MEMORANDUM

To: The Massachusetts Energy Efficiency Program Administrators and EEAC Consultants

From: Scott Walker, Michael Strom, David Barclay, Sam Manning, and Jayne Piepenburg, NMR Group

Date: February 17, 2016

Re: RLPNC: 16-3 Lighting Decision Making

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 continues to have a positive influence on the retail lighting market in Massachusetts. The results also provide insights into how the program can most effectively market itself going forward.

Objectives and Research Questions

The objectives of the current research are to determine what motivates consumers to purchase efficient lighting and what factors influence consumers to instead purchase inefficient lighting in Massachusetts and New York. More specifically, the research is designed:

- To identify factors that influence consumers' decisions to purchase efficient lighting and the barriers that lead 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 question is to understand the factors that influence efficient lighting purchases and why some consumers persist in purchasing inefficient alternatives.

APPROACH

The evaluation team utilized a novel approach by analyzing lighting purchase data and administering surveys to recent shoppers in Massachusetts and 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 the team access to many details about the type of lighting purchased by the panelists during the study period.

OVERALL ASSESSMENT

Program support for efficient residential lighting in Massachusetts continues to have clear, measurable impacts on consumers' likelihood to purchase efficient over inefficient technologies.

KEY FINDINGS

- Massachusetts lighting consumers are buying **more efficient bulbs at a lower cost** than their counterparts in New York across nearly all demographic categories and retail channels.
- Massachusetts consumers are, however, **still buying a large share of inefficient bulbs (roughly one-half of all purchases)**.
- **Efficiency and long life are the most important factors** to buyers of efficient lighting. Efficiency is especially valued by Massachusetts consumers. Consumers of inefficient lighting are more likely to be attempting to match their purchases to bulbs that have burned out.
- **Decisions** about what type of bulbs to purchase are typically **made in advance** of the shopping trip, especially for LED bulbs.
- **Retail channels like grocery and discount stores** sell a relatively small share of lighting overall, but a **disproportionately large share of inefficient bulbs**.
- Low-income consumers, compared to other income groups, are not buying a disproportionate share of lighting at hard-to-reach channels.

RECOMMENDATIONS

- Continue program support for efficient lighting.
- Do not focus messaging on particular socioeconomic groups.
- Pursue marketing messages outside of the retail environment.
- Pursue ways to change shelf-stocking practices of grocery and discount stores.

Section 1 Introduction

The residential lighting market is shifting rapidly due to technological advances coupled with 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 necessarily 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 item, which continually shows recall error and bias. This study introduces 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)[1], along with a survey of known lighting purchasers about their choices and preferences.[2] 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.

1.1 OBJECTIVES

- To identify factors that influence consumers' decisions to purchase efficient lighting and the barriers that lead 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 question seeks to understand the factors that influence efficient lighting purchases and why some consumers persist in purchasing inefficient alternatives.

1.2 REPORT ORGANIZATION

This report begins with the team's research methodology, followed by an analysis of data on bulb purchases during a 12-month period by InfoScout panelists in Massachusetts and New York. It then presents the findings of a survey of a subsample of these customers on their lighting decision-making. Appendix A details the demographic characteristics of the sample.

[1] 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.
[2] 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.

Section 2 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.[3] 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 2015 to August 2016.[4] The team chose New York as a comparison area because it presents a unique opportunity to understand how the residential lighting market has responded to the cessation of standard spiral CFL incentives in 2012 and essentially all upstream lighting incentives in 2014. The team then surveyed, through InfoScout's apps, a subsample of these lighting purchasers.

The purchase data include the date of purchase; name and location of the store; demographic and geographic data on the purchaser;[5] 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."

The team 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.[6] The filtered dataset included the following:

- 1,632 unique purchasers/panelists (406 in MA and 1,226 in NY, 51% and 30%, respectively, of the total InfoScout panels in each state), who made
- 3,654 individual shopping trips that included a lighting purchase (816 in MA, 2,838 in NY), which represent
- 13,124 light bulbs (3,094 in MA and 10,130 in NY).

[3] http://www.infoscout.com
[4] 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.
[5] Including age, income, ethnicity, education, household size, and ZIP code
[6] 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.

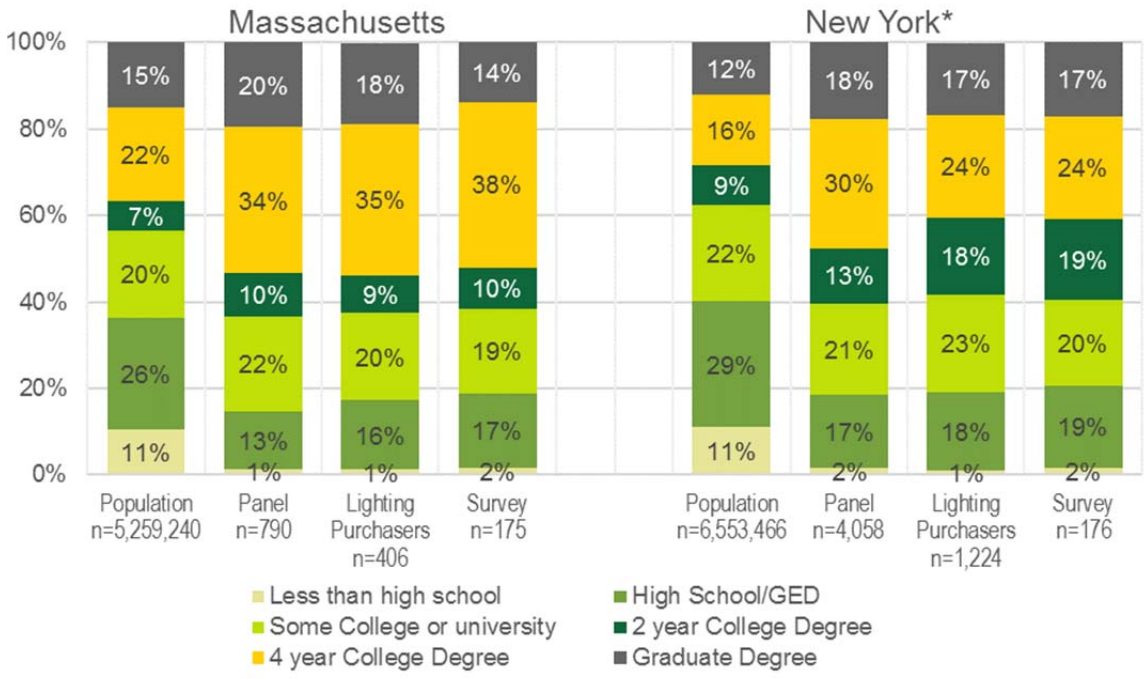
Survey

The team 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 initial quota of respondents was 100 in Massachusetts and 175 in New York, though InfoScout ultimately surveyed 351 respondents (175 in MA and 176 in NY).

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.[7] Even so, as shown in Appendix A, InfoScout's panelists in Massachusetts and New York are broadly representative of the general population. The panel does under-represent, however, persons with a high school education or less (Figure 1). To compensate for minor demographic differences, the team weighted the results by the state and educational attainment of the panelists (Table 1). 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 those states. We present all subsequent results weighted according to the scheme shown in Table 1.

Figure 1: Educational Attainment



*All of New York state (including New York City and Long Island).

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

Table 1: Weighting Scheme

	General Population*	InfoScout Panel	Weight
Massachusetts	**6,705,586**	**790**	
Less than high school	707,896	11	11.7631
High School/GED	1,731,053	104	3.0508
Some College or university	1,353,729	175	1.4250
2-year College Degree	447,814	78	1.0523
4-year College Degree	1,453,152	268	0.9972
Graduate Degree	1,011,943	154	1.2073
New York	**19,673,174**	**4,058**	
Less than high school	2,164,884	65	6.1279
High School/GED	5,722,401	686	1.5335
Some College or university	4,386,763	860	0.9371
2-year College Degree	1,816,425	519	0.6427
4-year College Degree	3,195,551	1213	0.4840
Graduate Degree	2,387,150	714	0.6143

*From ACS 5-year estimates. New York excludes New York City and Long Island.

Section 3 Analysis of Recent Bulb Purchase Data

This section presents analysis of the data on bulbs purchased in a 12-month period (August 2015 to August 2016) by InfoScout's panelists.

3.1 INFOSCOUT BULB PURCHASE DATA

As noted above, the filtered dataset of lighting purchases made by InfoScout's panelists in Massachusetts and New York includes the following:

- 1,632 unique purchasers/panelists (406 in MA and 1,226 in NY, 51% and 30%, respectively, of the total InfoScout panels in each state), who made
- 3,654 individual shopping trips that included a lighting purchase (816 in MA, 2,838 in NY), which represent
- 13,124 light bulbs (3,094 in MA and 10,130 in NY).

For comparison, Table 2 shows data from the 2015-16 Lighting Market Assessment, which included on-site visits in Massachusetts and New York from December 2015 to March 2016. Massachusetts on-site participants purchased an average 11.8 bulbs each in the previous year versus an average of 7.6 for the InfoScout panelists. In New York, on-site participants averaged 9.7 and InfoScout panelists 8.3.

Table 2: Type of Light Bulbs Obtained in Past Year – Panel On-site Visits

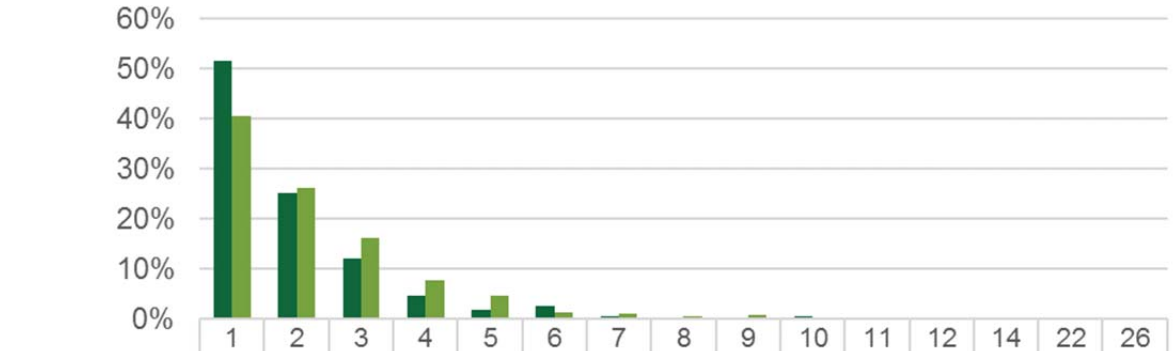
Bulb Type Purchased	Massachusetts			New York*		
	# of bulbs	% of bulbs	% of HHs	# of bulbs	% of bulbs	% of HHs
Total	*3,202*	-	*n=270*	*776*	-	*n=80*
Incandescent	1,045	33%	70%	349	45%	71%
CFL	861	27%	70%	219	28%	54%
LED	863	27%	43%	101	13%	25%
Halogen	329	10%	30%	71	9%	28%
Fluorescent	98	3%	14%	37	5%	8%
DK	7	<1%	2%	0	0%	0%
None	-	-	7%	-	-	11%

*Base: Panel sites only; installed and stored bulbs obtained within the past year.
*Not including one outlier who purchased 150 halogen bulbs.

3.1.1 Purchase Trips

Nearly one-half of the overall panelists made only a single shopping trip during the 12-month period that included a lighting purchase (Figure 2). Eight percent made five or more trips to buy lighting, with a maximum of 26 trips by one panelist. Over three-quarters of purchases included five bulbs or fewer (77%), with 92% including 10 or fewer.

