General Service Lamps: Stocking and Shelving Survey

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General Service Lamps: Stocking and Shelving Survey

Final Report

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Abstract

Due to the uncertainty that came from the United States Department of Energy (DOE) signaling its intent to change the definition for general service lamps (GSLs)[1] and rollback the proposed national standards, Cadmus conducted this study to understand and determine how DOE's actions affected lighting product retailers ordering and stocking decisions in New York State. Retailers routinely make purchases and stock these products more than six months in advance, so decisions made in the summer of 2019 directly influence the inventory stock this winter and into the spring and summer of 2020. This survey and analysis gauged the current stock and shelving of GSLs and upcoming purchase decisions for the coming year to accurately estimate the baseline and future impacts of lighting standards under the larger Product and Appliance Standards legislation. Additionally, Cadmus developed survey questions related to the COVID-19 crisis and how it impacted stocking and shelving of GSLs.

Keywords

general service lamps, general service incandescent lamps, compact fluorescent lamps, general service light-emitting diode lamps, organic light-emitting diode lamps, Vintage Edison Specialty LEDs, A-lamp, Reflector lamp, Globe lamp, Candelabra-style lamps, backstop provision

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Acronyms and Abbreviations

ASAP	Appliance Standards Awareness Project
CFL	compact fluorescent lamps
DOE	United States Department of Energy
EISA 2007	Energy Independence and Security Act of 2007
GSL	general service lamps
GSIL	general service incandescent lamps
IRL	incandescent reflector lamps
LED	light-emitting diode
NAICS	North American Industry Classification System
NOPR	Notice of Proposed Rulemaking
OLED	organic light-emitting diode

Summary

The Energy Independence and Security Act of 2007 (EISA 2007) initiated a process of establishing federal lighting energy conservation standards for general service lamps through legislation and regulations. The process started by this legislation has played a large role in the market transformation of lighting products over the last decade and has affected the savings achievable through energy efficiency programs and state appliance standards.

This Act required the United States Department of Energy (DOE) to establish new standards for general service lamps (GSLs) by 2017 or implement a backstop efficiency standard of 45 lumens per watt effective January 2020. In January 2017, DOE expanded the GSL definition (from basically A-line lamps) to encompass more lamp types. However, as manufacturers prepared to comply with these regulations, DOE, under President Trump, reversed the regulatory changes in the GSL definition, did not propose new lighting standards, and declined to enact the backstop provision. The New York State Energy Research and Development Authority (NYSERDA) has sought to better understand how the uncertainties created by these shifting regulatory requirements affected this market so NYSERDA could more accurately estimate the baseline and future impacts of lighting standards in New York State. To develop this understanding, NYSERDA contracted with Cadmus to analyze lighting sales and shelving data covering two cycles, 2019 to 2020 and 2020 to 2021, and to interview manufacturers, distributors, and retailers across the State to gain an understanding of this market and the effects of the changing regulations.

S.1 Project Objectives

The following are primary objectives of the study:

- Estimate 2019 to 2020 market shares of technologies by lamp type and by the different GSL definitions (narrow and expanded).
- Estimate 2020 to 2021 market shares of technologies by lamp type and by the different GSL definitions.
- Assess retailer stocking practices and responses to regulatory and other uncertainties.

To determine the 2019 to 2020 market shares, Cadmus purchased full category sales data from Apex Analytics.[2] Cadmus estimated the market shares for the 2020 to 2021 season by combining data from 97 retailer site visits with data from two large, home center websites, collected using web-scraping software. Retailer stocking practices were determined using these data sets and supported by interviews with four manufacturers, two distributors, and 12 retailers (six full interviews and six partial interviews) serving the New York State market.

Secondary objectives included understanding lighting-related decisions, determining awareness of general service lamp definitions and federal rulings, identifying the impact of COVID-19 on stocking and shelving practices, and estimating changes to sales of different lighting technologies in 2021.

S.2 Key Findings

Cadmus found that light-emitting diode (LED) bulbs accounted for most sales in the 2019 to 2020 cycle and in the 2020 to 2021 cycle across all bulb types. LED shares increased between cycles for A-lamps, globes, and candelabras, while the shares for reflectors were high and essentially unchanged. Findings from the market actor interviews supported these findings.

Table S-1 compares overall market shares between years for the 2017 expanded definition of GSL bulbs by technology—which includes: A-lamps, candelabra, globe, and reflector bulbs. Overall, the market share for LEDs increased by 16 percentage points between 2019 and 2020 across the four bulb types, up to 73% of the market. Market actors generally agreed that lighting sales will continue on a similar trajectory in 2021 as they did from 2019 to 2020, with LEDs gaining market share relative to other technologies.

Table S-1. Expanded GSL Definition Market Shares by Year

Year	LED	CFL	Halogen	Incandescent
2019	56%	2%	33%	8%
2020	73%	1%	11%	15%

Table S-2 compares market shares for A-lamps, which represent the subset of bulbs fitting the narrow definition of GSL bulbs. LED A-lamp market shares increased substantially between 2019 and 2020—up from 52% to 77%. Most of the increase in LED A-lamp market share is due to a shift away from halogen bulbs, which decreased from 41% of the market in 2019 to 13% in 2020.

Table S-2. Narrow GSL Definition (A-lamp) Market Shares by Year

Year	LED	CFL	Halogen	Incandescent
2019	52%	3%	41%	5%
2020	77%	2%	13%	7%

For those bulb types excluded from the narrow GSL definition, LEDs saw modest increases in market shares, with globes and candelabras having the largest percentages that are still incandescent. There is a large energy savings potential from applying standards to these bulbs.

Cadmus also observed that halogen bulb shares decreased while incandescent bulb shares increased slightly within the expanded GSL definition. However, it is important to acknowledge some inherent uncertainty in comparing the two years, given differences in the data sources for each year. The uncertainty applies primarily to distinguishing between halogen and incandescent bulbs (globe and candelabra, in particular) but has little impact on LED market share estimates. Cadmus detailed data differences in construction of the data sets for each year and the limitations of each in the Data Reliability Risk and Mitigation Approach section.

All retailers, distributors, and manufacturers interviewed said that sales performance was the primary factor that determined which lighting products to stock.

All four manufacturers interviewed were aware of the EISA 2007 rulings and the associated expanded definition and rescission; conversely, only three of 12 retailers and one of two distributors interviewed were aware of the rulings. Due to the long ramp-up period associated with the federal lighting standards changes in EISA 2007, manufacturers noted the uncertainty caused by the changing GSL definitions had not led them to make any significant production changes.

S.3 Conclusions

Major conclusions from this study about market shares of different general service lighting include the following:

- The general service lighting market is moving toward LEDs across bulb types.
- Applying the expanded GSL definition is likely to be feasible in the near future.
- The market baseline across bulb types is dominated by LEDs and halogens.
- Most of the growth in LEDs market shares has resulted from a decline in halogens.
- Bulb types in the expanded GSL definition offer significant energy savings opportunities.
- LEDs are moderately more common in upstate than in Downstate New York.

Key conclusions from this study about general service lamp stocking practices and what influences market actor decisions include the following:

- The recent federal regulatory uncertainties did not affect retailer stocking practices.
- Retailers and distributors have only limited knowledge of regulations that affect lighting.
- Manufacturers are aware of lighting product regulations and track regulatory processes at the federal and State levels.
- Retailers and distributors would likely be able to respond to changes in standards given the already high prevalence of bulbs meeting the increased standards.
- Manufacturers will respond to changes in efficiency standards but seek certainty in the timing of implementation.

1 Introduction

This report presents findings from Cadmus, an evaluation contractor, about the impact of recent United States Department of Energy (DOE) rulings on retailer stocking of general service lamps (GSLs) in New York State. For more than a decade, a series of changing regulatory requirements issued by DOE has created uncertainties for market actors in the lighting supply chain as well as consumers.

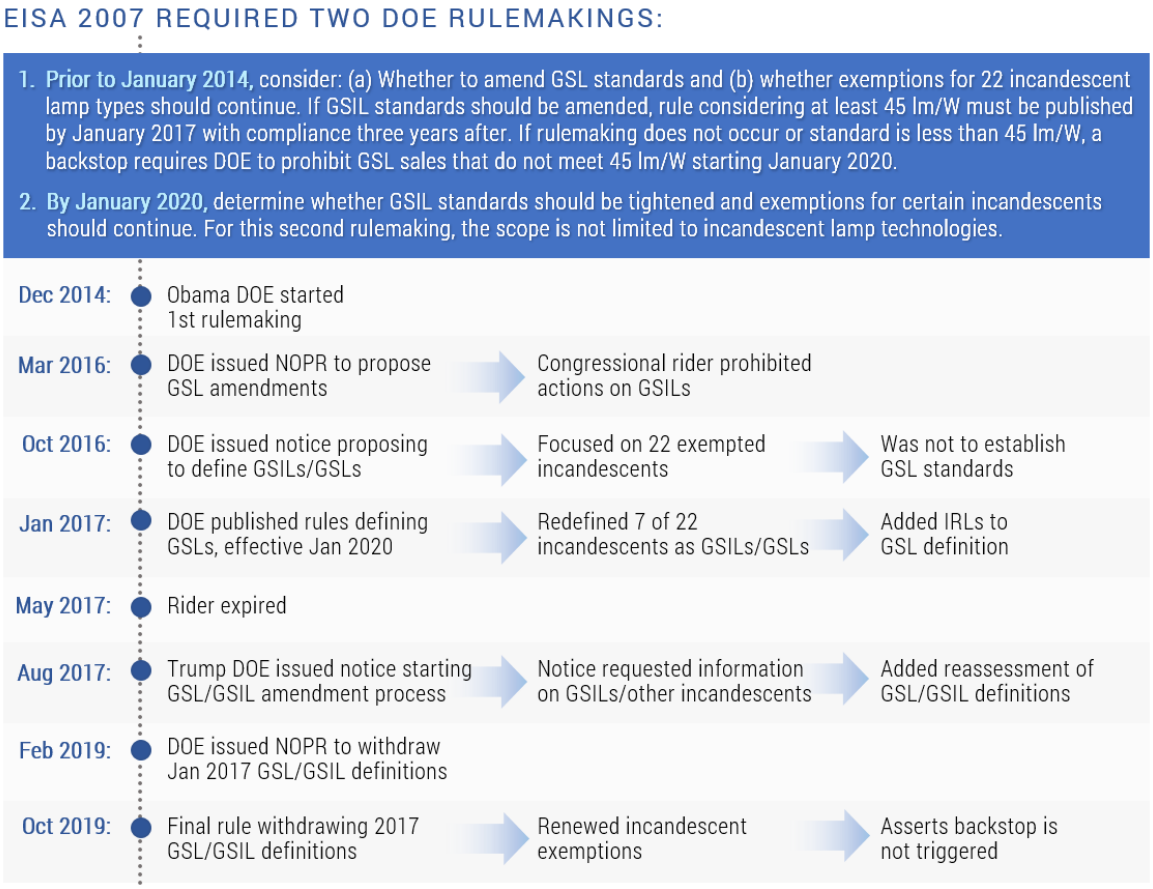
In 2007, the Energy Independence and Security Act of 2007 (EISA 2007) established standards by statute for general service incandescent lamps (GSILs) and required DOE to initiate rulemakings to (1) consider amending general service lamp (GSL) standards and (2) determine whether 22 exempted incandescent lamp types should continue to be exempted from the definition of GSLs and the requirements for general service incandescent lamps. EISA also included a backstop efficiency standard of 45 lumens per watt for general service lamps, effective January 2020 if DOE failed to adopt new energy standards.

