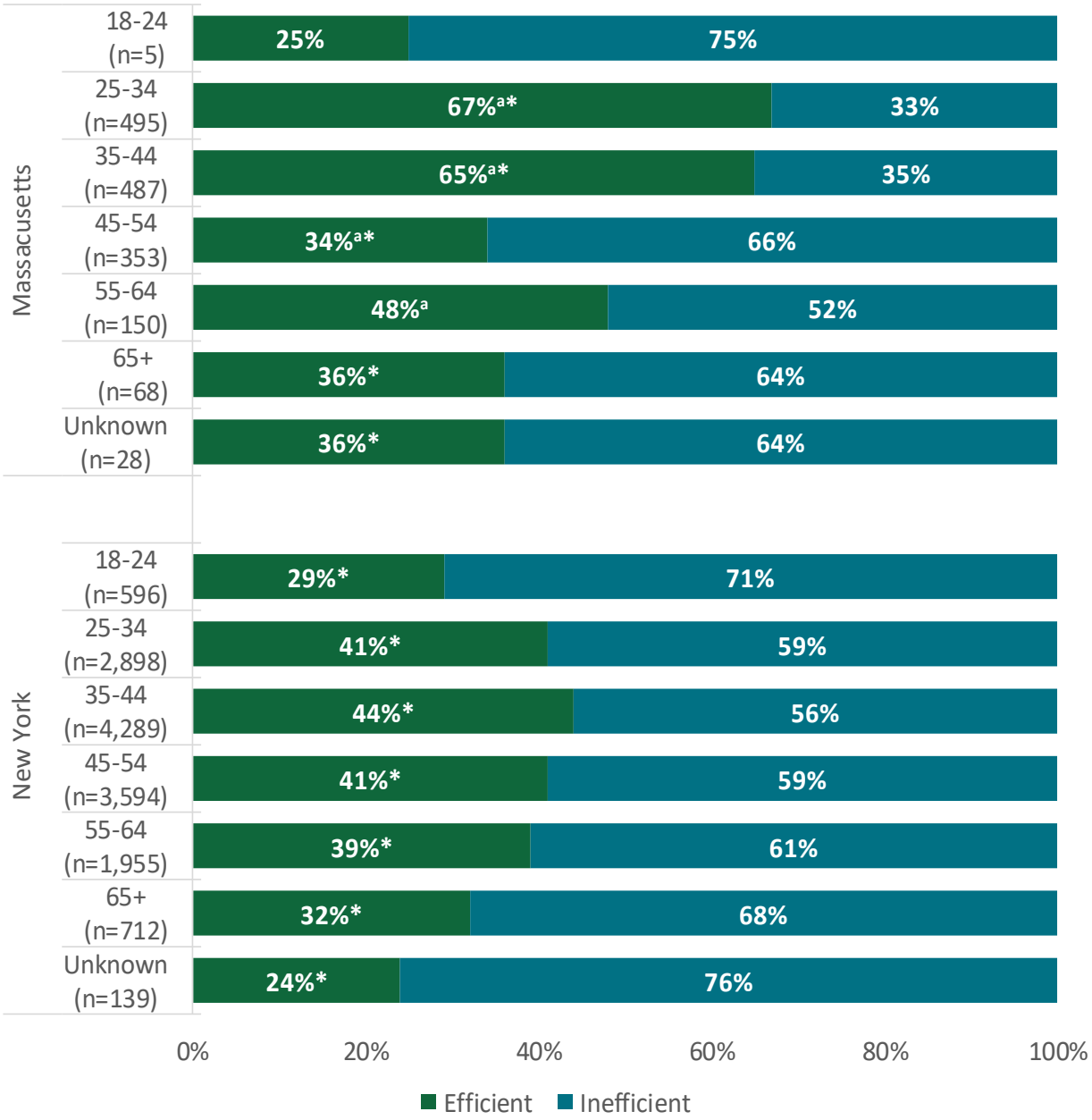
Table 23: Efficient vs. Inefficient by Income and Channel (MA only)[a]