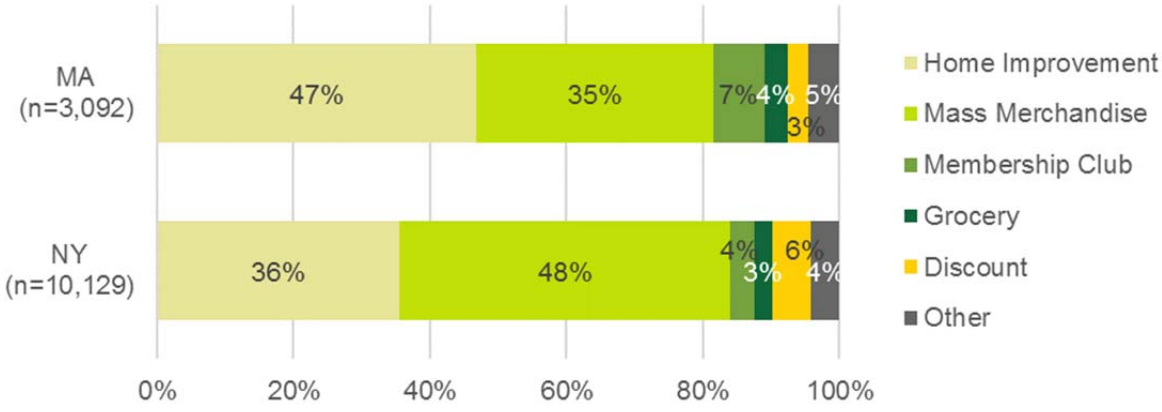
Figure 2: Number of Purchase Trips by Panelist



	1	2	3	4	5	6	7	8	9	10	11	12	14	22	26
MA (n=816)	52%	25%	12%	5%	2%	3%	1%	0%	0%	0%	0%	0%	0%	0%	0%
NY (n=2,838)	40%	26%	16%	8%	5%	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%

A distinct advantage of the InfoScout data is that they include records of purchases at a broad range of retail channels, including (but not limited to) the large home improvement and mass merchandise as well as chain grocery, drug, and hardware stores. The dataset also includes discount[8] and other retailers[9] that the PAs target for the hard-to-reach (HTR) component of the program. The home improvement and mass merchandise channels were the most popular sources for light bulbs by far, with 83% of bulbs overall coming from one or the other. Figure 3 shows that the popularity of these channels extended to both states, though the relative shares are roughly switched (47%/35% home improvement vs. mass merchandise in Massachusetts, 36%/48% in NY).

Figure 3: Bulbs Purchased by Channel*

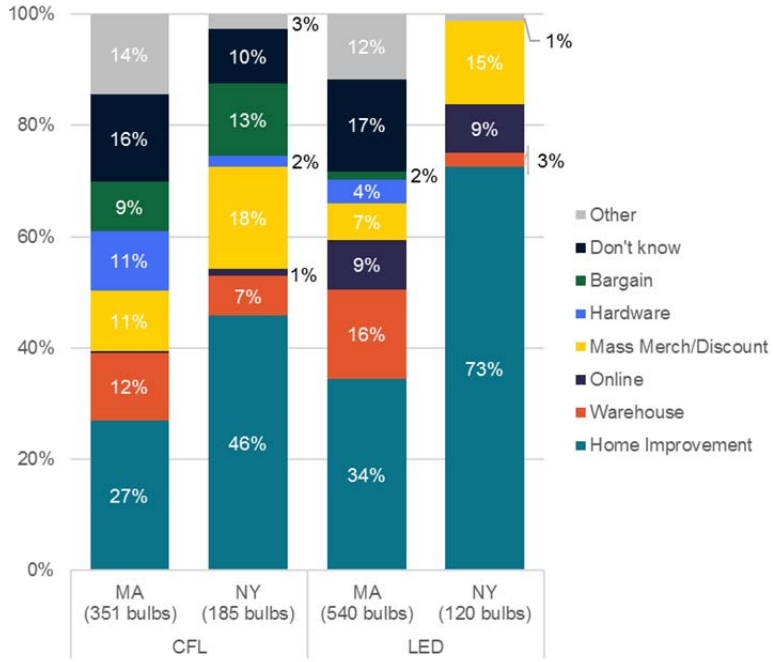


* *Other* includes hardware, drug, lighting and electronics, and miscellaneous stores, as well as online purchases.

[8] Discount store channels includes dollar store chains.
[9] Other retailers aggregated: online, hardware, drug store, lighting and electronics, and "other" (e.g., ethnic grocers and bodegas) store channels deemed by InfoScout data.

For comparison, Figure 4 represents the sources of CFL and LED bulbs purchased by participants in the 2015-2016 Lighting Market Assessment. As for the InfoScout panelists, Home Improvement is the dominant channel in Massachusetts. Home Improvement stores are also the largest source of bulbs for the New York on-site panelists, instead of Mass Merchandise as in the InfoScout data.

Figure 4: Store Channel for Bulbs Purchased by 2015-2016 On-site Panelists



*Base: All LED/CFL bulbs purchased or obtained within the past year by panelists

3.1.2 Lighting Technology and Price

This section explores the bulb types that InfoScout panelists purchased in Massachusetts and New York. We also examine price differences between the states to measure the influence of program support.

Table 3 compares the proportions of purchases by lighting type in Massachusetts and New York. **Massachusetts panelists bought a significantly larger share of efficient bulb types** (45% CFL or LED) than New York panelists (30%). **Nearly one-half of bulbs purchased by Massachusetts panelists, however, were inefficient** (incandescent or halogen), and more than one-quarter were incandescent, even though general service A-line incandescents can no longer be manufactured or shipped into the United States.[10] For comparison, we include results from the 2015-2016 Lighting Market Assessment, which included visits to homes in both Massachusetts and New York during the period from December of 2015 to March of 2016. Specifically, the on-site data represent installed or stored bulbs verified as being newly obtained between visits to the on-site panelists' homes. The on-site data reveals larger efficient bulb shares in both states compared to the InfoScout data, but again identifies Massachusetts consumers as buying more efficient bulbs than New York consumers.

Table 3: Purchased Bulbs by Lighting Technology

	Massachusetts InfoScout	New York InfoScout	Massachusetts On-sites	New York On-sites
	n=3,092	n=10,129	n=3,202	n=776
CFL	20%*	14%	27%	28%
LED	25%*	16%	27%**	13%
Halogen	22%*	30%	10%	9%
Incandescent	27%*	34%	33%**	45%
Fluorescent	6%	6%	3%**	5%

*Significantly different between MA and NY InfoScout at the 90% confidence level.
**Significantly different between MA and NY On-sites at the 90% confidence level.

Figure 5 represents market share estimates for Massachusetts, New York, Connecticut, and the entire United States. This information was derived from the RLPNC 16-5 Sales Data Estimate Memorandum. The market share estimates in Figure 5 come from IRI panel data for the year 2015. The market estimates for LED bulbs in MA are slightly lower than the InfoScout panel and the on-site visits, while the NY estimates align similarly between all three sources. CFL estimates (23%) for MA fall in between the InfoScout (20%) and on-site (27%) bulb share. The sales data estimate (30%) for CFL bulbs in NY is more aligned with the on-site (28%) data compared to the InfoScout purchasing data (14%). The market share estimate for incandescents in both MA and NY are noticeably lower than estimates from on-site visits as well as InfoScout lighting panel.

Figure 5: 2015 Bulb Market Share in US, MA, NY, and CT

(Source: Adjusted IRI Panel Data, includes all retail channels)

[10] Although Congress has decided not to allocate budget to enforce this aspect of the first EISA phase-out.

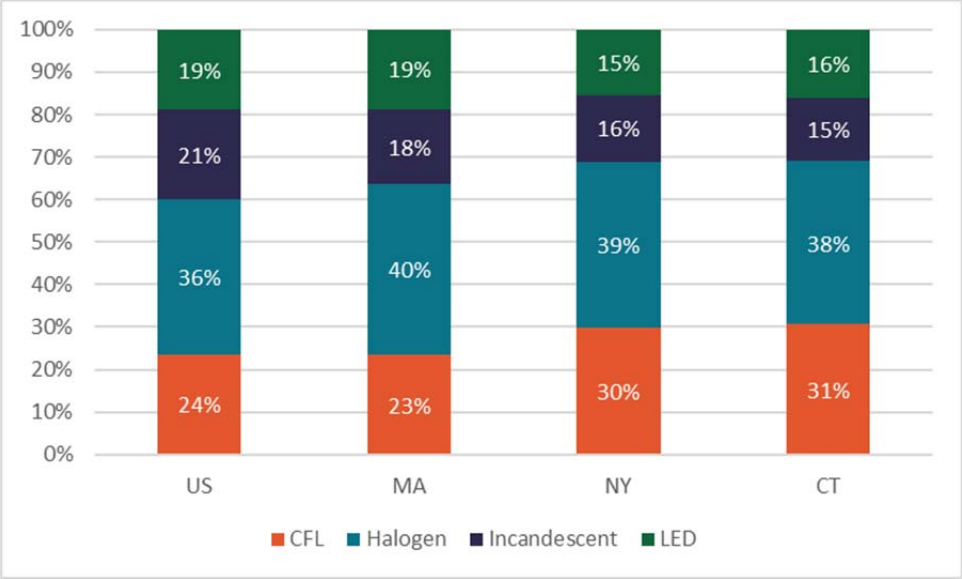


Table 4 compares the average price per bulb for each lighting technology in Massachusetts and New York. **The Massachusetts purchases clearly show the influence of program incentives: efficient bulbs were substantially less expensive in Massachusetts than in New York, and inefficient types were more expensive**. Both LED and CFL bulbs were $0.72 less expensive, on average, in Massachusetts compared to New York. Inefficient types proved to be more expensive in Massachusetts than New York, with an average price difference of $0.35 for halogen bulbs and $0.29 for incandescents.

Table 4: Price by Lighting Technology

	Massachusetts	New York
	Average Cost n=3,092	Average Cost n=10,129
CFL	$1.39*	$2.11
LED	$2.53*	$3.25
Halogen	$2.00*	$1.65
Incandescent	$1.42*	$1.13
Fluorescent	$4.32*	$2.65

*Significantly different from NY at the 90% confidence level.

Table 5 compares the average lumen output by bulb type as well as the average cost per lumen. LED bulbs in MA had a significantly lower price per lumen than in NY, supporting the lower cost per bulb seen in Table 4. Price per lumen and lumen output were similar between MA and NY for other bulb types, with the exception of the lumen output for incandescent bulbs, which was higher in Massachusetts.

Table 5: Average Lumens and Price per Lumen

	Massachusetts		New York	
	Avg. Cost Per Lumen	Avg. Lumens	Avg. Cost Per Lumen	Avg. Lumens
	n=876[a]		n=2,171[a]	
CFL	$.01140	941	$.01110	902
LED	$.00771*	769	$.01059	730
Halogen	$.00651	930	$.00560	1044
Incandescent	$.00634	862*	$.00684	693
Fluorescent	$.00450	2403	$.00388	2246

[a]Lumen output data not available for all bulbs.
*Significantly different from NY at the 90% confidence level.