Under EISA, GSILs were defined narrowly to reflect the characteristics of typical incandescent or halogen, A-line lamps (or A-lamps) with a medium base. The 22 lamp types exempted from the definition of GSILs for regulatory purposes included three-way, candelabra, and globe-type lamps. Candelabra-base and intermediate-base incandescent lamps were restricted to maximum wattage levels, but not to the efficiency requirements for GSILs. The corresponding narrow definition of GSLs included CFLs and light-emitting diodes (LEDs) and was tied to the GSIL definition, initially including medium base, A-line incandescent light bulbs.

In March 2016, DOE issued a Notice of Proposed Rulemaking (NOPR) to initiate the process required by EISA. In January 2017, DOE published rules that expanded the definition of GSLs and general service incandescent lamps. DOE broadened the GSL definition to remove some of the restricting requirements, such as the base-type requirement, and specifically included eight previously exempted lamp types (including certain incandescent reflector lamps, IRLs). This rule did not address setting standards for GSLs, however, due to a Congressional funding rider that prohibited DOE from amending the standards.

Late in 2019, however, the DOE, under President Trump, revisited these changes and rescinded the expanded definition of general service lamps, did not propose new lighting standards, and declined to implement the backstop provision, arguing that conditions did not exist to trigger that provision. Figure 1 presents a truncated timeline of the key GSL regulatory process.

Figure 1. General Service Lamp Regulation Timeline



NYSERDA is concerned about the uncertainties created in the GSL market by these changing regulatory requirements. Understanding how the market has responded to these regulatory fluctuations is important to NYSERDA as it tries to more accurately estimate baseline market efficiency levels and future impacts of programs. NYSERDA selected Cadmus to develop a market baseline and gauge the effect of these rulings on a key market characteristic—retailer stocking of GSLs—by compiling and analyzing general service lamp type and technology data for two periods: 2019 to 2020 and 2020 to 2021. Cadmus also conducted interviews with key market actors to understand what influences the lighting supply chain, the effects of changing regulations, and expectations about the future.

Cadmus compiled and analyzed data from a variety of sources using the methods shown in Table 1 to accomplish the key research objectives that were developed to assess the impact of the DOE rulings on the market shares of GSLs.

Table 1. Evaluation Objectives and Methods

Objective	Purpose	Methods
Estimate 2019 to 2020 market shares of technologies by lamp type that reflect the different GSL definitions and expectations about the backstop.	Establish a market baseline under original conditions.	Purchase New York State market data from the 2019 to 2020 period.
Estimate 2020 to 2021 market shares of technologies by lamp type that reflect the different GSL definitions and status of the backstop.	Determine the potential impact of DOE rulings.	Conduct retailer site visits; perform web-scraping.
Assess retailer stocking practices.	Understand factors influencing stocking decisions.	Conduct retailer site visits; interview market actors.

2 Methodology

This section contains a summary of the methodology to complete the work, including the retailer site visits, web-scraping, and market actor interviews. Cadmus relied on data obtained from Apex Analytics to assess the market during the 2019–2020 period and the findings from that data are presented later.

Cadmus used the site visits and web-scraping data to assess the 2020–2021 lighting market. To estimate the market shares for the 2020 to 2021 sales cycle, Cadmus conducted two data collection activities: retailer site visits and web-scraping data. The retailer site visit discussion includes a description of the sampling approach; the web-scraping data collection did not require a sampling plan because the data was collected from a census of stores in New York State.

2.1 Retailer Site Visit Methodology

This section describes the retailer site visit sampling plan and approach.

2.1.1 Site Visit Sampling Plan

Cadmus developed a sampling plan for retailer site visits to observe stocking practices and product inventory. Additionally, off-shelf promotional placement of lighting products and the bulb style and technology for any products featured in these displays was recorded during the site visits.

Working with NYSERDA to ensure the sample design met the needs of the study, Cadmus used InfoGroup data provided by NYSERDA to develop the sample frame, designed to address two key priorities:

- Avoid oversampling national chain stores, which have similar product assortments across locations.
- Sample stores that are representative of lighting sales.

The InfoGroup data included company name, address for each unique store location, NAICS code and description, and sales volume. Cadmus reviewed the NAICS codes and the stores within each code and removed retailers that were unlikely to have household lighting products (such as Macy's and Nordstrom from the department store category and some builder supply and landscape stores in the hardware and home center categories).

Table 2 shows the sample frame for site visits, including the eight retailer-category NAICS codes, the sample region, and the sampling weight within each sample region.

Table 2. Site Visit Sample Frame

Sample Region	NAICS Description	Sample Weight	Target Sample Size (added oversample)	Number of Completes
Downstate	All Other General Merchandise Stores	12%	7	5
	Department Stores	3%	4	4
	Hardware Stores	5%	4	3
	Home Centers	11%	5	5
	Office Supply and Stationery Stores	1%	3	1
	Pharmacies and Drug Stores	30%	15 (3)	16
	Supermarkets and Other Grocery (excluding Convenience) Stores	38%	20 (12)	23
	Warehouse Club Stores and Supercenters	2%	5	5
Subtotal			**63 (15)**	**62**
Upstate	All Other General Merchandise Stores	18%	6 (3)	7
	Department Stores	10%	3	3
	Hardware Stores	7%	3	2
	Home Centers	7%	3	3
	Office Supply and Stationery Stores	1%	2	1
	Pharmacies and Drug Stores	22%	8	8
	Supermarkets/Other grocery (excluding Convenience) Stores	36%	10	9
	Warehouse Club Stores and Supercenters	1%	2	2
Subtotal			**37 (3)**	**35**
Total			100 (18)	97

Cadmus divided store locations, based on county, into upstate and downstate geographic regions. The InfoGroup data did not include lighting-specific sales volume, so sample points were allocated using total sales volumes for each store. Downstate stores accounted for 62% of sales and upstate stores accounted for 38% of sales.

Within each geographic region, Cadmus created overall sampling weights, shown in Table 2, by combining the store and sales sample weights:

- The ***store weight*** is the number of unique store locations within each category divided by the total number of stores in the sample region.
- The ***sales weight*** is the total sales for each category divided by the total sales for the sample region.

Sampling with just the store weight would allocate most of the sample points to categories with a large number of unique store locations but that account for a small share of sales (such as general merchandise stores and supermarkets). Conversely, sampling with just the sales weights would allocate most of the sample points to home centers and supercenters that have disproportionately high sales volumes, but a small number of unique locations with similar product assortments. Cadmus combined the store and sales weights to ensure that the sample is representative of both stores with higher sales volume and stores with a greater diversity in product assortment.

Cadmus initially planned for 100 site visits, divided between the two geographic regions. However, Cadmus noticed through review of the site visit data that pharmacy and supermarket/grocery categories had higher-than-expected shares of stores that were closed or that did not stock household light bulbs. Cadmus pulled an additional 18 sites for these categories (shown in parentheses in Table 2). Ultimately, data were collected from 97 store locations.

2.1.2 Site Visit Data Collection

Cadmus subcontracted the retailer site visits to FieldAgent, a firm that specializes in retail audits using a crowdsourcing approach to data collection. Cadmus worked with FieldAgent staff to define the data points to collect and to design the data collection instrument, which included several aspects:

- Images of the main lighting section, including any signage or promotional elements in the aisles.
- Images of any lighting products outside the main aisle, such as endcaps, displays, shippers, wing stacks, or register displays, including specific images of the products on these displays and prices.
- Linear foot estimate of space used for each lighting product type.
- Close-up images of individual products in the lighting section with sufficient resolution to observe the breakdown by lighting type.
- Relative on-shelf stock levels of different products, determined by estimating the count of product present on the shelves.
- Lighting fixtures sold at the store, such as in the home improvement department and mass merchandiser/club location.

Cadmus provided FieldAgent with the target sample quotas for each retailer category and geographic region. FieldAgent began making site visits on October 2, 2020—after Cadmus approved the data collection instrument and provided instructions for FieldAgent site-visit staff—and completed site visits by November 5, 2020. Cadmus reviewed the site-visit data to ensure the quality and resolution of photos and to verify that site-visit staff were capturing all data points requested.

2.1.3 Site-Visit Data Analysis

Cadmus began analyzing site-visit photos as soon as they were available through FieldAgent's client dashboard, along with summary files of the responses recorded by agents visiting each store. The agents recorded LED market shares in 25% increments, which was not granular enough for analysis. Instead, Cadmus reviewed the photos for each site to determine product types and technologies. Cadmus then estimated inventory shares based on the proportion of pack-faces for each technology, which has been used successfully in previous lighting market assessments.