	n	Mass Merch.	Home Imp.	Discount	Mem. Club	Online	Grocery	Other[b]
<$40k	**374**	**36%**	**23%**	**1%**	**24%**	**12%**	**3%**	**1%**
Efficient	259	38%	20%*	--	38%*	4%*	--*	--*
Inefficient	115	31%	29%	1%	4%	25%	7%	3%
$40k-80k	**557**	**53%**	**25%**	**2%**	**6%**	**10%**	**--**	**4%**
Efficient	260	35%*	30%*	--*	11%*	19%*	--	5%*
Inefficient	297	70%	21%	3%	2%	2%	1%	2%
$80k-125k	**356**	**42%**	**36%**	**1%**	**4%**	**15%**	**1%**	**1%**
Efficient	238	33%*	38%	1%	7%*	21%*	--	--*
Inefficient	118	61%	32%	--	--	3%	1%	3%
$125k+	**181**	**33%**	**56%**	**--**	**--**	**6%**	**2%**	**3%**
Efficient	68	57%*	36%*	--	--	2%*	--*	5%
Inefficient	113	14%	71%	--	--	10%	4%	1%

[a] This table sums across rows rather than columns. The row indicates the share of bulbs purchased in each channel by income group, and for the efficient and inefficient bulbs purchased by that income group.
[b] *Other* includes hardware, drug store, lighting and electronics, and miscellaneous channels, but not online channels.
* Efficient proportion significantly different from inefficient proportion for this income group and channel at the 90% confidence level.

Among Massachusetts lighting purchasers, those in the 25-34 and 35-44 age brackets purchased the greatest proportions of efficient bulbs – the only age groups to purchase more than 50% efficient bulbs in either Massachusetts or New York.