To provide a more apple-to-apples comparison, Table 6 shows a breakdown of average prices for only A-line-shaped bulbs (including twist/spiral CFLs). As above, we find that both CFL and LED A-line bulbs were less expensive in Massachusetts ($1.42 CFL/$2.44 LED) than in New York ($1.96 CFL/$3.13 LED). The average lumen output is significantly higher for the A-line LEDs purchased in Massachusetts.

Table 6: Price and Lumen Output of Standard A-Line Bulbs by Lighting Technology[a]

	Massachusetts		New York	
	Avg. Cost n=1,772	Avg. Lumens[b] n=473	Avg. Cost n=5,631	Avg. Lumens[b] n=908
CFL	$1.42*	962	$1.96	974
LED	$2.44*	983*	$3.13	837
Halogen	$1.40*	686*	$1.12	806
Incandescent	$1.19*	1139	$0.85	1161

[a] Excludes products without Bulb Shape information and specialty types such as colored bulbs and bug lamps. Does include dimmable and 3-way bulbs. CFLs include twist/spiral and A-line shapes.
[b] Lumen output data not available for all bulbs.
*Significantly different from NY at the 90% confidence level.

Only a small share of the product descriptions in the InfoScout data included ENERGY STAR certification, but by matching the purchase records against internal NMR databases of ENERGY STAR-certified bulbs, we were able to identify whether roughly one-third of the total LEDs purchased in each state qualified for the ENERGY STAR[11] certification.[12] Table 7 shows an equal share of 43% ENERGY STAR-certified LEDs purchased in Massachusetts and New York. This is a similar result to our findings in the 2015-2016

[11] Based on ENERGY STAR standard 1.0.
[12] NMR's databases draw upon information from webscraping from major retailers' web sites, with confirmation from the ENERGY STAR logo found on packages during the shelf stocking study.

Lighting Market Assessment for LEDs purchased in the previous year in New York, but falls short of the 70% ENERGY STAR share found in Massachusetts homes in that study. Our upcoming report on shelf-stocking practices in Massachusetts and New York will provide more data on the relative availability of ENERGY STAR LEDs in the two states.[13]

Table 7: ENERGY STAR-Certified LED Bulbs

	Massachusetts InfoScout	New York InfoScout	Massachusetts On-sites	New York On-sites
	n=228	n=608	n=1,580	n=361
ENERGY STAR Certified	43%	43%	70%*	47%
Not ENERGY STAR Certified	57%	57%	30%*	53%

*Significantly different between MA and NY On-sites at the 90% Confidence level.

3.1.3 Efficient vs. Inefficient Lighting Purchases

This section compares the lighting purchases of Massachusetts and New York panelists by the efficiency of the purchased lamp. **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. We also include survey questions targeted at purchasers of inefficient bulbs, which we discuss below in Section 4.

As shown in Table 2, Massachusetts consumers bought more efficient lighting than New Yorkers, though efficient lighting still accounted for less than one-half of total purchases (Table 8).

Table 8: Efficient vs. Inefficient by State

	Massachusetts	New York
	n=2,921	n=9,452
Efficient Lighting	48%*	32%
Inefficient Lighting	52%*	68%

*Significantly different from NY at the 90% confidence level.

Clear differences emerged in the efficiency of lighting sold by different retail channels. **Membership clubs sold a much greater share of efficient lighting than any other channel** (Table 9). As an example, one of the major chains of membership clubs, Costco, only sells CFLs and LEDs. The home improvement and mass merchandise channels had a broader range of lighting products, though with a roughly even efficient/inefficient split overall for home improvement and a tilt toward inefficient bulbs in mass merchandise stores, especially in New York. In both of these channels, Massachusetts stores sold a greater share of efficient bulbs than in the corresponding New York stores. **Inefficient bulb**

[13] RLPNC 16-6: Lighting Shelf Stocking; report to be submitted early 2017.

types are heavily favored at discount and grocery stores. We will further explore these channel and state differences in the in-progress Lighting Shelf Stocking study.

Table 9: Efficient vs. Inefficient by State and Channel

	Massachusetts			New York		
	Efficient	Inefficient	n	Efficient	Inefficient	n
Membership Club	79%*	22%	239	95%*	5%	334
Home Improvement	55%*	45%	1,284	41%*	59%	3,378
Mass Merchandise	38%*	62%	1,052	24%*	76%	4,594
Grocery	14%*	86%	113	14%*	86%	294
Discount	18%*	82%	97	8%*	92%	445
Other[a]	51%	49%	136	52%	48%	407

* Significantly different from inefficient at the 90% confidence level for this channel and state.

[a] *Other* includes hardware, drug, lighting and electronics, and miscellaneous stores, as well as online purchases.

Table 10 reveals that **educational attainment does not have a strong influence on efficient lighting choices.** The shares of efficient purchases were similar across the education categories within each state, though Massachusetts consumers favor efficient lighting over New York residents overall.

Table 10: Efficient vs. Inefficient by State and Educational Attainment

	Massachusetts			New York		
	Efficient	Inefficient	n	Efficient	Inefficient	n
High school / GED or less	45%*	55%	473	30%*	70%	1,740
Some college	44%*	56%	639	34%*	66%	2,117
2 or 4 Year College Degree	52%	48%	1,257	32%*	68%	4,107
Graduate or professional degree	50%	50%	551	35%*	65%	1,477

*Significantly different from Inefficient for this category and state at the 90% confidence level.

Household Income is also a weak predictor of efficient bulb preferences (Table 11). While differences emerge between the two states, the shares are similar across income categories within states. When looking at A-line shaped bulbs in Massachusetts the $80k-125k income bracket was significantly more likely to purchase efficient A-line bulbs (56% vs 44%). The 125k+ bracket was significantly less likely to purchase efficient A-line bulbs (41% vs. 59%). The shares for efficient and inefficient A-line bulbs in New York were similar to those in Table 11.

Table 11: Efficient vs. Inefficient by State and Household Income

	Massachusetts			New York		
	Efficient	Inefficient	n	Efficient	Inefficient	n
<$40k	51%*	49%	798	29%*	71%	2,433
$40k-80k	43%*	57%	940	34%*	66%	3,585
$80k-125k	45%*	55%	689	34%*	66%	2,106
$125k+	49%	51%	340	31%*	69%	1,010

* Significantly different from Inefficient for this category and state at the 90% confidence level

Table 12 reveals that income has some impact on efficient purchases for specialty Bulbs in New York (excludes A-lines). However, in Massachusetts household income is a weak predictor for efficient purchases of specialty bulbs, as the lowest and highest income brackets purchase a largest proportion.

Table 12: Efficient vs. Inefficient Specialty Bulbs by State and Household Income[b]

	Massachusetts			New York		
	Efficient	Inefficient	n	Efficient	Inefficient	n
<$40k	52%	48%	251	21%*	79%	937
$40k-80k	33%*	67%	202	27%*	73%	1,317
$80k-125k	26%*	74%	288	33%*	67%	824
$125k+	54%	46%	320	36%*	64%	462

* Significantly different from Inefficient for this category and state at the 90% confidence level

[b] Includes all bulb types except for A-line Shaped bulbs

There are some items of interest when looking at efficient purchases in Massachusetts by income group *and* store channel (Table 13). All income groups bought more than three-quarters of their lighting products at home improvement or mass merchandise stores. **Lower-income consumers bought relatively more lighting at discount stores**. High-income customers are the only group that bought a significantly larger share of efficient than inefficient lighting at mass merchandise stores. This result flips for home improvement stores, where the $125k+ group was the only bracket that bought a significantly smaller share of efficient than inefficient bulbs. High-income consumers bought fewer bulbs at discount and membership club stores, as might be expected from a group less concerned with seeking out the lowest price. The share of lighting purchased at grocery stores is similar across income groups.

Table 13: Efficient vs. Inefficient and Income by Channel (MA only)

	Mass Merch.	Home Imp.	Discount	Membership Club	Grocery	Other[b]	n
<$40k	**45%**	**31%**	**7%**	**9%**	**3%**	**6%**	**798**
Efficient	25%*	53%*	2%	9%	0%	9%	438
Inefficient	65%	7%	12%	8%	5%	4%	360
$40k-80k	**35%**	**48%**	**3%**	**5%**	**4%**	**1%**	**940**

Efficient	31%	53%*	1%	8%	2%	3%	398
Inefficient	37%	45%	4%	3%	6%	0%	542
$80k-125k	**34%**	**49%**	**0%**	**8%**	**4%**	**4%**	**689**
Efficient	28%*	50%	1%	18%*	1%	2%	309
Inefficient	39%	48%	0%	0%	7%	7%	380
$125k+	**41%**	**54%**	**1%**	**0%**	**4%**	**1%**	**340**
Efficient	56%*	40%*	0%	0%	1%	3%	155
Inefficient	26%	67%	1%	0%	6%	0%	185

[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, online, lighting and electronics, and miscellaneous channels.
* Efficient proportion significantly different from inefficient proportion for this income group and channel at the 90% confidence level.

In contrast to the results for income and educational attainment, consumer age did have an influence on preferences for efficient lighting, at least in Massachusetts where 56% of buyers 34 and under purchased efficient bulbs, a significantly larger share than for other age groups (Table 14). This result was not evinced for younger New Yorkers, which had a significantly lower share of efficient lighting purchases than the 35-44 and 45-54 age groups.

Table 14: Efficient vs. Inefficient by State and Age

	Massachusetts		New York	
	Efficient	Inefficient	Efficient	Inefficient
	n=1,420	n=1,500	n=3,054	n=6,387
34 and under	56%*	44%	30%*	70%
35-44	51%	49%	37%*	63%
45-54	43%*	57%	26%*	74%
55+	30%*	77%	33%*	67%

*Significantly different from Inefficient for this state and age group at the 90% confidence level.

Section 4 Survey Results

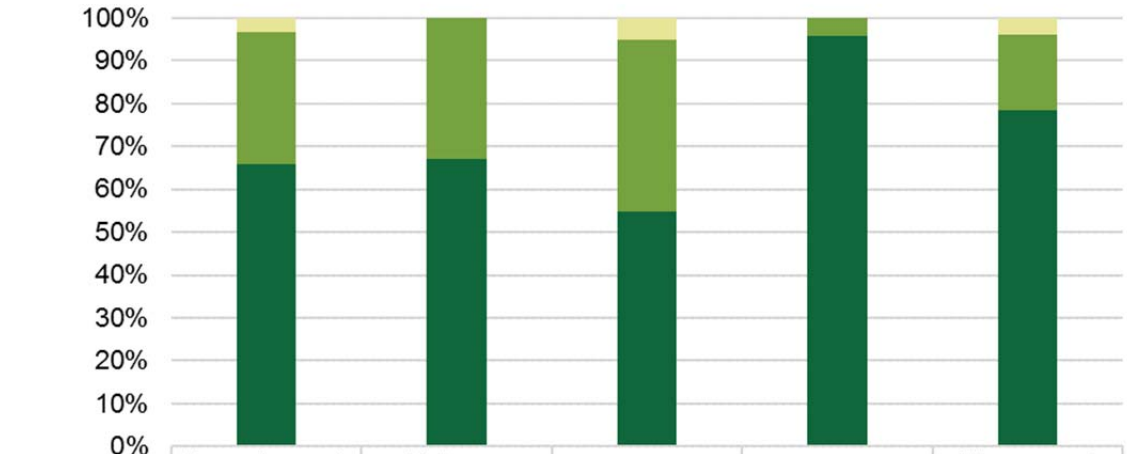
After cleaning and preparing the InfoScout purchase data, the evaluation team submitted the reduced set back to InfoScout to form our sample pool for a survey on lighting decision making. Working with an instrument provided by the team, InfoScout administered the survey via the same mobile device apps that the panelists use to upload their receipts. InfoScout sent the survey to potential respondents in waves from November 2-4, with the most recent purchasers receiving the survey first. The waves were sent until the survey response quota was met. The survey presented respondents with the details of their purchases (date, store, bulb type, amount), and 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). 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 1,632 New York and Massachusetts InfoScout panelists who purchased lighting, 351 successfully completed our survey, including 175 from Massachusetts and 176 from New York. As with the purchase data analysis, the survey results are weighted according to the weighting scheme described in Section 2.