Pack-faces represent the share of two-dimensional area of the shelf displays. While accounting for the pack-faces and the depth of packages would capture actual inventory on shelves at a specific time, the site visit photos did not consistently show the depth of packages in sufficient detail. Cadmus notes that the depth of packages can fluctuate significantly on a day-to-day or hour-by-hour basis, depending on restocking schedules, so having the depth only provides a snapshot of shelf stock. Using the pack-face measurement depends on the reasonable assumption that products are shelved to the same depth. Focusing on pack-faces allowed Cadmus to prioritize collecting photos that capture comprehensive shelf layouts and package details that permitted Cadmus to reliably categorize bulb types and technologies.

Figure 2 shows an example shelf with incandescent and LED vintage and candelabra bulbs. This photo shows 38 pack-faces that are upright and facing the customer, including those stacked on top of other packs (and excluding packs that are not upright). There are six incandescent and 32 LED pack faces, for which Cadmus would record 16% (6/38) incandescent and 84% (32/38) LED. Cadmus used this method to count the pack-faces and shelf area for all photos from each site. Where the photos overlapped, Cadmus estimated where that overlap occurred to avoid double-counting products.

Some stores in the sample frame were closed and no longer in business; in one case, another business was operating in that location when FieldAgent arrived to take photos. Additionally, some selected sites did not sell any lighting products: these were often neighborhood pharmacies or small grocery stores. Cadmus removed these sites from the analysis since they do not represent the New York State lighting market.

Once all the photos from sites with lighting products were reviewed, Cadmus averaged the inventory shares by bulb type for each category across all locations within each sample retailer category. If a given store did not carry a bulb type, these data points were treated as missing rather than as zeros. For example, if a neighborhood grocery only sold A-lamp bulbs, Cadmus did not record 0% for reflector, candelabra, and globe bulbs. However, if a store sold a bulb type but did not sell each technology, a zero was recorded for the missing technology. For example, if that same neighborhood grocery sold LED and halogen A-lamps but not CFL or incandescent bulbs, zeros were recorded for the CFL and incandescent technologies.

Because lighting market shares for each store location were not available, Cadmus did not weight observations for stores within a given retail channel. For example, each store visited within the department store retail channel was treated equally. Cadmus did, however, apply the market share weights shown in Table 3 to combine findings across retail channels and estimate market shares within the total statewide lighting market.

Figure 2. Shelf Display Example of Shelf Area

2.1.4 Weighting

Cadmus weighted the site visit sample to be representative of the overall retail market in the State. However, because the share of lighting sales within a given retail channel is not proportional to overall sales, Cadmus applied post-sampling weights to combine market shares across retail channels; this allowed the data to represent the share of lighting market for each retail channel. Cadmus derived the post-sampling weights from a recent NMR Retail Channel study[3] that compared household lighting saturations and purchases between New York State and Massachusetts, asking participating households where they purchased recently installed LED bulbs.

Table 3 shows the estimated share of the LED market by retail channel and year (2016 to 2018) based on recent household purchases in the State, as reported by NMR, along with Cadmus' sample retail categories.

Table 3. Share of LED Market by Retail Channel

NMR Retail Channel	2016	2017	2018	Average Market Share	Cadmus Sample Retail Categories
Home Improvement	69%	64%	53%	62%	Home centers
Mass Merchandise	12%	26%	24%	21%	Department stores
Hardware	11%	2%	18%	10%	Hardware stores
Grocery	1%	1%	4%	2%	Supermarkets, all other general merchandise stores
Membership Club	5%	2%	1%	3%	Warehouse club stores and supercenters
Other	2%	4%	1%	2%	Pharmacies and drug stores, office supply and stationery stores

The retail categories from Cadmus' site visit sample frame did not map one-to-one with retail channels in the NMR report. For example, the NMR mass merchandise retail channel likely includes the supercenters, which Cadmus combined with the warehouse club stores in this study. This means that supercenter sales in this study are slightly underweighted. However, the alternative was to map supercenters and club stores to the NMR mass merchandise retail channel, which would have heavily over-weighted the warehouse club stores.

2.2 Web-Scraping Methodology

This section describes the data collection and analysis method Cadmus used for the web-scraping methodology.

2.2.1 Web-Scraping Data Collection

Cadmus collected data from websites on two large home center retailers using Parsehub[4] web-scraping software and a Google Chrome browser extension. Parsehub software, which uses cloud-service IP addresses, was not able to select store locations in the State for one of the two retailers. Rather than limit data collection to one retailer, Cadmus used a Chrome browser extension with similar functionality to collect inventory data from the second retailer.

The web-scraping software iterated over all store locations in New York State, filtering to products available for same-day pickup in each store. For each product the software also collected the number of those products available and product specifications (such as price, technology, style, and brand), allowing Cadmus to categorize the bulbs by technology and style to distinguish between narrow and expanded definitions of GSL bulbs.

Parsehub collected data from each store at several different times and over multiple days to capture weekends and weekdays, as inventory data collected on any single day may be affected by restocking or unique sales events.

2.2.2 Web-Scraping Data Analysis

Cadmus analyzed the data collected with the web-scraping software to categorize each product. The product specifications included bulb shape, light color, bulb base, bulb type, and a product description. Cadmus used these fields to filter products that were excluded from the two GSL definitions and not included in the analysis, specifically circline bulbs, night-lights, bug zapper, heat lamps, decorative colored bulbs, black lights, string lights, high-wattage utility lights, holiday lights, and capsule, wedge, or appliance bulbs. Cadmus then categorized the remaining bulb styles to four categories, with A-lamp bulbs fitting the narrow GSL definition and reflector, globe, and candelabra bulbs likely included along with A-lamps in the expanded definition of GSLs.

The vintage Edison style bulb, often with visible LED filaments that mimic the aesthetic of classic incandescent bulbs, was not specifically noted in the 2019 data from Apex Analytics. Cadmus categorized Edison style bulbs as candelabras since the majority of these were ST19 bulbs with small base and have similar applications for use in equipment, such as ceiling fans and wall sconces. Figure 3 shows an example of a vintage Edison LED shelf display from a site visit. All the bulbs discernable in this photo are LEDs.

Additionally, Cadmus categorized integrated LED downlights as reflector bulbs since these products can be reasonable substitutes for many indoor reflector bulb applications.

For each store included, the web-scraping software collected data from three to five daily observations. Cadmus calculated the average daily inventory for each product observed so that subsequent inventory averages and totals would not reflect any differences in the number of daily observations. Cadmus then summed the average daily inventory for each product by technology and product type to calculate market shares.

Figure 3. Vintage Edison Specialty LED Shelf Display

2.3 Data Reliability Risk and Mitigation Approach

We are confident our overall observations about technology mixes and trends are accurate; however, we acknowledge there are potential sources of uncertainty in our estimates. The following paragraphs discuss possible sources of uncertainty and steps we took to minimize any errors they might introduce.

Comparing market shares between data sets constructed using different methodologies has some limitations. Market shares for 2019 were calculated from full-category sales data.

Both the site visit data and the web-scraping data, with which Cadmus estimated 2020 market shares, are based on the assumption that shelf inventory is a reasonable proxy for product sales (that retailers dedicate more shelf space to products with a higher sales volume). To verify this assumption, Cadmus asked retailers during interviews whether sales and inventory differed and, if so, whether they could quantify the difference in a way that would allow evaluators to adjust the market share estimates derived from inventory data. Retailers noted in their interviews that the share of inventory was "roughly proportional" to the share of sales. Therefore, Cadmus did not make any adjustments to inventory summaries.

Additionally, classifying bulb technologies for all but Home Center stores relied on manually reviewing site visit photos from stores across New York State. While LEDs featured clear and consistent labels indicating LED technology, labels on halogens and incandescent bulbs were not labeled as clearly and consistently, particularly for candelabra and globe products. Miscategorized halogen and incandescent bulbs may account for some of the observed differences in incandescent market share between years. This would not impact the estimated LED market shares, which is the primary focus of this study.

To ensure the web-scraping software correctly captured product specs and inventory, Cadmus conducted manual spot check reviews of products. Cadmus determined that product specs and inventory levels were accurate compared to manually searching product URLs within store location. However, for some products, price was not reliable across dates and store locations. For example, a six-pack of integrated LED downlights showed a price of $3.59 at some stores and a price of $44.98 at others. This difference was not a function of pack size (as $3.59 per bulb would amount to $21.54 for a six-pack, which is less than half the price observed at other stores). Because of these discrepancies and because price was not critical for this analysis, Cadmus did not include price in any of the analyses.

Finally, the web-scraping inventory analysis assumes that retailer websites are updated in near real time to accurately reflect the current shelf product. If inventory updates do lag, that lag is unlikely to impact some bulb technologies differently than others, in which case there is no bias in market share estimates. Additionally, data for a census of home center stores in the State were collected, Cadmus was able to compare the inventory shares data for these stores with the ones included in the site visits to ensure consistency and accuracy of inventory estimates.

2.4 Market Actor Interviews Methodology

Cadmus completed 18 phone interviews (12 full interviews and six partial interviews) with national-level lighting manufacturers and New York State–based retailers and distributors who sell GSLs. Cadmus designed two interview guides—one for retailers and distributors (see appendix A) and one for manufacturers (see appendix A)—to address several objectives:

- Assess current GSL sales and stocking practices, with a specific focus on the supply chain (such as determining what is kept in backstock and storage at the store and how often shipments are delivered) and the impact of uncertainty regarding the GSL definition.
- Determine the relationship between sales and stocking to enable estimating sales shares from stocking data.
- Understand the timing of various lighting-related decisions, such as when stock is acquired and shelf sets are refreshed.
- Determine market actors' awareness of the GSL definitions and federal lighting standard rulings and how these rulings influenced their past and current decisions.
- Identify the impact of COVID-19 on stocking and shelving practices, including changes in customer buying patterns, supply chain disruptions, and retail practices.
- Estimate anticipated changes to sales of different lighting technologies in 2021.

Cadmus received input on the interview guides from both NYSERDA and from the subcontractor, Appliance Standards Awareness Project (ASAP), to ensure coverage of all relevant topics.