Figure 41: Efficient vs. Inefficient by Age

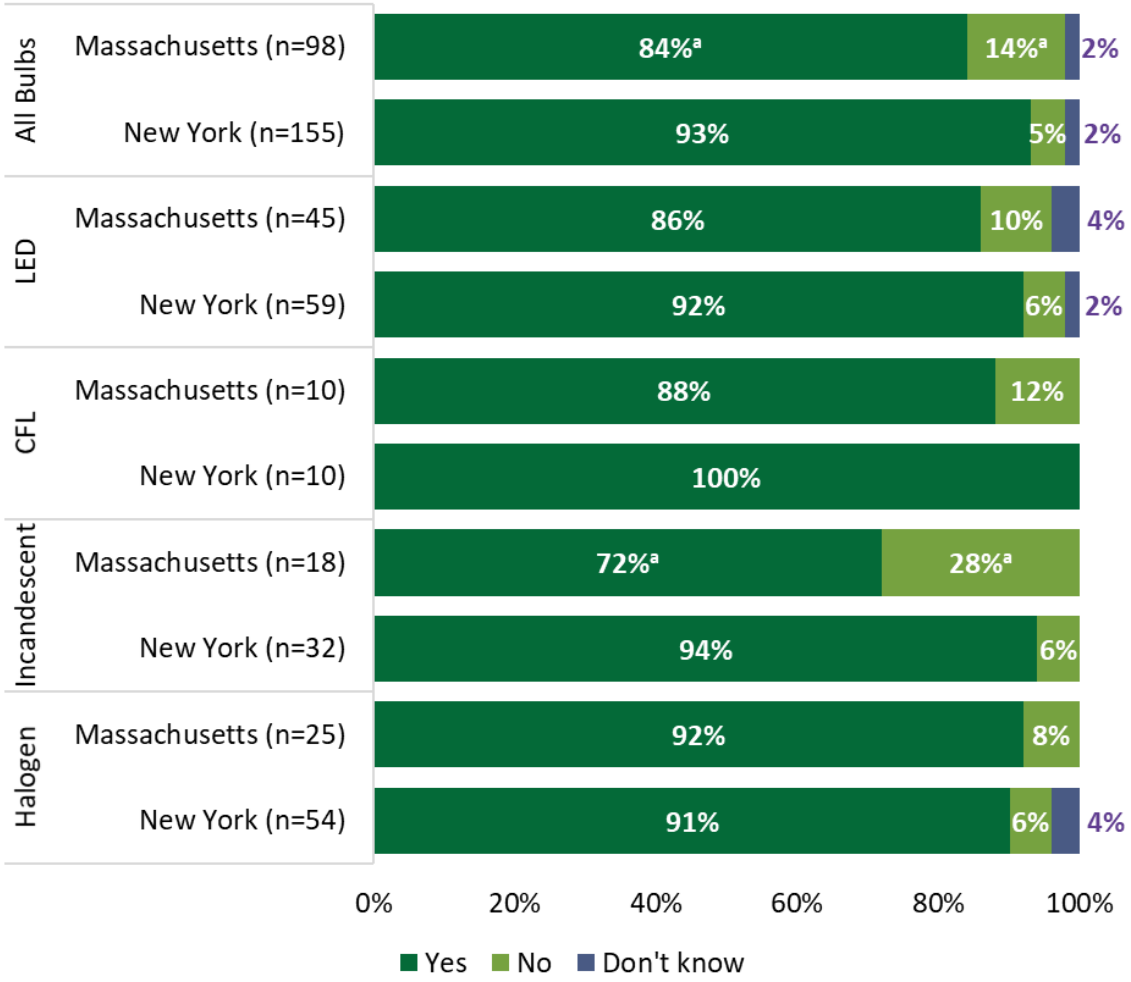


[a] Significantly different from New York 2017 (both efficient and inefficient) at the 90% confidence level.
*Significantly different from inefficient for this state and channel.

D Appendix D Detailed Purchase Planning

Independent of bulb type or efficiency of bulb purchased, 84% of Massachusetts respondents and 93% of New York respondents planned their purchase in advance (Figure 42). The difference between Massachusetts and New York respondents was primarily due to differences among incandescent bulb shoppers. Massachusetts incandescent purchasers were more likely to buy a bulb as an impulse purchase: only 72% of Massachusetts incandescent bulb shoppers planned to buy a light bulb before heading to the store, as opposed to 94% of New York incandecent shoppers. Among those who did not plan to buy a lightbulb, 39% of those in Massachusetts selected an LED bulb, while 38% selected an incandescent. Unplanned purchases in New York followed a similar trend: 35% of unplanned purchasers selected an LED and 44% selected an incandescent bulb.