4.1.1 Purchase Planning

The survey responses suggest that **the great majority of lighting purchases are planned in advance**, and that LED purchasers are more likely to plan their purchases in advance than those buying other lighting technologies. Independent of bulb type or efficiency of bulb purchased, 87% of survey respondents said that they had planned ahead to purchase a light bulb on their shopping trip (89%/84% in MA and NY, respectively).

One-quarter of shoppers in both the Massachusetts and New York panels (26% and 28%, respectively), however, **did not determine which type of bulb to purchase before heading to the store**. Of these undecided shoppers, 35% of Massachusetts respondents chose CFLs, while only 11% of New Yorkers chose CFLs. New Yorkers were more likely to choose incandescents than any other bulb type. **Almost all of the respondents (96%) who ultimately purchased an LED bulb said they had planned to do so in advance**, a much greater share than for those who purchased other bulb types (Figure 6). Further, **only a single Massachusetts respondent who said he/she had decided which bulb to purchase at the store ultimately selected an LED** (Table 15). This suggests that in-store signs and messaging regarding LEDs may not have a strong influence at the time of purchase, or perhaps that the impact of in-store messaging is delayed or cumulative over multiple trips, affecting purchase decisions in the future.

Figure 6: Proportion of Survey Respondents Who Did or Did Not Plan to Buy the Type of Bulb They Did, by Bulb Type



	Incandescent (n=85)	Halogen (n=64)	CFL (n=52)	LED (n=57)	Fluorescent (n=30)
Don't know	3%	0%	5%	0%	4%
No	31%	33%	40%	4%	18%
Yes	66%	67%	55%	96%	79%

Table 15: Purchases by Respondents Who Did Not Plan to Buy a Specific Type of Bulb (n=76)

	Massachusetts	New York
	n=39	n=37
CFL	35%*	11%
Incandescent	29%	47%
Halogen	26%	33%
Fluorescent	9%	5%
LED	2%	5%

* Significantly different than New York at the 90% confidence level.

4.1.2 Bulbs in Storage

Just over one-third of survey respondents in both Massachusetts and New York said that they had bulbs in storage (Table 16). This is lower than the findings from the on-site visits in the 2015-2016 Lighting Market Assessment, where nearly nine out of ten (86%) homes in the on-site study had at least one bulb in storage. There are two very different possible explanations for this large difference; those that shop and purchase bulbs are those with the least supply in storage, this direction of self-selection for purchasers would be expected (but perhaps not expected to be this strong) or the survey respondents may reflect a recall bias on this topic.[14]

Table 16: Before Your Shopping Trip, Did You Have any Bulbs in Storage in Your Home?

	Massachusetts	New York	Efficient Purchasers	Inefficient Purchasers
	n=162	n=162	n=121	n=169
Yes	35%	34%	50%**	29%
No	61%	65%	49%**	67%
Don't know	9%*	1%	1%**	4%

*Significantly different than New York at the 90% confidence level.
**Significantly different than inefficient at the 90% confidence level.

Roughly two-thirds of the respondents who had stored bulbs said that they did check to see if they had a similar bulb in storage before their shopping trip (Table 17).

Table 17: Did You Check to See if You Had a Similar Bulb in Storage?

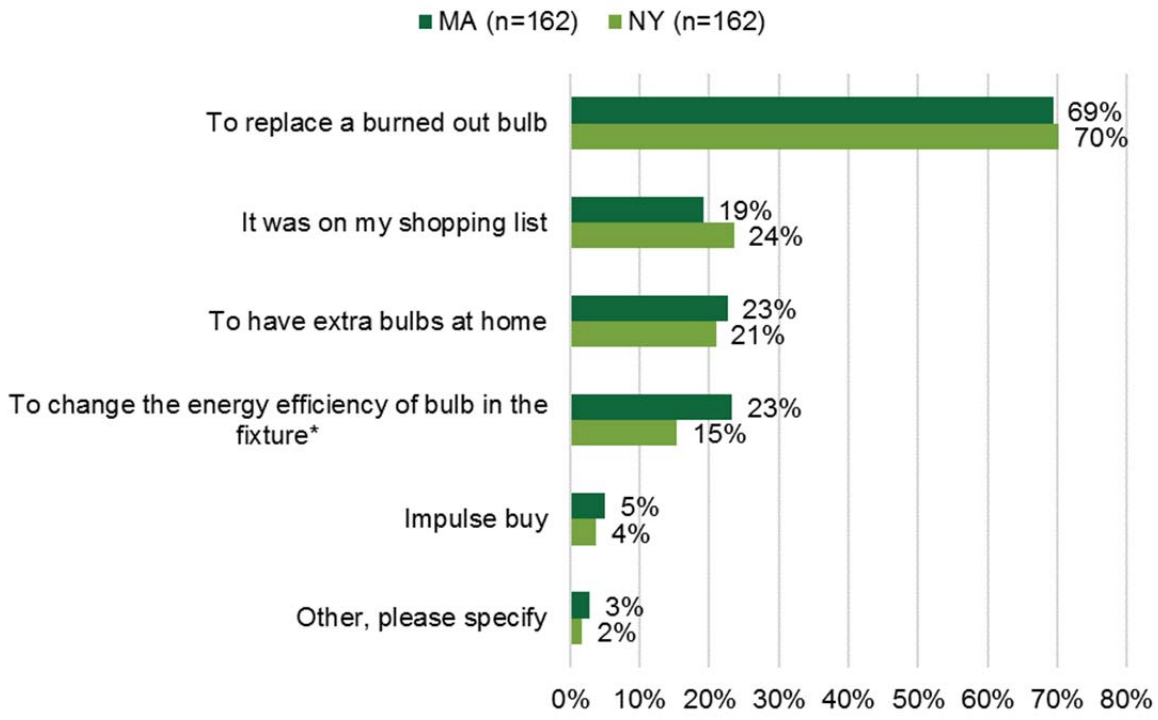
	Massachusetts	New York	Efficient Purchasers	Inefficient Purchasers
	n=63	n=57	n=55	n=60
Yes	67%	63%	63%	71%
No	30%	36%	34%	28%
Don't know	3%	1%	3%	1%

[14] Efficient and Inefficient purchasers are determined by lighting technology purchased and include InfoScout panelists from both MA and NY.

4.1.3 Reasons for Purchase

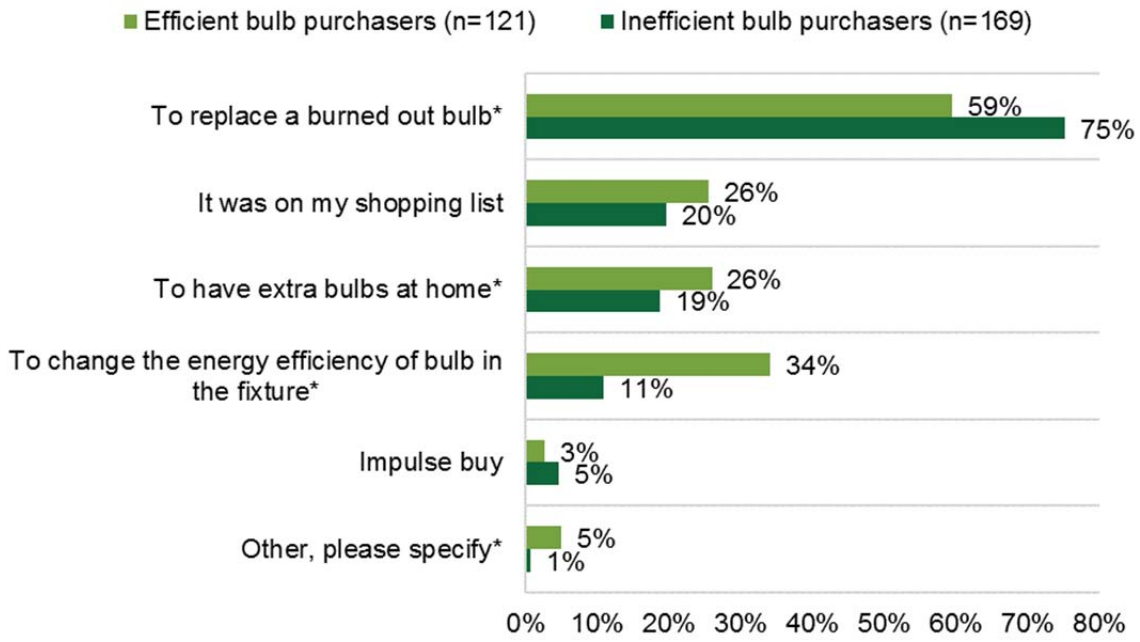
The **main reason that respondents purchased a bulb was to replace one that had burned out**. More than two-thirds of Massachusetts and New York respondents cited this reason for their purchases (Figure 7). Massachusetts respondents were significantly more likely than New York respondents to say that they bought a bulb because they wanted to change the energy efficiency of the bulb in the fixture (23% vs. 15% for NY).

Figure 7: Reasons Why Survey Respondents Purchased Lighting, by State (multiple responses)



When looking at the same question by the efficiency of the purchased bulb, efficient bulb buyers were much more likely to cite energy efficiency as a reason for purchasing a new bulb (Figure 8).