Cadmus stratified the interview sample by market actor type and, within the retailer stratum, by retailer type to ensure representation across channels that sell GSLs. To create the sample frame, Cadmus combined data from numerous sources, including data sets of relevant North American Industry Classification System (NAICS) codes (purchased from InfoGroup and Exact Data), published utility trade ally lists, and individual contact referrals from NYSERDA and Cadmus networks. Additionally, Cadmus conducted individual outreach at national-level retailers, using contact details gathered from store employees or found via online research. To qualify for the interviews, all retailer and distributor respondents had to have had decision-making authority for lighting stocking at their store.

Table 4 shows the final number of interviews completed by Cadmus. The number of completed interviews fell slightly short of the interview targets for several market actor types due to multiple factors:

- Many records in the sample contained the general store phone number rather than the phone number of the lighting decision-maker, which resulted in the need to go through multiple contact chains to reach the right person.
- Independent stores with multiple locations (or chain stores) typically make decisions at the corporate level, which Cadmus was unable to obtain direct contact information for unless the store-level contact provided the interviewer with a referral.
- There is a small number of corporate-level decision-makers for stores in the office supply, mass merchandiser, or wholesale club tiers, which makes outreach efforts difficult.
- Many stores from the sample in the pharmacy channel did not sell light bulbs.
- There was a language barrier with some store contacts, specifically in the greater New York City area.

While the interview completions are lower than planned, the answers that respondents gave to key questions tended to coalesce around the same response, meaning that increasing the final interview count may not have yielded many new answers. Additionally, lighting manufacturers, who regularly interface with national-level retailer contacts, provided some insights into this group of decision makers.

Table 4. Market Actor Interview Sample

Market Actor Type	Market Actor Subtype	Interview Completions			Total Interviews
		Target	Full	Partial	
Manufacturers	-	3–5	4	0	4
Distributors	-	4–5	2	0	2
Retailers	Grocery	4–5	1	4	5
	Hardware	6–7	4	1	5
	Pharmacy	2–3	1	1	2
	Mass Merchandisers/Supercenters	1	0	0	0
	Office Supply	1	0	0	0
	Warehouse Club	1	0	0	0
Total		**22a25**	**12**	**6**	**18**

In some cases, respondents were not willing or able to complete the full 20-minute interview with Cadmus but offered to respond to some questions via email. In those cases, Cadmus sent respondents a shortened set of high-priority questions (provided in appendix C) to gather some of the information critical to the project's research objectives. These responses were counted towards the "Partial Completions" count in Table 4.

3 Market Assessment

This section presents Cadmus' assessment of the market shares for the two sales cycles, 2019 to 2020 and 2020 to 2021. It also presents information on product displays.

3.1 2019 to 2020 Market Data

To determine the 2019 to 2020 market shares, Cadmus purchased full category sales data for the State from Apex Analytics. Apex also provided national lighting sales and sales summarized across non-program states, those without utility-sponsored lighting programs. Lighting sales from Apex were delivered already cleaned and summarized by product category:

- A-lamps
- Reflectors
- Globes
- Candelabras

The A-lamps represent the original, narrow definition of GSL bulbs, which have been subject to EISA efficiency standards since 2012. On the other hand, the majority of reflectors, globes, and candelabras represent bulbs that would fall under the expanded definition of GSLs with the reduced list of exempted lamp types (though some reflectors, such as integrated LED downlights and some pin-based MR16 bulbs, would still be exempt under the expanded definition).

In addition to State sales, Apex Analytics also provided national market shares for each product category and technology, as well as market shares in states without active utility-sponsored lighting programs that could have influenced the prevalence of efficient lighting products. Table 5 shows the national, non-program state, and New York LED market shares for 2019. The State has a significantly larger share of LEDs for globe and candelabra lamps than in non-program states.

Table 5. 2019 LED Market Shares by Region

Bulb Type	New York	National	Non-Program States
A-lamp	52%	58%	51%
Reflector	79%	84%	82%
Globe	59%	50%	42%
Candelabra	69%	56%	46%

Incandescent bulbs accounted for most of the globe and candelabra sales that were not LEDs, while most A-lamp and reflector sales that were not LEDs were halogens. Table 6 shows market shares in New York State by technology and bulb type.

Table 6. New York Market Shares by Technology and Bulb Type, 2019

Bulb Type	LED	CFL	Halogen	Incandescent
A-lamp	52%	3%	41%	5%
Globe	59%	0%	19%	22%
Reflector	79%	0%	14%	7%
Candelabra	69%	0%	1%	30%

3.2 Market Data, 2020 to 2021

To estimate 2020 to 2021 market shares in the State, Cadmus combined the site visit and web-scraping data after completing review and analysis of the two data sets.

For the final analysis Cadmus replaced the home center site visit data with the web-scraping data because Home Centers account for such a large share of the lighting market. The web-scraping data was more comprehensive since collection took place at multiple points in time from a census of home center stores in New York State, rather than a sample of stores at one point in time per-store with the site visits.

3.2.1 Inventory Shares

Table 7 shows the late-2020 State market shares by technology for each bulb type, derived from the inventory collected with web-scraping software. Cadmus included linear tube products in addition to the narrow and expanded GLS categories to show the market share of these relatively recent LED tube bulbs.

Table 7. Home Center Retailer Web Inventory Shares by Bulb Type, 2020

Bulb Type	LED	CFL	Halogen	Incandescent	Fluorescent
A-lamp	78%	2%	9%	10%	0%
Globe	58%	0%	7%	35%	0%
Reflector	81%	0%	14%	5%	0%
Candelabra	69%	0%	0%	30%	0%
Linear tube	22%	0%	0%	0%	78%

LEDs account for more than three-quarters of reflector and A-lamp bulb inventory within Home Center stores (78% and 81%, respectively). LED shares were slightly lower for globe and candelabra bulbs but still more than half of bulb inventory. While linear tube bulbs are not expected to fall within the narrow or expanded definition of GSLs, LEDs are starting to gain market share, accounting for 22% of 4-foot and 8-foot linear tubes in Home Center stores. Less-efficient technology shares, halogen and incandescent, were nearly even for A-lamps at 9% and 10% of inventory, respectively. Halogens had the second-highest shares for reflector bulbs at 14% while incandescent bulbs accounted for only 5%. Incandescent bulbs showed substantial shares within candelabra and globe bulb styles, with about one-third of inventory for both bulb types.

Table 8 shows the combined inventory or market shares by technology for each bulb type, derived from the site visits and the web scraping data. As noted earlier, Cadmus replaced the site visit data for Home Centers with the web-scraping data given its comprehensiveness. Additionally, while the web-scraping and site visit data aligned closely for LED market shares for each bulb type, web-scraping collected product specs, which allowed Cadmus to categorize bulbs more accurately than we could, using the photos from the site visits. Using product specs for the Home Centers to categorize bulbs increases the accuracy of the incandescent and halogen bulb shares.

Table 8. Site Visit and Web Data Combined Inventory Shares by Bulb Type, 2020

Bulb Type	LED	CFL	Halogen	Incandescent
A-lamp	77%	2%	13%	7%
Globe	61%	0%	12%	27%
Reflector	78%	0%	16%	5%
Candelabra	72%	0%	1%	27%

In the site visits, Cadmus found a small share of incandescent A-lamp bulbs. These are technically exempt from the EISA standards as they are specialty products, such as rough or vibration service bulbs. However, Cadmus included these in the estimates of market share because, while these products cost significantly more than traditional incandescent A-lamps, consumers with a strong preference for incandescent bulbs could purchase and use these lamps as traditional incandescent bulbs.

Table 9 shows the combined market shares across all New York State retail channels for each technology. These shares combine all the product data that Cadmus collected which likely fell under the expanded GSL definition. Subsequent tables comparing shares by sample region and retail channel will present summaries of the expanded GSL definition unless otherwise noted with specific bulb-type designations.

Table 9. Overall Site Visit Inventory Shares by Technology, 2020

State	LED	CFL	Halogen	Incandescent
New York	73%	1%	11%	15%

Comparing the A-lamp shares in Table 8 (the narrow definition of GSLs) and the combined shares in Table 9 (the expanded definition), the share of LEDs drops from 77% to 73% while the share of incandescent light bulbs increases from 7% to 15%. This reflects the higher prevalence of incandescent bulbs in the globe and candelabra bulb categories compared to A-lamp and reflector bulbs.

Table 10 shows a comparison of the inventory shares between the upstate and downstate sampling regions.

Table 10. Site Visit Inventory by Sample Region and Technology, 2020

Sample Region	LED	CFL	Halogen	Incandescent
Downstate	70%	1%	14%	15%
Upstate	75%	0%	7%	16%

Inventory shares did vary slightly between upstate and downstate stores, with upstate stores showing slightly higher shares of LEDs and lower shares of halogen and incandescent bulbs.

Table 11 shows a comparison of inventory shares between the upstate and downstate sampling regions within each retail channel.

Table 11. Site Visit Inventory by Sample Region and Retail Channel, 2020

Retail Channel	Sample Region	LED	CFL	Halogen	Incandescent
Department Stores	Downstate	84%	1%	9%	6%
	Upstate	85%	0%	3%	12%
Grocery	Downstate	17%	2%	37%	44%
	Upstate	32%	0%	32%	37%
Hardware Stores	Downstate	34%	0%	28%	37%
	Upstate	58%	3%	13%	26%
Home Centers	Downstate	73%	1%	11%	14%
	Upstate	76%	0%	7%	16%
Other	Downstate	39%	2%	33%	28%
	Upstate	50%	0%	24%	25%
Warehouse Clubs and Supercenters	Downstate	80%	0%	20%	0%
	Upstate	94%	2%	5%	0%

Stores in the grocery, hardware, and other retail channels showed significant differences in inventory shares between sample regions. These retail channels have greater diversity, with many small, independent neighborhood stores or small chains compared to national chains, which account for most of the department stores, warehouse club, and home centers—stores that have largely consistent product assortments and layouts between locations. All three retail channels with greater diversity showed lower shares of LEDs in downstate locations compared to upstate stores within the same retail channel.