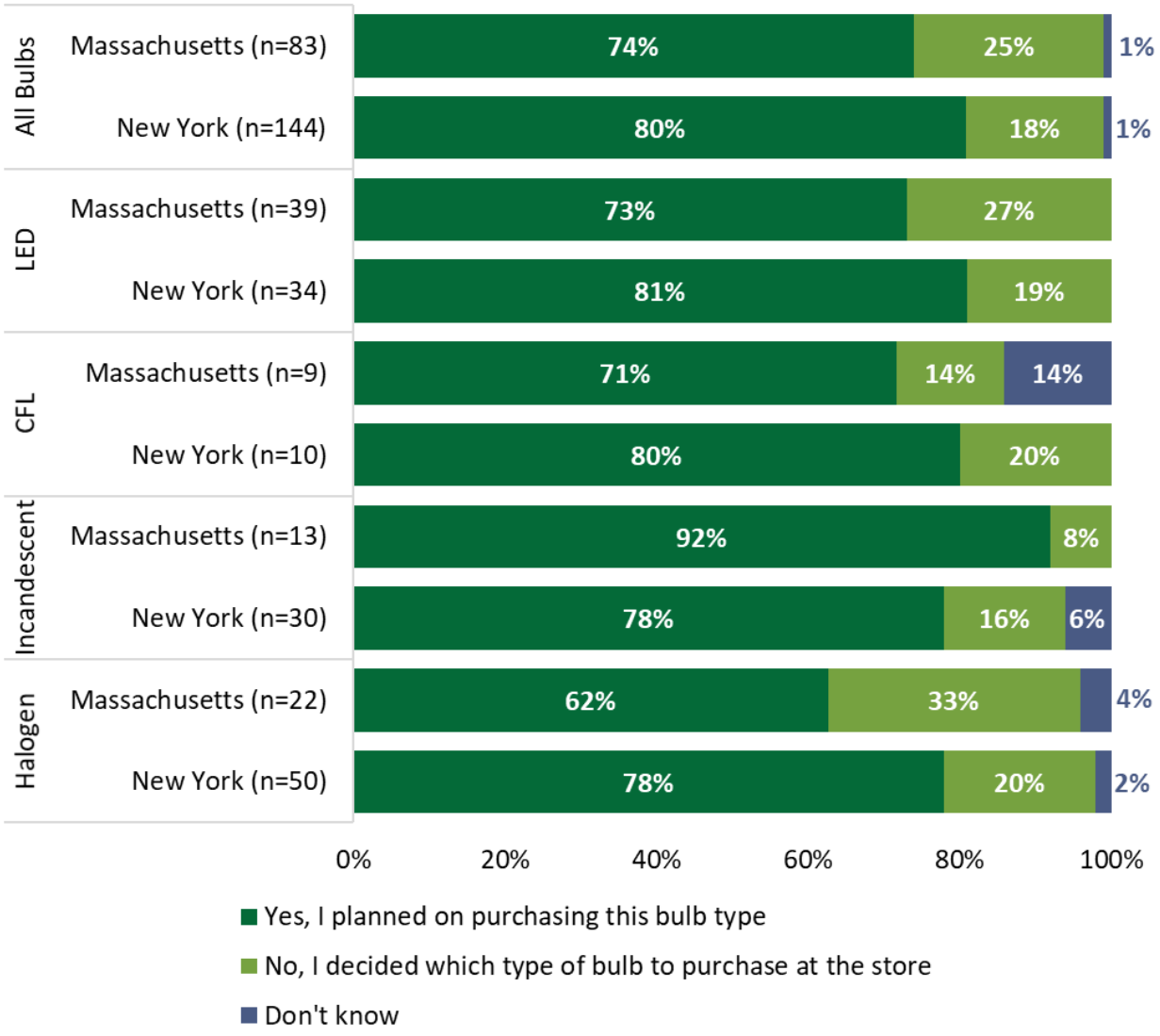
Figure 42: Planned to Buy a Bulb



[a] Significantly different from NY at the 90% confidence level.

Among the shoppers who had planned to buy a bulb before going to the store, more than three out of four (76%) had also determined which type of bulb to purchase in advance (73% in Massachusetts and 80% in New York). In Massachusetts, of those who ultimately purchased an incandescent bulb, the majority (92%) had planned to do so in advance. This suggests that incandescent light bulb purchasers in Massachusetts may strongly default to this choice, and that these shoppers may be more difficult to reach with PA-sponsored lighting programs (Figure 43).

Figure 43: Planned to Buy Bulb Type Purchased

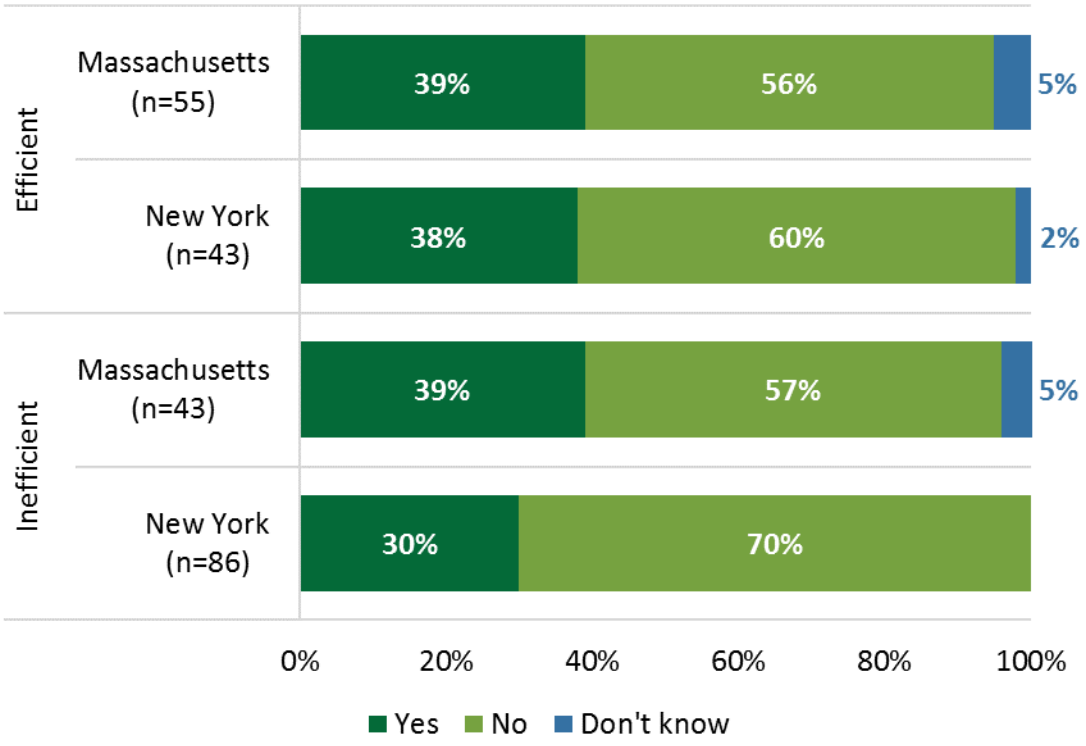


Appendix E Bulbs in Storage

Just over one-third of survey respondents in both Massachusetts (38%) and New York (34%) said that they had at least one bulb in storage in 2017. This was lower than the findings from the on-site visits in the 2016-2017 Lighting Market Assessment, where four out of five (83%) homes in the on-site study had at least one bulb in storage. The difference likely stems from respondent recall bias. However, it is possible that recent purchasers are less likely to have bulbs in storage, in which case this direction of self-selection for purchasers would be expected.