Figure 8: Reasons Why Survey Respondents Purchased Lighting, by Bulb Efficiency (multiple responses)

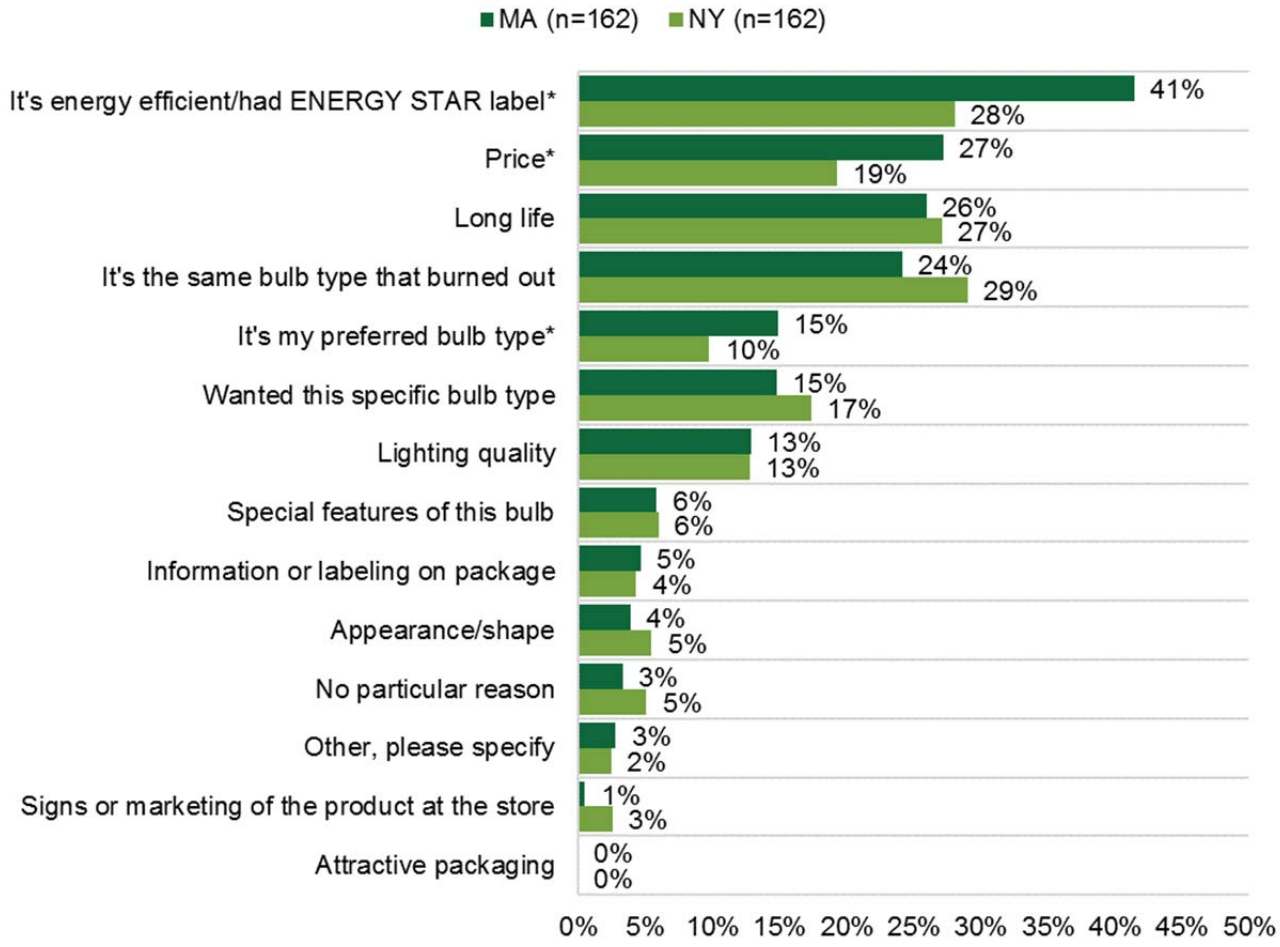


* Significantly different than Inefficient at the 90% confidence level.

Despite the similarities in reasoning among the Massachusetts and New York survey respondents when it came to explaining why they purchased light bulb(s), respondents from the two states diverged when asked *why* they purchased the specific type of bulb instead of some other bulb (Figure 9). **Forty-one percent of Massachusetts respondents said they selected the bulb they did because "it's energy efficient/had ENERGY STAR label,"** which was significantly higher than the 28% of New York respondents who cited efficiency. In addition, **Massachusetts respondents were much more likely than New York panelists to cite price as a reason they selected the bulb they did instead of some other bulb**. New York (29%) panelists were more likely to replace the same bulb type that burned out than Massachusetts (24%) panelists; a noteworthy finding given its implications for future purchases of inefficient lighting.

When breaking results down by efficiency, efficient bulb purchasers were significantly more likely than inefficient bulb purchasers to say that they purchased the type of bulb that they did because it is energy efficient or had an ENERGY STAR label (48% for efficient vs. 28% for inefficient). Efficient bulb purchasers were also significantly more likely to say they purchased the type of bulb they did because of the bulb's long life (37%) or because they wanted that specific bulb type (22%) compared to inefficient bulb purchasers (21% and 12%, respectively).

Figure 9: Reasons Why Survey Respondents Purchased the Type of Lighting They Did, by State



* MA significantly different than NY at the 90% confidence level.

4.1.3.1 Inefficient Bulb Purchasers

We asked respondents who had purchased inefficient bulbs (incandescent or halogen) whether this type was their first choice and questioned them about their awareness of more efficient bulb types. If they said they were aware of more efficient types, they received a follow-up question on why they chose the inefficient bulb. Purchasers of inefficient bulbs did so purposefully: 65% of incandescent purchasers and 59% of halogen purchasers said it was their first choice (Table 18). A larger share of Massachusetts inefficient buyers considered other options, though the difference is not statistically significant.

Table 18: Was this Bulb Type Your First Choice?

	Incandescent	Halogen	Total	Massachusetts	New York	Total
	n=100	n=69	n=169	n=81	n=88	n=169
First choice	65%	59%	63%	60%	67%	63%
Considered other options	29%	34%	31%	33%	27%	31%
Don't know	6%	7%	6%	7%	6%	6%

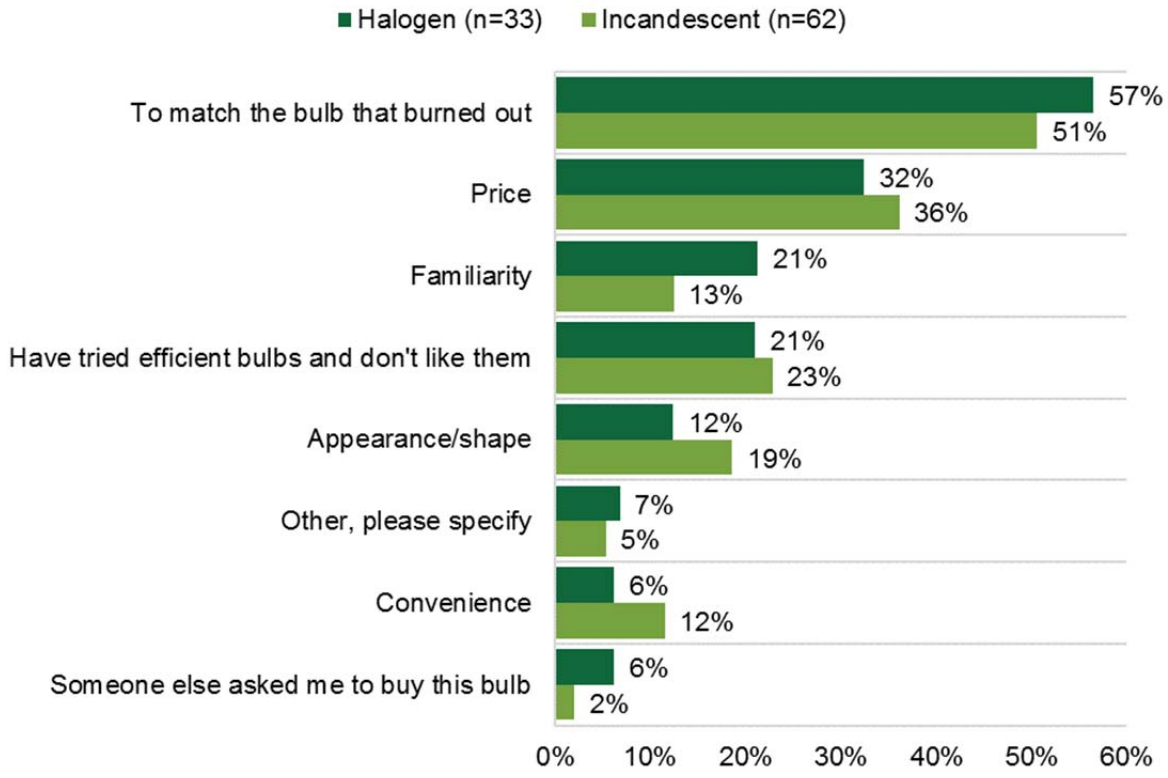
Nearly two-thirds of respondents who purchased inefficient bulbs said they were aware that there were more efficient choices available (Table 19). The difference in awareness was greater between incandescent and halogen buyers, with incandescent purchasers indicating greater awareness, than between respondents in the two states. Given that halogen general service bulbs are often marketed with an efficiency message, this suggests an opportunity to educate halogen buyers about more efficient technologies.

Table 19: Were You Aware of More Efficient Choices?

	Incandescent	Halogen	Massachusetts	New York
	n=100	n=69	n=81	n=88
Yes	66%	55%	60%	64%
No	28%	36%	32%	30%
Don't know	6%	9%	8%	6%

As shown in Figure 10, a desire to match an inefficient bulb that had burned out is the main reason that respondents chose an inefficient replacement, though price is also important to these buyers. It is notable that over 20% of respondents reported having tried efficient bulbs but did not like them. This presents a marketing opportunity for inefficient lighting purchasers to try LED bulbs, as the technology and quality of products have progressed.

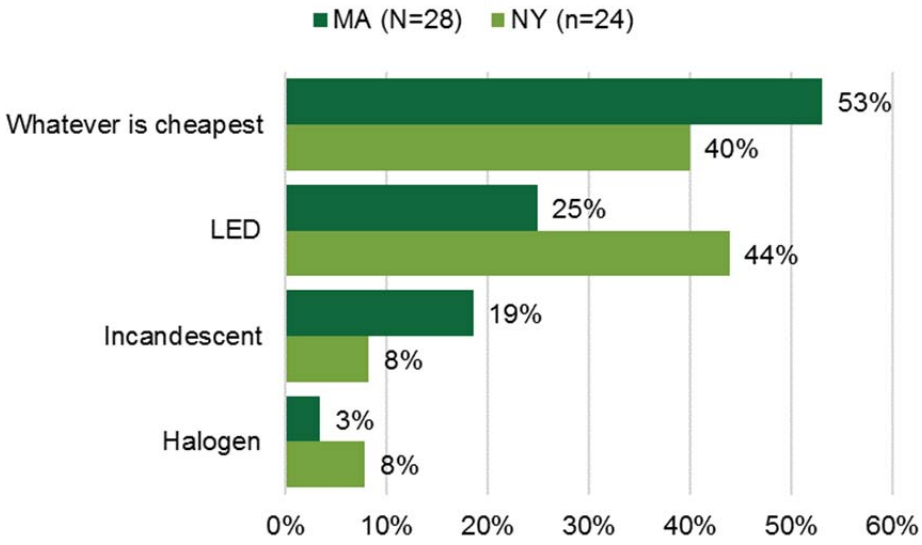
Figure 10: Why Did You Purchase this Bulb Instead of a More Efficient Type?



4.1.3.2 CFL Purchasers

We asked survey respondents who purchased CFLs two additional questions: what type of bulb they would have purchased if CFLs had not been available, and, if they chose a specific type, why they would have chosen this alternative bulb type. Over half of Massachusetts CFL buyers said they would have chosen whatever was cheapest, while one quarter would have purchased an LED (Figure 11). Forty-four percent of New York CFL buyers would have purchased an LED and 40% would have purchased whatever was cheapest. More than twice as many Massachusetts respondents said they would have chosen an incandescent bulb if a CFL had not been available (19% vs. 8%), though the difference is not statistically significant.

Figure 11: Preferred Second-Choice Bulb Type of CFL Purchasers, by State



* Significantly different from NY at the 90% confidence level.

Among CFL buyers who chose LED as their preferred alternative, respondents primarily cited long life as the reason (72% in MA, 55% in NY, Table 20). The second most cited reason for Massachusetts respondents was familiarity (42%), significantly more than New York respondents (9%). Price was the second most cited choice for New York respondents (36%). The small sample of respondents for this question limits our ability to draw strong conclusions.