Additionally, warehouse clubs and supercenters showed significantly higher shares of LEDs in the upstate locations compared to downstate locations. One possible explanation for this difference is that product assortments differ somewhat between urban and suburban locations. Another possible explanation is that the difference is an artifact of the small sample sizes within channels—in the case of warehouse club and supercenter stores, five downstate and two upstate locations were visited among three primary retailers. Any retailer-specific differences between the upstate and downstate samples would lead to differences between upstate and downstate estimates, though Cadmus did not design the sample to test for differences between regions or retailers.

3.3 Product Displays

In addition to capturing shelf space to estimate inventory, FieldAgent also recorded whether stores had lighting products featured in off-shelf displays—endcaps, wing stacks, shippers, or pallet displays—during the site visits. For stores where off-shelf displays did feature lighting products, FieldAgents also recorded if the featured products were LEDs.

Table 12 shows the percentage of stores with off shelf-displays and the percentage of displays that featured LEDs by retail channel. For example, 57% of department stores had off-shelf displays with lighting products and 100% of the stores with displays featured LEDs in the off-shelf displays. A much smaller share of grocery stores had off-shelf displays (7%) and only 75% of those displays featured LEDs. The other 25% of grocery displays featured lighting products that were not LEDs.

Table 12. Off-Shelf Displays by Retail Channel

Retail Channel	Percent of Stores with Displays	Percent of Displays with LEDs
Department Stores	57%	100%
Grocery	7%	75%
Hardware	43%	100%
Home Centers	88%	86%
Other	10%	100%
Warehouse Club & Supercenters	0%	0%

Table 13 shows the share of displays by sample region. To combine display summaries across retail channel, Cadmus weighted the displays by the retail channel market shares shown in Table 3. The statewide total reflects, weighted by market shares by region shown in Table 2.

Table 13. Off-Shelf Displays by Sample Region

Sample Region	Percent of Stores with Displays	Percent of Displays with LEDs
Downstate	64%	81%
Upstate	83%	100%
Statewide	71%	89%

Upstate stores had a higher share of stores that featured lighting products in off-shelf displays compared to downstate stores. Upstate stores were also more likely to feature LEDs in the off-shelf displays.

Statewide, 71% of stores featured off-shelf displays with lighting products and 89% of the displays featured LED bulbs.

4 Key Findings

This section presents key findings from the sales data analysis and market actor interviews.

4.1 Inventory and Sales Analysis

LED bulbs accounted for most sales in the 2019 to 2020 cycle as well as most of the inventory in the 2020 to 2021 cycle Cadmus analyzed. This was true across all bulb types. LED shares did increase between cycles for all but one bulb type—reflectors—which essentially remained unchanged between years.

For those bulb types excluded from the narrow GSL definition, LEDs saw modest increases in market shares. Of the bulb types studied, globes and candelabras have the largest percentages that are still incandescent.

The analysis showed that halogen bulb shares decreased from the first to second period, largely due to a shift from halogen to LED bulbs.

A-lamps, which represent the narrow definition of GSL bulbs, showed a significant increase in LED market shares between 2019 and 2020—up from 52% to 77% (see Figure 4). Most of the increase in LED market share is due to a shift away from halogen bulbs, which decreased from 41% of the market in 2019 to 13% in 2020.

Figure 4. A-Lamp Market Shares by Year and Technology

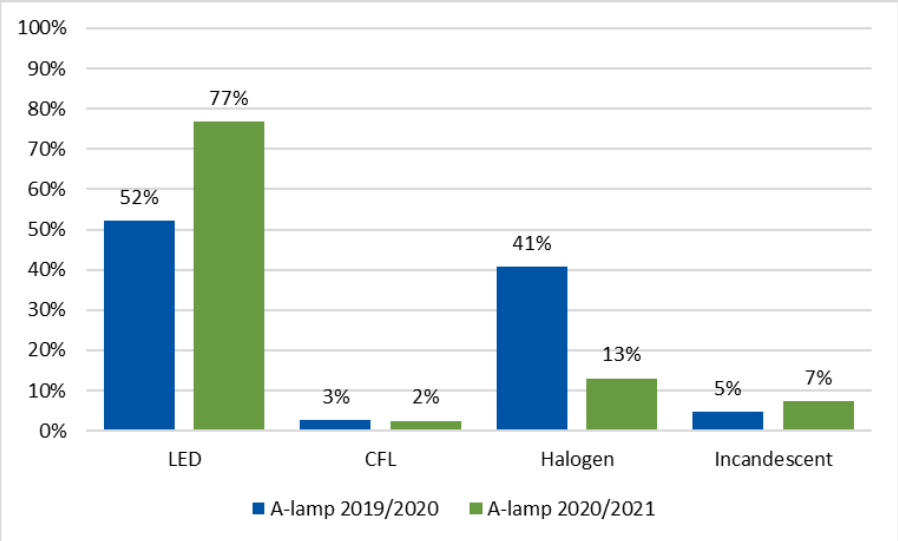
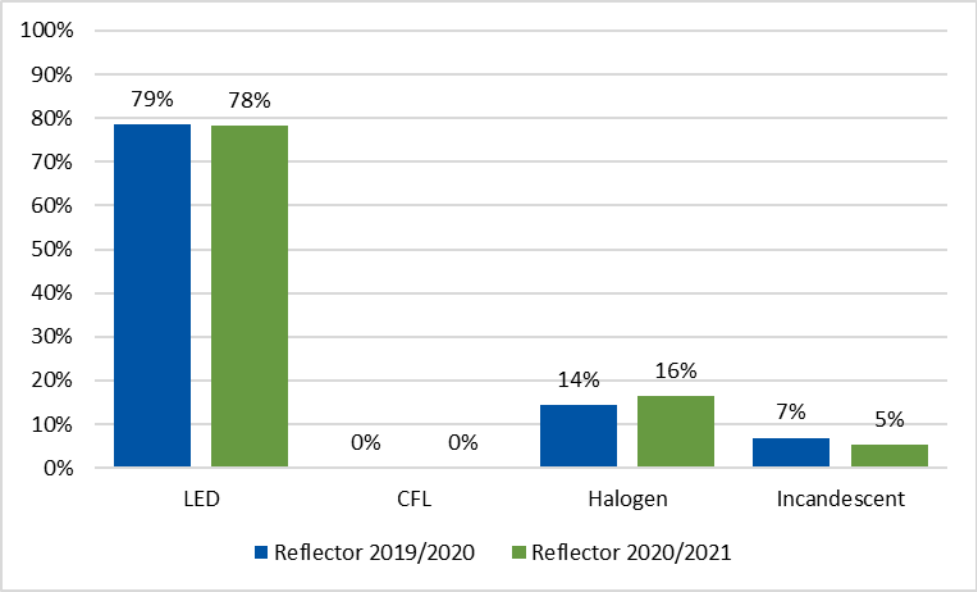


Figure 5 shows that LED shares were high and essentially unchanged for reflector bulbs. The market shares of halogen reflectors increased while incandescent shares decreased, but these changes are small.

Figure 5. Reflector Market Shares by Year and Technology



LED shares increased for globe style bulbs, up from 59% in 2019 to 61% in 2020 (see Figure 6) and the incandescent share increased slightly, from 22% in 2019 to 27% in 2020.

Figure 6. Globe Market Shares by Year and Technology

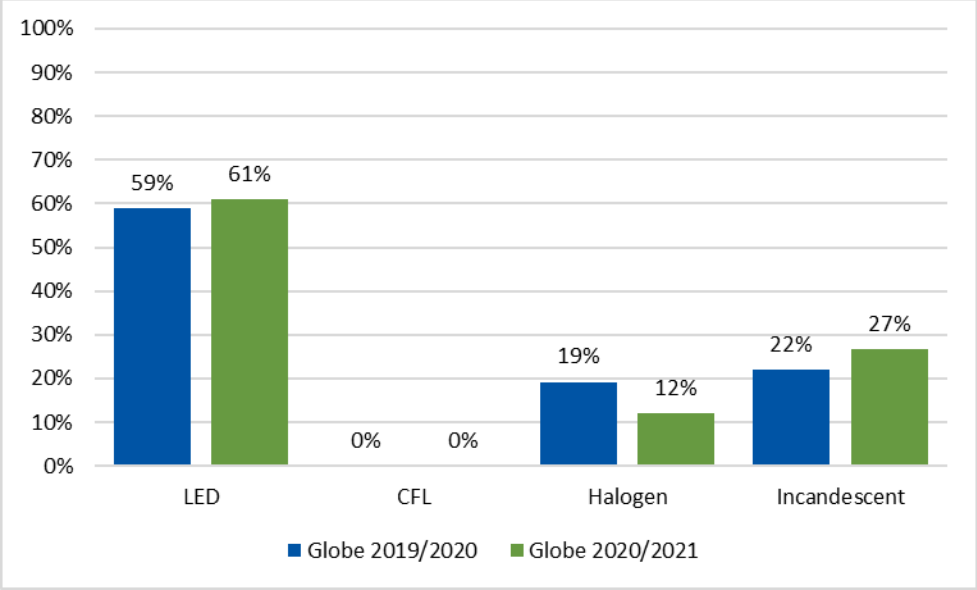


Figure 7 shows candelabra bulbs also remained largely unchanged with a slight increase in LED shares and a slight decrease in incandescent shares.