Roughly three-quarters of the respondents in each state who had stored bulbs said that they had checked to see if they had a similar bulb in storage before their shopping trip (77% in Massachusetts and 76% in New York); this did not differ between efficient bulb purchasers and inefficient purchasers (Figure 44).

Figure 44: Stored Bulbs



Appendix F RLPNC 17-12 InfoScout Survey Instrument

This survey asks a number of questions about your recent lighting purchase. Please answer the questions to the best of your ability. All of your responses will remain confidential.

[Note: Bulb purchase information including type and price will be pulled directly from survey respondent purchase data. Respondents will be asked about the bulb(s) they most recently purchased and scanned into InfoScout]

SHOPPING EXPERIENCE

S1. You submitted a receipt from [store name] on [date] for [$total]. On that trip, you bought [quantity] [bulb description] for [$item price]. Do you remember making this purchase?

1. Yes
2. Somewhat
3. Not sure
4. I definitely did not make this purchase

[IF S1=3, skip to SL4. IF S1=4, Terminate]

S2. Did you plan to buy a light bulb on your shopping trip to [store] on [date]?

1. Yes
2. No
3. Don't know

S2a. [IF S2=1] Did you plan to specifically purchase a [bulb type] type of bulb, rather than other lamp types like [CFL, Halogen, or Incandescent]?

1. Yes, I planned on purchasing this bulb type
2. No, I decided which type of bulb to purchase at the store
3. Don't know

S2b. [If S2a = 1] Did any of the following influence your decision to purchase a [bulb type] type of bulb? [MULTIPLE RESPONSE] [RANDOMIZE RESPONSES]

- ☐ Coupon
- ☐ Print advertisement
- ☐ Radio advertisement
- ☐ Online or email advertisement
- ☐ Television advertisement
- ☐ In-store signage on this or a previous shopping trip
- ☐ Advice from a store employee
- ☐ None of these

S2c. [If S2a = 1] Before you visited the store did you do any research on light bulbs to help make your decision on what type of bulb to purchase?

1. Yes
2. No
3. Don't know

S2d. [If S2c = 1] What resources did you use to research light bulbs to make your decision? [MULTIPLE RESPONSE] [RANDOMIZE RESPONSES]

- ☐ General online research
- ☐ A specific website [Specify: _____]
- ☐ Family or friends
- ☐ Conversations with store employees
- ☐ Other [Specify: _____]
- ☐ Don't know

S3. Before your shopping trip, did you have any bulbs in storage in your home?

1. Yes
2. No
3. Don't know

S4. [IF YES] Did you check to see if you had a similar bulb in storage?

1. Yes
2. No
3. Don't know

S5. Why did you buy light bulb(s) on that trip? [MULTIPLE RESPONSE] [RANDOMIZE RESPONSES]

- ☐ To replace a burned-out bulb
- ☐ Impulse buy
- ☐ It was on sale
- ☐ It was on my shopping list
- ☐ To have extra bulbs at home
- ☐ To change the energy efficiency of bulb in the fixture
- ☐ To change how the lighting looked
- ☐ Other [RECORD]

S6. Why did you purchase a [bulb type] bulb instead of some other bulb? [MULTIPLE RESONSE] [RANDOMIZE RESPONSES]

- ☐ Price
- ☐ Better value
- ☐ It was on sale/discounted
- ☐ It was a good value
- ☐ Appearance/shape
- ☐ Information or labeling on package
- ☐ Wanted this specific bulb type
- ☐ Lighting quality
- ☐ Long life
- ☐ It's the same bulb type that burned out
- ☐ It's energy efficient/had ENERGY STAR label
- ☐ It's my preferred bulb type
- ☐ Special features of this bulb [Specify: _____]
- ☐ Signs or marketing of the product at the store
- ☐ Advice from a store employee
- ☐ No particular reason
- ☐ Other [RECORD]

S7. Was there another bulb you considered on this shopping trip?

1. Yes
2. No
3. Don't know

S8. Was [bulb type] your first choice or did you consider other options?