Table 20 Reasons Why CFL Purchasers Preferred the Second-Choice Bulb Type

	Massachusetts			New York		
	LED	Incandescent	Halogen	LED	Incandescent	Halogen
	n=7	n=5	n=1	n=11	n=2	n=2
Price	28%	59%	0%	36%	0%	0%
Convenience	28%	41%	0%	0%	0%	0%
Familiarity	42%	55%	0%	9%	50%	0%
Appearance/Shape	17%	0%	0%	9%	0%	0%
Someone else asked me to buy this bulb	0%	0%	0%	0%	50%	0%
To match the one that burned out	0%	37%	0%	9%	50%	100%
Have tried efficient bulbs and don't like them	0%	18%	100%	9%	0%	0%
Long life	72%	0%	100%	55%	0%	0%

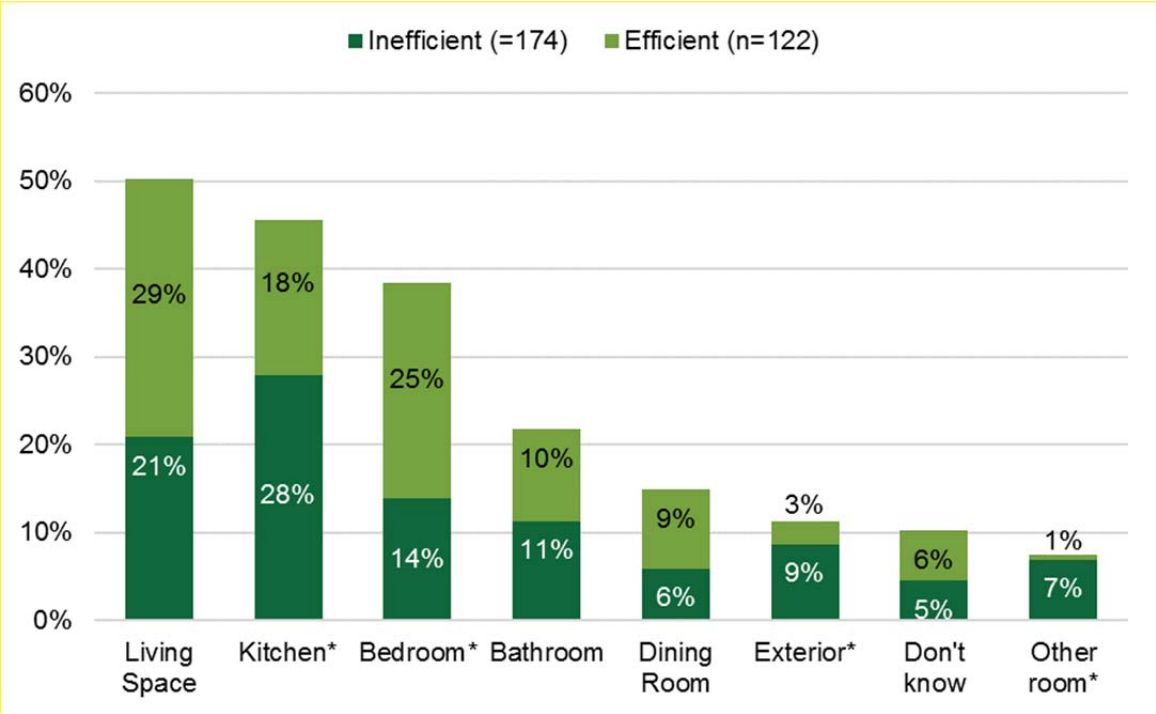
4.1.4 Purchase Uses

All survey respondents answered questions about where they installed the bulb(s) they purchased (Figure 12). Living space was the most likely location overall for efficient bulbs to be installed (29%), and the second most likely location for inefficient bulbs (21%) after the kitchen (28%). Inefficient bulb purchasers (28%) were significantly more likely than efficient bulb purchasers (18%) to say they installed the light bulbs they purchased in the kitchen. It is notable that inefficient bulbs were installed in areas associated with high hours of use: exterior (4.5), kitchen (4.2), and living spaces (3.1).[15]

Additionally, inefficient bulb purchasers were significantly more likely than efficient bulb purchasers to say they installed their purchased bulbs in exterior spaces (9% vs. 3%), and, although it is the least likely place overall for purchased bulbs to be installed, inefficient bulbs were also significantly more likely than efficient bulbs to be installed in an "other" room.

[15] Northeast Residential Lighting Hours-of-Use Study; NMR Group, Inc. and DNV GL; 2014.

Figure 12: Rooms Respondents Installed Purchased Bulb(s)

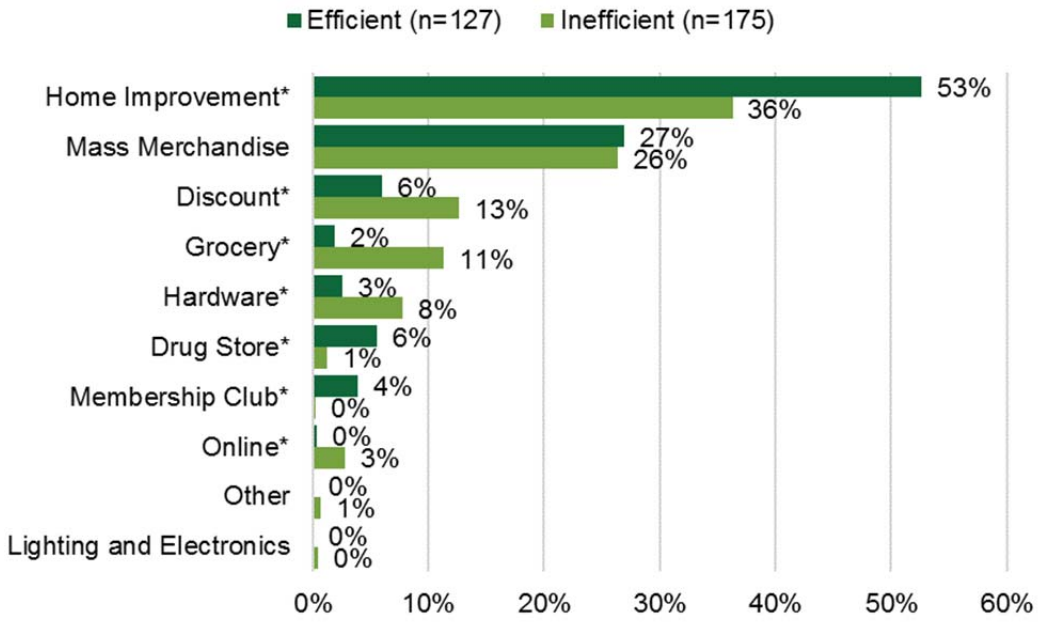


4.1.5 Store Location Choices

The home improvement channel was the most frequently cited response for both efficient and inefficient bulb purchasers (Figure 13). Over one-half of efficient bulb purchasers typically shop at home improvement stores (53%), significantly more than inefficient bulb purchasers (36%). Inefficient bulb purchasers were significantly more likely to say they typically shop at discount (13%) or grocery stores (11%), compared with 6% and 2% of efficient bulb purchasers, respectively. This suggests that those who said they typically shop at hard to reach channels are more likely to purchase inefficient bulbs. Significant differences for efficient and inefficient lighting purchases also emerged in hardware, drug store, membership clubs, and online channels. Two-thirds of those who said they typically shop for lighting at a store channel other than the one recorded for this trip, purchased inefficient lighting. While 54% of those who shopped at a store within the same channel as they typically shop chose inefficient lighting. However, no significant difference existed between these groups.

The retail channels identified by Massachusetts and New York respondents as those that they typically shop at for lighting showed similar trends. Home improvement stores were most common among both groups, followed by mass merchandise stores and then discount stores. The only significant difference between Massachusetts and New York respondents was the hardware channel; 7% of Massachusetts respondents identified this channel as their typical shopping destination for lighting, whereas only 2% of New York respondents cited the hardware channel.

Figure 13: Store Channel Where Survey Respondents Typically Purchase Lighting, by Efficiency



* Efficient significantly different than inefficient at the 90% confidence level.

Appendix A Demographics

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

- The general population[16]
- The population of all InfoScout panelists
- The population of InfoScout panelists who purchased lighting products from August 2015 through August 2016
- The subsample of the 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 Section 2. 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.[17]

A.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.

[16] 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.
[17] 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 14: Massachusetts Lighting Purchasers