Figure 7. Candelabra Market Shares by Year and Technology

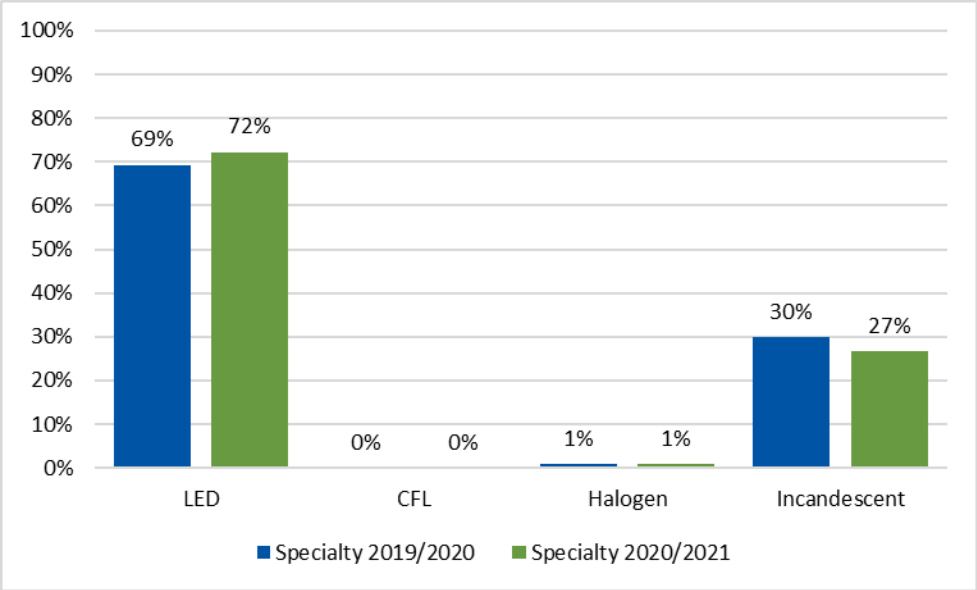


Table14 shows a comparison of overall market shares between years for the expanded definition of GSL bulbs by technology.

Table 14. Expanded GSL Market Shares by Year

Year	LED	CFL	Halogen	Incandescent
2019	56%	2%	33%	8%
2020	73%	1%	11%	15%

Overall, the market share for LEDs increased by 16 percentage points from 2019, up to 73% of the market. The share of incandescent bulbs appears to have increased while halogen shares have decreased. Part of this apparent increase could be attributed to the data collection methodology in this study. Much of the analysis relied on review of photos from the site visits. LED packages are clearly labeled and easy to distinguish (see Figure 3 for an example). However, halogen and incandescent bulbs, particularly globes and candelabras, were less clearly labeled and were more difficult to distinguish; therefore, the 2020 share might be overestimated.

4.2 Market Actor Interview Findings

This section presents findings from the market actor interviews, including insights on the topics of current GSL sales and stocking practices, the awareness and impact of federal lighting standards, the impact of the COVID-19 pandemic on the lighting market, and anticipated future changes in the lighting market.

4.2.1 Current GSL Sales and Stocking Practices

All retailers, distributors, and manufacturers, regardless of size or channel, said they determine which lighting products to stock primarily based on sales performance. Retailers, including hardware stores, noted that lighting is a small portion of their overall sales, leading them to stock only what customers demand. One retailer said that stocking "depends on customer demand, pricing, and product popularity. As of recent, customers are more interested in LEDs and less interested in CFLs and incandescents, so we are phasing out [CFLs and incandescent light bulbs]." One distributor with a large special-order business (contributing to approximately 20% of their sales) said that if customers continue to place special orders for a certain lighting product, they start to stock that product. Two manufacturers and one distributor said their clients at large national retailers share their lighting sales data with them so that the manufacturers and distributor can recommend which products the retailer should stock. This in turn helped these manufacturers and the distributor to better understand what is in demand and what and how many products to produce. Outside of sales performance, respondents cited pricing (one retailer and one distributor) and product quality (one retailer and one distributor) as important factors when determining what to stock.

While manufacturers consider sales performance as the key metric to determine what products to manufacture, they take additional factors into consideration. One such factor noted by all four manufacturers is the desire to stay ahead of market trends by developing cost-effective LED versions of popular lighting products. One manufacturer stated: we are "encouraging energy efficiency because we see LEDs as the future. There is a small subset of customers who still want traditional technologies (so we are manufacturing these), but more and more customers are switching to LEDs." Another manufacturer noted the importance of pricing, saying, "We have been trying to slowly but surely create a comparably priced LED for each type of bulb, which we can then take to retailers and let them choose what to stock." Another manufacturer did note that for some products, such as T3/T4 halogens, it is difficult to create a comparable LED and therefore they keep offering the incandescent version.

Retailers noted that they frequently order and replenish their stock of lighting products, with nearly all stating they order lighting products weekly. Retailers try to keep between one- and four-weeks' worth of products on the shelf or in storage at the store to meet customer demand, with the most common length of time reported as "several weeks." Three retailers could not provide a specific timeframe but said they keep "10 to 15 of each item" in stock. One retailer noted that because the store is small, the product manager tries "to keep the stock of [lighting products] on the [at a minimum] because we don't want to hold on to extra stock."

Retailers and distributors gave a range of frequencies when asked how often they reassessed which products to stock and how to shelve them. On the low end, three said they make these decisions one or two times per year, usually around the holidays, and on the high end, three said they are always reviewing the products they offer. Other answers included quarterly (one distributor), on an as-needed basis (one retailer), and less often than once per year (one retailer). Generally, stores with larger lighting sections were more likely to reassess product stocking and shelving on a regular twice-per year or quarterly cycle.

All retailers noted that, in general, the share of shelf space dedicated to each lighting product was roughly proportional to its share of sales. While they could not provide specifics for different technology types, one retailer summed up the sentiment shared by others, saying, "we only stock what will sell well."

4.2.2 Awareness and Impact of Federal Lighting Standards Rulings

Only three retailers and one distributor were aware of EISA in general, with only one retailer (hardware store) aware of the expanded definition and rescission. Two retailers did note being aware of certain lighting "being phased out" but were not concerned enough by the change to look into it further. While interviewers did not specifically ask respondents why they were not very aware, many retailers had noted earlier in the interview that they were responsible for making stocking decisions across a wide variety of categories and lighting represented only a small portion of their sales. This lack of focus on lighting likely meant they did not need to know about EISA and the associated regulatory uncertainty, as they only keep a small amount of stock in the store (and could conform to any new regulations). Manufacturers echoed this sentiment when discussing how the lighting buyers at national-level retailers respond to any EISA uncertainty, with one saying these retailers "rely on us to make recommendations on their product assortment. They trust us to be the experts in lighting and make sure they are compliant with any regulations."

Conversely, and as expected, all four manufacturers were aware of the EISA rulings and the associated expanded definition and rescission, with two specifically noting that they were involved in some of the hearings on the definition rulings. In general, manufacturers said the GSL definition expansion in January 2017 was not approached appropriately and instead should have been accomplished through the next rulemaking cycle. They all noted that the market is "heading toward an all-LED future" and that this should be the main force driving change. The manufacturers all want to be part of the rulemaking process and said it would be beneficial to include them in any future discussions on this topic. All four manufacturers were also aware of pending litigation, brought forth by states and environmental groups, regarding the definition of GSLs and have been following developments closely. With the January 2021 change in the administration, one manufacturer believes that new federal rulemaking will phaseout halogen bulbs within the next four years.

Due to the long ramp-up period associated with the federal lighting standards changes in EISA 2007, manufacturers noted the uncertainty caused by the changing GSL definitions had not led them to make any significant production changes. One manufacturer specifically said that making manufacturing decisions three years in advance would have been "a waste of resources" while two others noted that, based on their discussions with industry advocates, they anticipated that the expanded definition would likely not hold up after the federal government reassessed the ruling. Thus, these manufacturers took no action based on the expanded GSL definition. Another manufacturer said that "until something is finalized, the company is not able to react to it. We need to make decisions on what will happen, not what might happen."

Manufacturers were also aware of the various state-level lighting regulations, specifically naming those in California and Nevada. One manufacturer said the main issue with implementing these lighting standards is the ramp-up period being too quick to allow retailers to fully sell all their old inventory. This manufacturer said California's ramp-up period was particularly short, leading to frustration in the market. Another manufacturer concurred, saying that most of the impact from state-level standards is felt by the retailers and distributors, which could result in an overstock of products in the short term. While manufacturers noted that state-level standards have not had much of an impact on their own sales yet, many national-level retailers did not want to have multiple shelf sets for different states. Therefore, these retailers will standardize what they sell across the country by switching to only selling products that meet all the different state-level standards. One manufacturer said that state-level standards add confusion and it would be preferable to have just one federal standard.

Going forward, all four manufacturers and one lighting-focused distributor plan to keep a close eye on any unfolding regulatory changes at the federal or State level. These market actors think the main event that will impact the regulatory environment is the upcoming federal administration change, which will likely set the next federal standards. As discussed earlier, the manufacturers said it would be beneficial to include manufacturers in the federal rulemaking process to ensure that they can respond adequately to any upcoming changes.

4.2.3 COVID-19 Impact

The reported impacts of the COVID-19 pandemic on business varied across the retailers, distributors, and manufacturers. Retailers reported that COVID-19 had a range of impacts, such as increased sales and supply chain issues, but said that lighting generally represents too small a percentage of their sales to have much impact. Only one retailer (pharmacy) reported that their lighting sales were impacted by the pandemic, specifically stating that they have "kept more product in stock and have seen an increase in sales," specifically shifting to larger pack sizes (which are selling better). This retailer noted an increase out-of-stock lighting products from some of their suppliers, suggesting that some lighting supply chain issues are funneling down to retailers. In response, this retailer was able to compensate by increasing its orders from other suppliers.

Distributors reported more COVID-related impacts than those reported by retailers. One lighting-focused distributor reported a large negative sales impact, specifically because many job sites were closed or lighting retrofits were postponed, leading to fewer contractors who were purchasing lighting. Additionally, this distributor was holding a large number of custom lighting orders for customers that the distributor was not sure, under the circumstance, would sell. This distributor pointed out that there has been considerably longer wait times to receive orders, stating that "orders to lighting manufacturers, where we usually see an eight- to 10-week delivery window…is now in the five- to six-month range." The distributor believes these delays will continue for at least the next year or two because manufacturers will need time to hire new staff to catch up with backlogged demand, acquire raw materials, and begin moving the product through the supply chain. Conversely, another (general building supplies) distributor noted that the company has seen a significant change in business for non-lighting products but not for lighting.