1. First choice
2. Considered other options
3. Don't know

S9. [IF S8 = 2] What bulb type was your first choice? [RANDOMIZE]

1. LED [If bulb type <> LED]
2. CFL [If bulb type <> CFL]
3. Halogen [If bulb type <> Halogen]
4. Incandescent [If bulb type <> Incandescent]
5. Don't know

S10. [IF S8 = 1] Did you consider any other options? Select all that apply. [RANDOMIZE] [SELECT ALL THAT APPLY]

1. LED [If bulb type & S9 <> LED]
2. CFL [If bulb type & S9 <> CFL]
3. Halogen [If bulb type & S9 <> Halogen]
4. Incandescent [If bulb type & S9 <> Incandescent]
5. Don't know

S11. [IF PURCHASED CFL, HALOGEN, OR INCANDESCENT] Were you aware there are more efficient bulb choices available?

1. Yes
2. No
3. Don't know

S12. [IF S11=YES] Why did you purchase this bulb instead of a more efficient bulb? [MULTIPLE RESPONSE] [RANDOMIZE RESPONSES]

- ☐ Price
- ☐ Better value
- ☐ It was on sale/discounted
- ☐ It was a good value
- ☐ Appearance/shape
- ☐ Information or labeling on package
- ☐ Wanted this specific bulb type
- ☐ Lighting quality
- ☐ Long life
- ☐ It's the same bulb type that burned out
- ☐ It's energy efficient/had ENERGY STAR label
- ☐ It's my preferred bulb type
- ☐ Special features of this bulb [Specify: _____]
- ☐ Signs or marketing of the product at the store
- ☐ Advice from a store employee
- ☐ No particular reason
- ☐ Other [RECORD]

S13. If a [bulb type] had not been available during your trip, what type of bulb would you most likely have purchased instead? [RANDOMIZE RESPONSES]

1. [If bulb type <> LED] An LED bulb
2. [If bulb type <> halogen] A halogen bulb
3. [If bulb type <> incandescent] An incandescent bulb
4. [If bulb type <> CFL] A CFL bulb
5. Whatever is cheapest
6. I would not have purchased a bulb
7. Other [RECORD]

S14. Why would [S13 RESPONSE] have been your second choice? [MULTIPLE RESPONSE] [RANDOMIZE RESPONSES]

- ☐ Better value
- ☐ It was on sale/discounted
- ☐ It was a good value
- ☐ Appearance/shape
- ☐ Information or labeling on package
- ☐ Wanted this specific bulb type
- ☐ Lighting quality
- ☐ Long life
- ☐ It's the same bulb type that burned out
- ☐ It's energy efficient/had ENERGY STAR label
- ☐ It's my preferred bulb type
- ☐ Special features of this bulb [Specify: _____]
- ☐ Signs or marketing of the product at the store
- ☐ Advice from a store employee
- ☐ No particular reason
- ☐ Other [RECORD]

Use of Bulb

SL1. [If package quantity = 1] Where did you install this bulb? [SINGLE RESPONSE] [If package quantity > 1] Where have you installed bulbs from this pack? [SELECT ALL THAT APPLY]

1. My home/apartment
2. Someone else's home
3. Commercial space
4. Second home / vacation home
5. Not installed – in storage
6. Don't know

SL2. [IF SL1 = 4] Is your second home or vacation home located in Massachusetts?

1. Yes
2. No – outside of Massachusetts
3. Don't know

SL3. [IF SL1 = 2] You indicated that some of the bulbs were installed in someone else's home. Is that home located in Massachusetts?

1. Yes
2. No – outside of Massachusetts
3. Don't know

SL4. How difficult do you find it to choose an appropriate light bulb when shopping for one? [SCALE 1-5, WHERE 1 IS "Not difficult at all" AND 5 IS "Very difficult"]

SL5. [IF SL5 >4 or 5] What makes choosing an appropriate light bulb difficult? [Specify:_____]

SL6. Below is a list of information you might look for when shopping for light bulbs. Which of the following have you looked for when shopping for light bulbs? [RANDOMIZE] [SELECT ALL THAT APPLY]

1. Price
2. Wattage
3. Wattage equivalency
4. ENERGY STAR Label
5. Lumens or brightness
6. Bulb life
7. Shape/style
8. Energy efficiency
9. Other [Specify: _____]
10. Don't know

SL7. [IF SL6 <> 10] Which of these is most important in your selection of a light bulb? [IMPORT LIST FROM SL6]

SL8. [IF SL6 <> 10 & TWO CHOICES TAKEN] Which of these is the second most important in your selection of a light bulb? [IMPORT LIST FROM SL6 – REMOVE SELECTION FROM SL7]