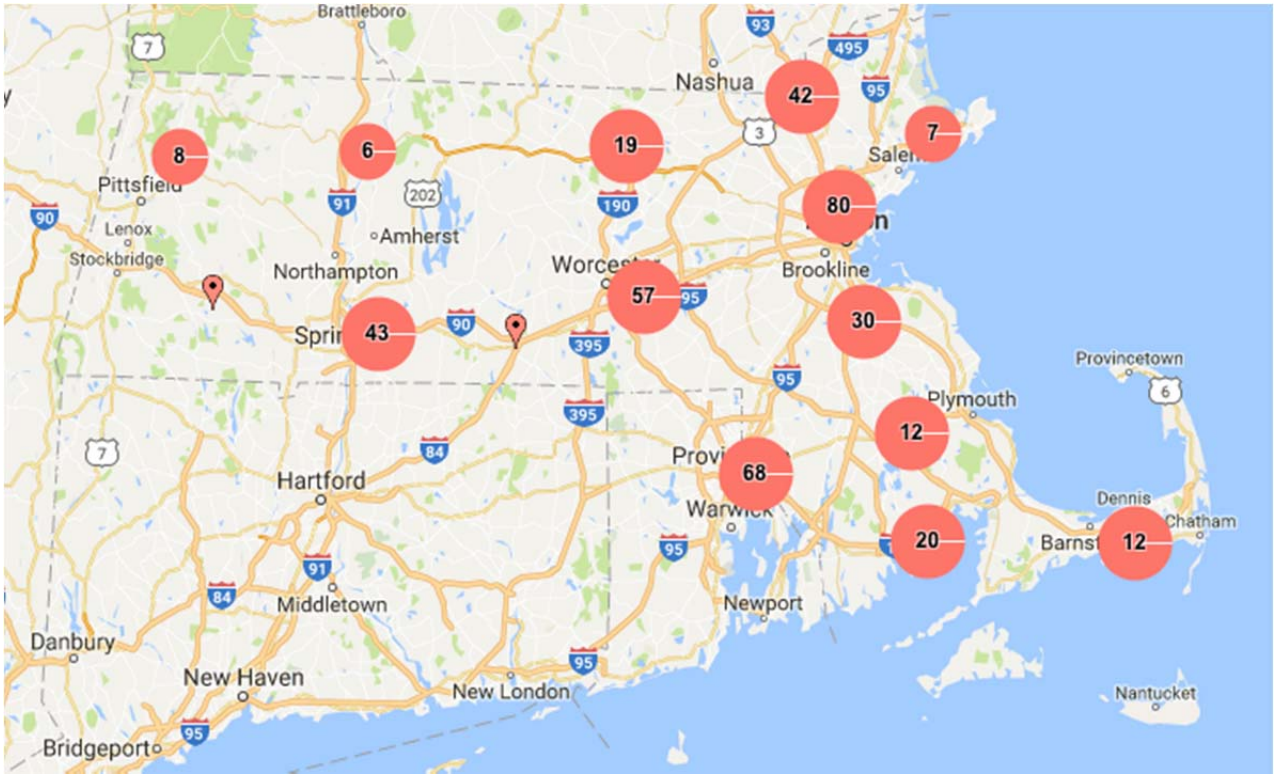


Figure 15: Massachusetts Survey Respondents

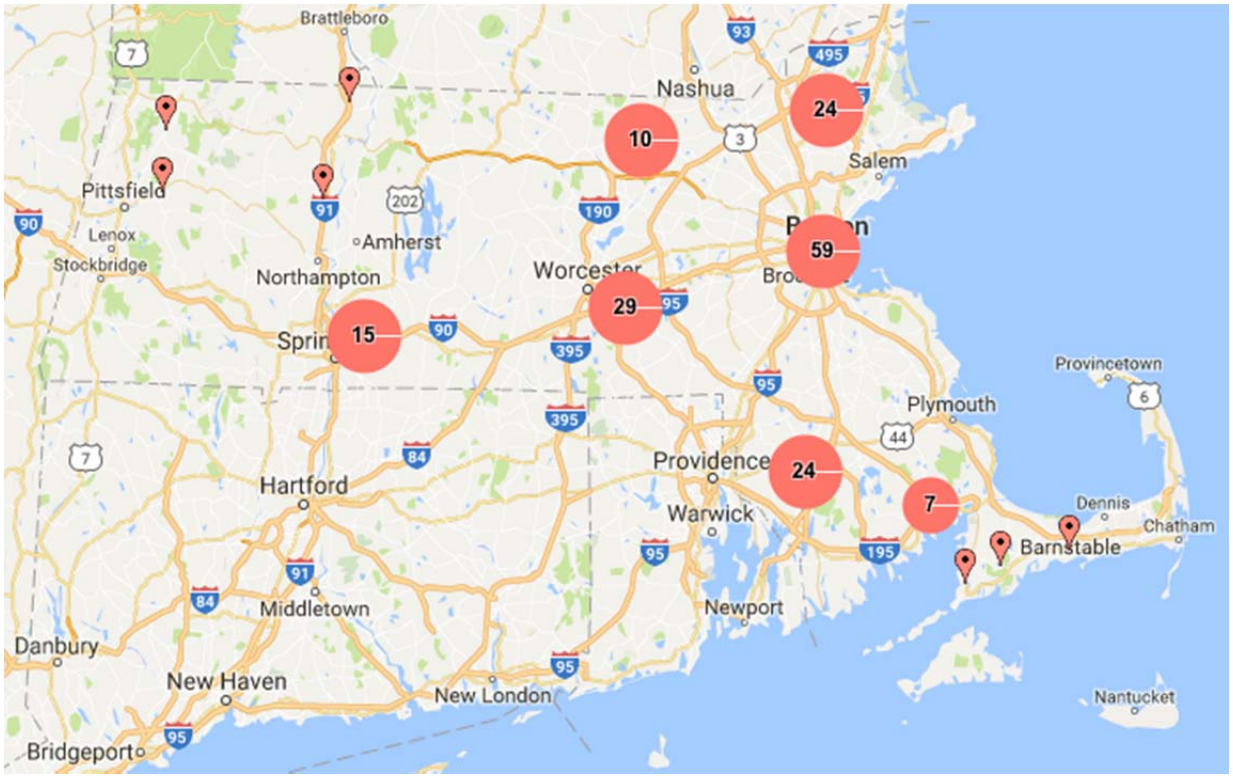


Figure 16: New York Lighting Purchasers

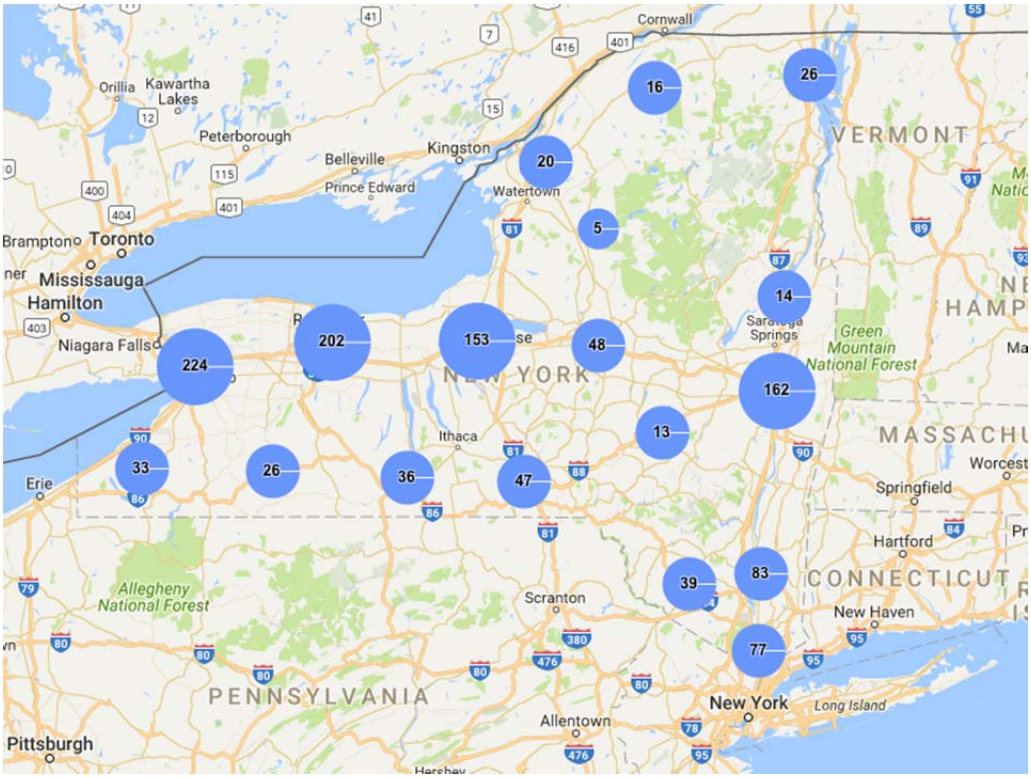
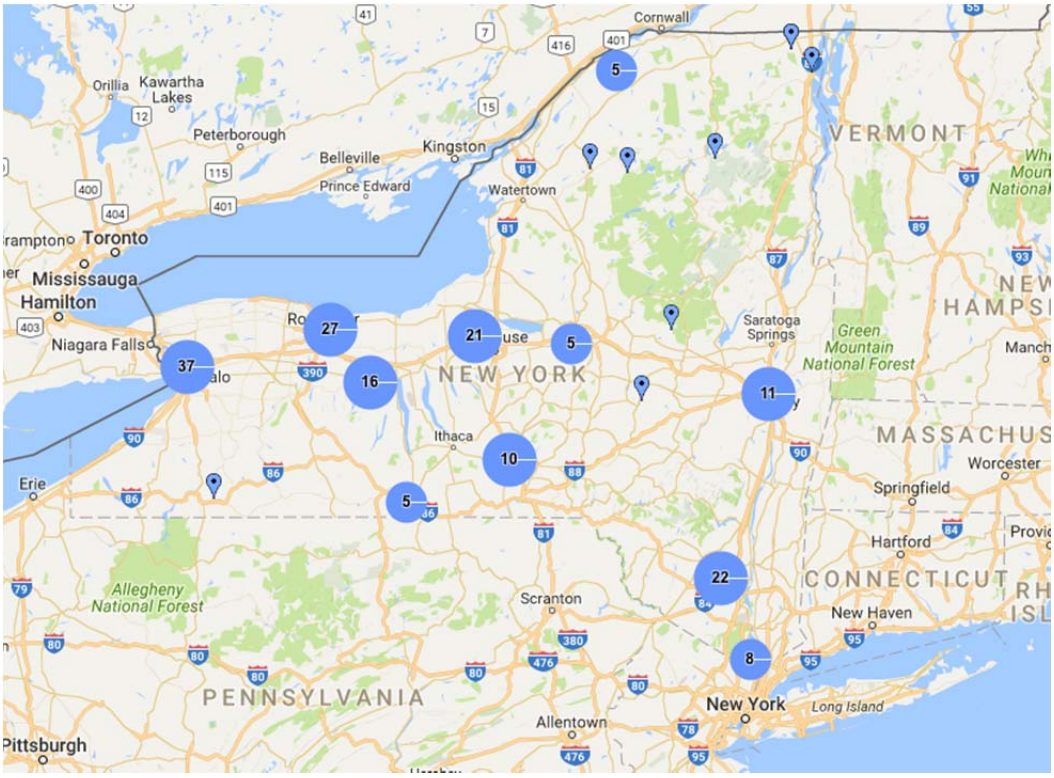


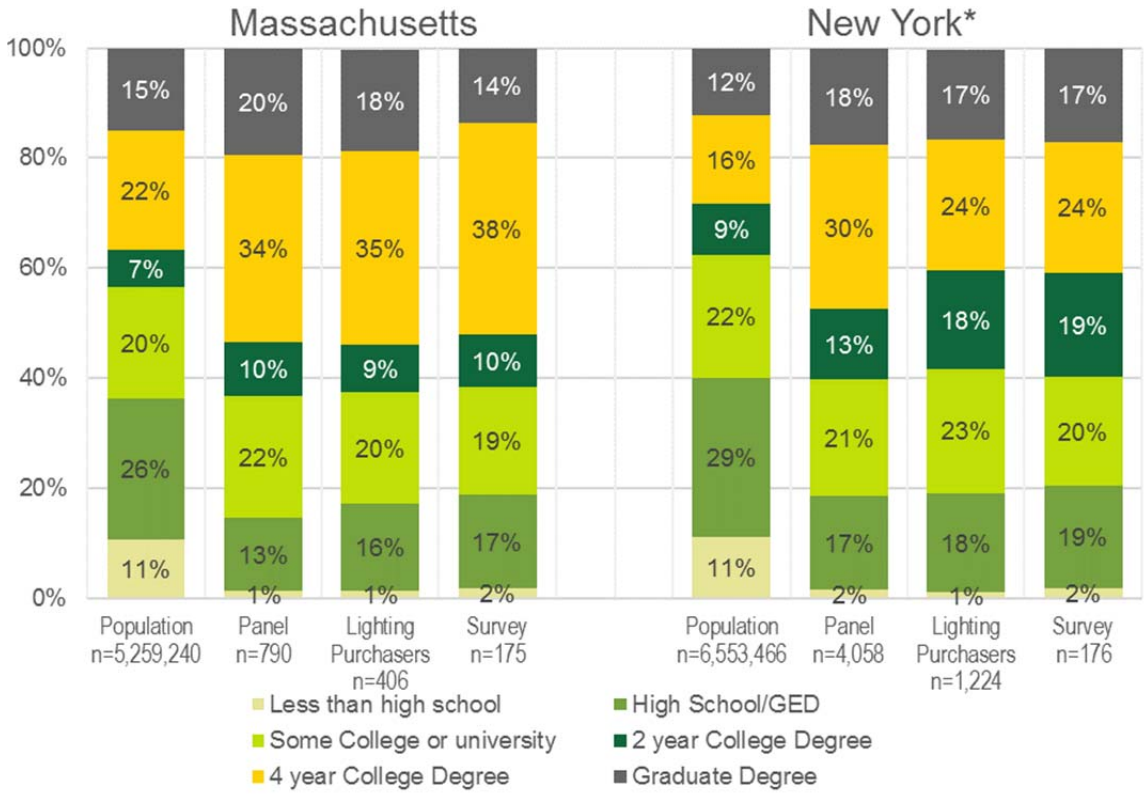
Figure 17: New York Survey Respondents



A.2 EDUCATIONAL ATTAINMENT

In both Massachusetts and New York, the InfoScout panel under-represents those with a high school/GED education or less, with the difference largely made up by over-representation of those with a four-year college degree (Figure 18). The three InfoScout groups are similar, with the exception of the split between those with a two-year and four-year college degree in New York, where the lighting purchasers are skewed more toward those with a two-year degree.