Manufacturers noted the largest impact of the COVID-19 pandemic: while it did not impact the mixture of products they manufacture, it created temporary changes in sales volume and distribution channels. One manufacturer said the pandemic "feels like the Great Recession when many companies went out of business: people aren't in buildings using lighting (so re-lamping slowed down), new construction got halted, and the global container supply chain had multiple impacts [on international shipping]." Another manufacturer concurred, saying the pandemic has "impacted our manufacturing practices because of component shortages and production delays. While the worst of these issues are behind us, we continue to see delays in assembly and critical material and electrical component delivery." This manufacturer has also had to significantly reallocate their resources to meet the new distribution channel needs (higher e-commerce volume and lower traditional retail and wholesale volume).

4.2.4 Future Lighting Sales Patterns

Market actors generally agreed that lighting sales will continue the same trajectory in 2021 as they did from 2019 to 2020, with LEDs gaining market share relative to other technologies. One manufacturer expects to see "year-over-year declines in demand for incandescents. We will keep making incandescent reflectors and a small number of A-lamps in the short-term, but many specialty bulbs are moving to only LED." This same manufacturer believes that the market will transition to predominately LED within a few years, "whether it's [regulatory changes] or market forces." Another manufacturer concurred, stating that "in the lighting market we're seeing a major transformation happening quickly. If federal rulemaking chooses to speed that up, it will happen, but the market will go there on its own." Distributors and retailers think the trend toward LEDs will continue, with one distributor noting potential changes to more specialty lighting: "LEDs have been huge for work lights. [Our customers] are always looking for efficiencies, and lighting is an area where we've seen big changes."

5 Conclusions

Fluctuations in federal regulations for general service lamps since enactment of EISA 2007 have introduced considerable uncertainty in the lighting market. The most likely outcome of EISA 2007, if fully implemented, was a shift of A-line lamps away from halogen and incandescent technologies to LEDs. The law could require the same for any other lamp types that were covered under a definition of GSLs and GSILs that was expanded in response to EISA 2007 to include previously exempted lamps. Between 2014 and 2020, DOE's interpretation and implementation of EISA 2007 changed dramatically. These significant changes created uncertainty for both suppliers and consumers in the general service lamp market. Given the regulatory uncertainty, stocking practices are driven primarily by consumer demand.

To inform lighting program design and to project potential program energy savings in New York State, NYSERDA needs to have a good understanding of the current state of the general service lamps/general service incandescent lamps (GSL/GSIL) market, answering questions such as: how supply-chain product decisions are made, and what effect regulations and other external factors have on the market. This information will help NYSERDA understand issues such as where the best opportunities are for increasing lighting efficiency; how suppliers are likely to respond to lighting incentive programs; underlying market trends; and how long it takes for the market to respond to external influences.

Adoption of the 2017 regulations that changed and expanded the definition of GSLs, followed by a proceeding that led to rescission of these changes and put the backstop requirement on hold, generated an opportunity to research how the market responded to major regulatory driving forces. This study provided snapshots of the GSL market at two different points in time that were affected by the varying regulatory requirements. During the two periods, Cadmus analyzed both the types of bulbs, those in the narrow and expanded GSL definition, as well as the technologies used in those bulbs—incandescent, halogen, CFL, and LED.

Stocking practices during the first period—2019–2020—were influenced in part by the 2017 DOE regulations and the uncertainty created by the process initiated to overturn those regulations. The second period—2020–2021—was influenced by the rescission of the expanded GSL definition and the lack of progress toward the 2020 backstop requirement. Results for the latter period provide, for one thing, a baseline from which to estimate energy savings potential.

The interviews with market actors and store site visits provided insights into the decision-making, awareness, marketing, and behavior of different supply-side market actors. These interviews give a basis for anticipating how the market is likely to respond to future programs and standards that affect this lighting sector.

5.1 Lighting Market Shares

Major conclusions from this study about market shares of different general service lighting products include the following:

- **The general service lighting market is moving toward LEDs:** The proportion of GSL bulbs that are LEDs have continued to increase. Currently, sales in New York State for GSLs in the narrow definition—primarily A-line bulbs—are 79% LEDs, up from 52% about a year ago. For bulbs in the expanded definition of GSLs—including globes, candelabras, and reflectors—the LED share went from 56% to 70% in one year.
- **Bulbs in the expanded definition are following a similar trend**—The trend toward LEDs across all bulb types studied suggested that this technology is becoming the norm and able to meet higher efficiency standards.
- **The market baseline across bulb types is dominated by LEDs**—Using the expanded GSL definition, in the 2020–2021 period 73% of bulbs were LEDs, 11% were halogens, 15% were incandescent light bulbs, and only 1% were CFLs.
- **Most of the growth in the LED market shares has resulted from a decline in halogens.**
- **Bulb types in the expanded GSL definition offer significant energy savings opportunities**—incandescent light bulbs still constitute 27% of globes and candelabra bulbs.
- **LEDs are more prevalent in Upstate New York**—Shares of LEDs were higher in Upstate New York though the difference was modest. This relationship held across all retailer types and may be a result of the diversity of stores in downstate New York or differences between suburban and urban stores.

5.2 Stocking Practices and Influences

Key conclusions from this study about general service lamp stocking practices and what influences market actor decisions include the following:

- **The recent federal regulatory uncertainties did not affect retailer stocking practices—** Customer demand and sales performance are the major determinants of retailer lighting product stocking decisions. All market actors interviewed agreed that sales performance was the primary factor that determined what general service lighting products to stock. Retail sales performance feeds back to manufacturers and distributors to inform what products they provide. While manufacturers may need months to shift production, retailers and distributors tend to keep limited stock on-hand, enough for days or weeks, and could respond relatively quickly to changes in standards.

- **Retailers and distributors have only limited knowledge of regulations that affect lighting**—Most retailers do not give much attention to lighting market issues because they do not provide a significant share of their sales; they rely on manufacturers to provide products that comply with regulatory requirements. They expect manufacturers to keep them informed about regulations that impact the availability of products, as well as to make recommendations regarding specific lighting products to stock.
- **Manufacturers are aware of lighting product regulations**—Some manufacturers reported that they follow regulatory processes closely to minimize uncertainties they face. They track standard development at the State, as well as federal level and will respond to changes in State standards, while preferring uniform federal standards.
- **Manufacturers will respond to changes in efficiency standards but seek certainty**—Manufacturers anticipate standards will increase in stringency and expect to increase their products' efficiency but will not initiate product changes without a high level of certainty that the requirements will go into effect. Manufacturers are concerned about State-standard processes not allowing sufficient time to change their production process efficiently.

Appendix A. Market Actor Interview Guide: Retailers and Distributors

Research Objectives	Question
Assess current GSL sales and stocking practices, with a specific focus on the supply chain (such as what they keep in backstock and storage at the store and how often they receive shipments) and the impact of uncertainty regarding the GSL definition.	Section D and Questions E4, E6, E7, and E9
Determine the relationship between sales and stocking to enable estimating sales shares from stocking data.	Questions D3 and D4
Understand the timing of various lighting-related decisions, such as when stock is purchased, and shelf sets are refreshed.	Questions D2, D5, and D8
Determine market actors' awareness of the GSL definitions and federal lighting standard rulings and how these rulings influenced their past and current decisions.	Section E
Identify the impact of COVID-19 on stocking and shelving practices, including changes in customer buying patterns, supply chain disruptions, and retail practices.	Section F
Estimate anticipated changes to sales of different lighting technologies in 2021.	Questions F4, F6, F7, and G2

Audience: Lighting retailers and distributors who sell GSLs in New York State.

Purpose: Gather qualitative data regarding the research objectives above.

Cadmus conducted these in-depth interviews with a relatively informal structure. This interview guide was intended to ensure that interviewers covered all topics during the interview, but the interviewer allowed the actual conversation to flow naturally to maximize the likelihood of obtaining a candid perspective from the respondent.

Cadmus scheduled interviews in advance of the call via email or telephone. Each interview took approximately 30 minutes.

Phone Interview Sampling Plan

Population	Data Source	Population Size	Selection Type	Target Range	Stratification
Retailers, local-level decision makers	InfoGroup	~8,000	Random stratified	8–10	Retailer type: Hardware (4-5), Grocery (2-3), Drug (1-2)
Retailers, national-level decision makers	Appliance Standards Awareness Project, online networking, Cadmus contacts	~100	Census of available contacts	7–8	Retailer type: Hardware (2), Grocery (1-2), Mass (1), Club (1), Drug (1), Office (1)
Distributors	National Electrical Manufacturers Association, Appliance Standards Awareness Project, Cadmus contacts, online networking	~250	Census of available contacts	4–5	None

General Instructions

- Interviewer instructions are in green **[LIKE THIS]**.
- Skip pattern instructions are in red **[LIKE THIS]**.
- Prior to conducting the interviews, Cadmus determined whether each retailer and distributor has locations outside of New York; Cadmus used this information to streamline background questions. This is referred to as **[MULTISTATE] (Y/N/UNK)**.

A.1 Email Invitation

To: **[EMAIL]**
From: NYSERDAResearch@qemailserver.com
Subject: NYSERDA needs your input on the lighting market!

Hello **[FIRST NAME]**,

The New York State Energy Research and Development Authority (NYSERDA) has contracted with The Cadmus Group to conduct a study to better understand the lighting market in New York State, specifically regarding how retailers and distributors are reacting to market changes. Given your role in your business, we thought you would be able to provide valuable insights and feedback.

This interview should take a maximum of 30 minutes and will be conducted over the phone by a Cadmus team member. Information will be kept confidential to the extent permitted by law; NYSERDA's analysis will use only summary data and will not identify individual respondents or companies.

If you are interested in participating, please respond to this email with a few times over the next couple of weeks that would work for you and we can schedule the interview. If you are not the right person to speak with regarding your company's lighting stocking decisions, please put us in touch with the right person.

If you have any questions about the validity of this research, please feel free contact me via the contact information below.