Figure 18: Educational Attainment

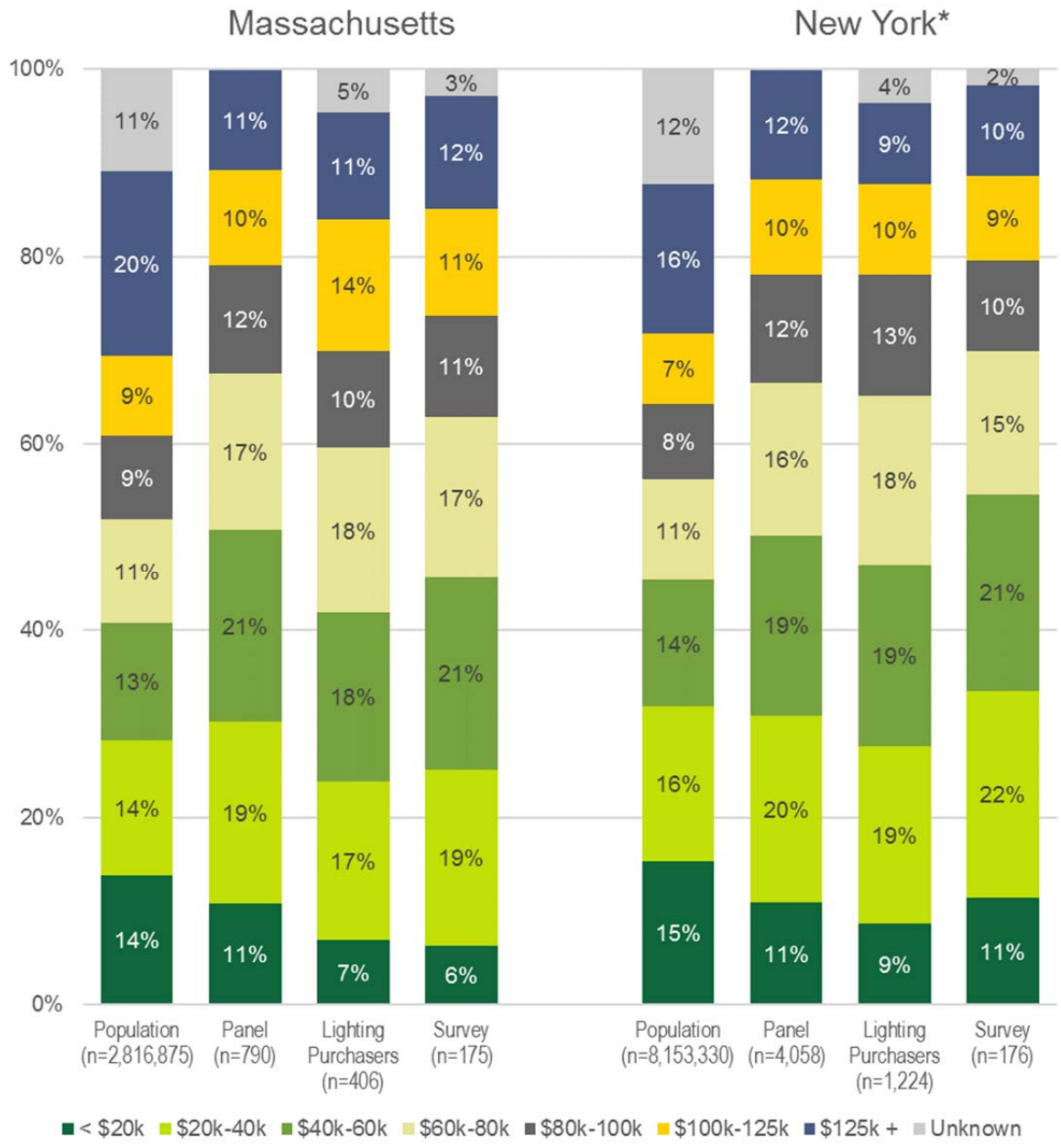


*All of NYS (including NYC and Long Island).

A.3 HOUSEHOLD INCOME

As with educational attainment, the InfoScout groups for household income are generally similar across Massachusetts and New York (Figure 19). In both states, the $125k+ income group is under-represented and the $40-60k and $60-80k groups are over-represented in the InfoScout categories compared to the general population. This data point has a larger share of unknowns in the Census than in the InfoScout categories.

Figure 19: Household Income

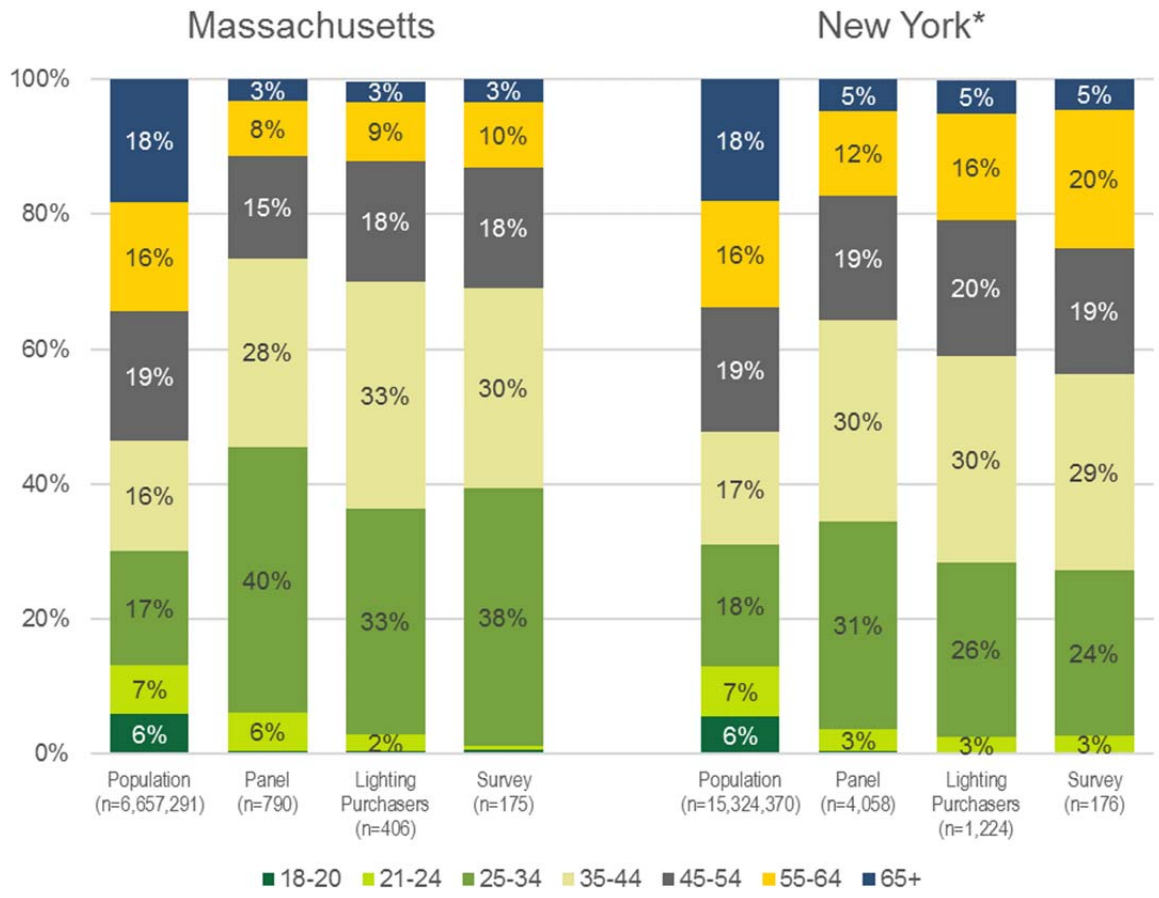


*Excludes NYC and Long Island.

A.4 AGE

As one might expect for a service like InfoScout's that targets retail customers with mobile devices, the InfoScout categories under-represent the oldest and youngest age categories and over-represents the 25-34 and 35-44 groups (Figure 20).

Figure 20: Age



*All of NYS (including NYC and Long Island).

Appendix B 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.

4.2 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 SL1. 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?

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

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]

1. To replace a burned out bulb
2. Impulse buy
3. It was on my shopping list
4. To have extra bulbs at home
5. To change the energy efficiency of bulb in the fixture
6. Other [RECORD]

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

- ☐ Price
- ☐ Appearance/shape
- ☐ Attractive Packaging
- ☐ 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 [I think we would want to just intuit these by looking up the product rather than asking which special features.]
- ☐ Signs or marketing of the product at the store
- ☐ 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. [IF PURCHASED HALOGEN OR INCANDESCENT] 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 PURCHASED HALOGEN OR INCANDESCENT] Were you aware there are more efficient bulb choices available?

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

S10. [IF S9=YES] Why did you purchase this bulb instead of a more efficient bulb? [MULTIPLE RESPONSE] [RANDOMIZE RESPONSES]

- ☐ Price
- ☐ Convenience
- ☐ Familiarity
- ☐ Appearance/shape
- ☐ Someone else asked me to buy this bulb
- ☐ To match the bulb that burned out
- ☐ Have tried efficient bulbs and don't like them

☐ Other [RECORD]

S11. [IF PURCHASED CFL] If a compact fluorescent (CFL) had not been available during your trip, what type of bulb would you most likely have purchased instead? [RANDOMIZE RESPONSES]

1. An LED bulb
2. A halogen bulb
3. An incandescent bulb
4. Whatever is cheapest
5. Other [RECORD]

S12. [IF PURCHASED CFL] Why would [S11 RESPONSE] have been your second choice? [MULTIPLE RESPONSE] [RANDOMIZE RESPONSES]

☐ Price
☐ Convenience
☐ Familiarity
☐ Appearance/shape
☐ Someone else asked me to buy this bulb
☐ To match the bulb that burned out
☐ Have tried efficient bulbs and don't like them
☐ Long life
☐ Other [RECORD]

4.3 STORE LOCATION

SL1. Is [store name] the closest store to your home that sells lighting products?

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

SL2. [IF SL1=NO] Why did you choose to purchase the bulbs at [store name] rather than the store that also sells lighting products and is closer to your home? [MULTIPLE RESPONSE] [RANDOMIZE RESPONSES]

☐ Convenience/I was in area
☐ Was shopping for something else
☐ Price
☐ Selection
☐ I prefer shopping at this store
☐ Other [RECORD]

SL3. Is [store name] where you typically purchase light bulbs?

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

SL4. [IF SL3=NO] Where do you typically shop for light bulbs? [RANDOMIZE RESPONSES]

A different location of [store name]

1. A different [store type] store
2. Home Improvement Store like Home Depot or Lowe's
3. Grocery Store
4. Lighting Store
5. Hardware Store
6. Club Store like Costco or BJs
7. Online
8. Other [RECORD]

SL5. Where did you install this bulb?

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

SL6. [If SL6 = 1 or 2] In what room in your home did you install this bulb?

1. Bathroom
2. Bedroom
3. Dining Room
4. Exterior
5. Kitchen
6. Living Space
7. Other room
8. Don't know

SL7. How important is energy efficiency to you when shopping for light bulbs?

1. One of the most important factors
2. Somewhat important
3. Neither important nor unimportant
4. Not too important
5. Not important at all
6. Don't know