Thanks,

Ryan

Ryan Moore | Project Manager
NYSERDA | 17 Columbia Circle | Albany, NY 12203-6399
P: 518-862-1090 x3267 | F: 518-862-1091 | E: ryan.moore@nyserda.ny.gov

A.2 Introduction

[NOTE: SCREENER IS CONTAINED IN A SEPARATE DOCUMENT]

Hello **[NAME]**. This is **[___]** from Cadmus. As we mentioned in the **[EMAIL INVITE/INITIAL PHONE CALL]**, we are conducting research on behalf of the New York State Energy Research and Development Authority, or NYSERDA, to better understand stocking and sales of screw-in light bulbs in New York. These include regular-shaped light bulbs (or A-lamps), reflector (or directional) bulbs, such as flood lights or bulbs designed for recessed sockets, and other specialty bulbs such as candelabra bulbs, which often have a smaller base, or globe-shaped bulbs, which can have either a small or regular-sized base, and specialty A-lamps such as three-way or "rough service" bulbs.

I expect this interview to take approximately 30 minutes. If you need to stop before then we can schedule a second call to finish. The information you provide will be kept confidential to the extent permitted by law including but not limited to the Freedom of Information Law.

A.3 Company Background

Based on online research, populate **[MULTISTATE]** and **[MULTI-STORE]**

First, I have general questions about your company.

C1. What types of lighting products do you sell? **[PROBE FOR TYPES OF BULBS AND FIXTURES; RECORD VERBATIM]**

C2. **[ASK DISTRIBUTORS ONLY, IF MULTISTATE = N OR UNK]** Does your company distribute lighting products outside the state of New York?

1. **[IF YES]** Within what geographic area does your company distribute lighting products?
2. **[IF YES]** Approximately what proportion of the lighting products you sell are distributed within New York?

C3. **[ASK IF MULTISTORE = N OR UNK]** Does your company have more than one retail store?

1. **[IF YES]** How many retail locations does your company have in New York State?

[IF DISTRIBUTOR HAS STORE OUTSIDE OF NEW YORK] Thank you. The rest of my questions will only focus on your company's business in New York.

A.4 Sales and Stocking Practices

D1. What factors do you consider when deciding which screw-in light bulb models to stock? **[LISTEN FOR THE INFLUENCE OF GSL DEFINITION AND LIGHTING STANDARDS RULINGS BUT DO NOT PROBE DURING INITIAL DISCUSSION; ASK PROBING QUESTIONS AFTER DEFINITION QUESTIONS IF NOT BROUGHT UP ALREADY]**

1. What about deciding how many of each model to stock?

D2. **[IF MULTI-STORE]** Are stocking decisions made for each store or, if not, at what level are stocking decisions made?

D3. How much inventory, in terms of days or weeks of sales, do you typically keep in stock? Is this level different for different types of screw-in light bulbs that you carry **[IF NEEDED: SUCH AS ONES THAT MOVE FASTER VERSUS SLOWER]**?

D4. Do the proportions of bulbs currently on shelves correspond to the proportions of sales?
   1. **[IF NO]** How do the proportions on the shelves differ from the proportions of sales? Does this vary? How and why? **[PROBE FOR WHETHER THIS YEAR IS DIFFERENT FROM TYPICAL YEARS IN TERMS OF THIS VARIATION, SUCH AS DUE TO COVID OR SUPPLY CHAIN ISSUES]**

D5. How often are stocking and shelving decisions made?
   1. Do you typically make stocking and shelving decisions during the same time each year?
   2. How often, if at all, are these decisions reviewed?

D6. Does your store have agreements with specific manufacturers that impact the decisions you make related to which lighting products to stock? **[PROBE FOR HOW AND WHETHER THIS IMPACTS THE FREQUENCY OF STOCKING DECISIONS AND THE EXTENT TO WHICH MANUFACTURERS INFLUENCE STOCKING, SUCH AS VIA SUGGESTIONS, PROMOTIONS, OR INCENTIVES]**

D7. How much time passes between when the decision to stock a specific product is made and when that product is available on shelves?

D8. On average, how long do you keep a particular light bulb model in stock before it is replaced by a newer model?
   1. Can you give me an example of what types of changes are made to specific models?

D9. **[IF NOT ALREADY ADDRESSED]** Does your company have any environmental or "green" initiatives currently in place or planned for the near future?
   1. **[IF YES]** How does this impact your stocking and sales practices?

A.5 Awareness of Lighting Standards

Now I'd like to ask you about federal lighting regulations first introduced under the Energy Independence and Security Act of 2007, or EISA. EISA covered a category of light bulbs called "general service lamps" and included a requirement that the U.S. Department of Energy implement new efficiency standards for these bulbs by 2020.

E1. Are you aware of the fact that EISA affects which light bulbs manufacturers can offer for sale? **[IF NO, SKIP TO NEXT SECTION]**

E2. Are you aware that EISA includes what is called a "backstop provision"? **[IF NEEDED, PROVIDE DEFINITION: THE EISA BACKSTOP PROVISION STATED THAT, IF THE DEPARTMENT OF ENERGY FAILED TO ADOPT NEW ENERGY STANDARDS, A 45 LUMEN PER WATT MINIMUM EFFICACY STANDARD FOR GENERAL SERVICE LAMPS WOULD COME INTO EFFECT JANUARY 1, 2020]**
   1. **[IF YES]** When did you become aware of the original EISA backstop provision?

E3. Were you aware that, in January 2017, the Department of Energy, under President Obama, issued a ruling redefining the term "general service lamp" to include not just A-lamps, but other types of screw-in bulbs such as directional, candelabra, globe-shaped, and other specialty bulbs that were previously exempt from the higher-efficacy standards that would have come into effect in 2020?
   1. When did you become aware of this redefinition?

E4. During the year after this ruling expanding the definition of general service lamp, did this ruling influence any of your stocking planning or considerations? How? **[IF NEEDED, PROMPT FOR GENERAL TIME PERIODS]**

E5. **[READ THIS QUESTION SLOWLY AS THERE ARE MULTIPLE COMPONENTS]** Were you aware that in August 2017, under President Trump, the Department of Energy issued an order that started a process of reviewing the definitions of different light bulb types and standards that led to rescinding the expanded definition of general service lamps in late 2019, around which time they also declined to enact the original EISA backstop provision, which would have instituted a 45 lumen per watt minimum efficacy standard for general service lamps? **[PROBE FOR SPECIFICS OF WHAT THEY WERE AWARE OF, IF NOT CLEAR THEY WERE AWARE OF BOTH COMPONENTS]**

E6. When did you first become aware that the ruling expanding the definition of general services lamps was likely to be rescinded?
   1. And when did you become aware of the final ruling on this rescission?
   2. How, if at all, did this rescission impact your stocking planning or considerations?

E7. When did you first become aware that the EISA backstop MIGHT NOT be implemented in 2020?
   1. And when did you become aware that the Department of Energy WOULD NOT implement the backstop in 2020?
   2. How, if at all, did this rescission impact your stocking planning or considerations?

E8. Were you aware that there is pending litigation regarding both of the late-2019 rulings? **[INTERVIEWER NOTE: THE NEW YORK STATE ATTORNEY GENERAL IS AMONG THOSE LITIGATING]**
   1. What do you know about the content and status of such litigation?
   2. How, if at all, does this pending litigation impact your stocking planning or considerations?

E9. **[SKIP IF RESPONDENT IS NOT FAMILIAR WITH FEDERAL REGULATIONS]** Would the mixture of screw-in lamp technologies (by technologies I mean LED versus halogen, incandescent, or CFL) currently on shelves be different if the regulatory changes had been announced earlier? In other words, to what extent was the mixture of screw-in lighting technologies in stock impacted by regulatory changes announced late in 2019?

A.6 COVID-19 and Regulatory Impacts

F1. Has the COVID-19 pandemic impacted your lighting-related stocking practices? How?

F2. Have you experienced screw-in lighting supply chain disruptions due to COVID-19?
   1. **[IF YES]** Have these disruptions impacted sales?
   2. **[IF YES]** Have these disruptions impacted the mixture of lighting products you offer?

F3. Do you expect any of these COVID-related changes to be long term, or even perhaps permanent? Which ones?

F4. Do you expect 2021 sales, in terms of quantity and technology mix, to differ substantially from 2020 sales?
   1. **[IF YES]** How?
   2. **[IF YES]** To what factors do you attribute these anticipated changes?

F5. What regulatory changes do you anticipate in the next two years? **[IF UNCERTAIN]** What is the likelihood that the current regulations will persist into 2021, including no expansion of the definition of a general service lamp and no increase in efficacy standards or the backstop? **[IF NEEDED, PROMPT FOR THE ESTIMATED LIKELIHOOD IN THE EVENT OF A CHANGE IN THE FEDERAL ADMINISTRATION]**

F6. What, if any, contingency plans have you made related to regulatory uncertainty?

F7. How do the arrangements you have with manufacturers impact the level of risk your company faces with regard to regulatory uncertainty?

A.7 Perspectives on Lighting Market

Now I would like to wrap up with a couple questions about your perspective on the lighting market, recent trends you have observed, and where you think the lighting market is headed.

G1. What changes have you observed in the lighting market in the last year? **[PROBE FOR CHANGES IN TYPES OF BULBS BEING SOLD, SUCH AS BULB SHAPES AND REFLECTORS; RECORD VERBATIM]**

1. To what do you attribute these changes? **[RECORD VERBATIM]**

G2. Where do you see the market heading in the next three years? **[RECORD VERBATIM]**

A.8 Closing

H1. Is there anything else you would like to add?

Thank you for your input. We appreciate your time. Have a nice day.

Appendix B. Market Actor Interview Guide: Manufacturers

Research Objectives	Question
Assess current GSL manufacturing and sales practices, with a specific focus on the supply chain and the impact of uncertainty regarding the GSL definition.	Section D and Questions E4, E6, E7, E9, and E10
Determine market actors' awareness of the GSL definitions and federal lighting standard rulings and how these rulings influenced their past and current decisions.	Section D
Identify the impact of COVID-19 on stocking and shelving practices, including changes in customer buying patterns, supply chain disruptions, and retail practices.	Section F
Estimate anticipated changes to sales of different lighting technologies in 2021.	Questions F4, F6, F7, and G2

Audience: Lighting manufacturers who sell GSLs in New York State.

Purpose: Gather qualitative data regarding the research objectives above.

Cadmus conducted these in-depth interviews with a relatively informal structure. This interview guide was intended to ensure that the interviewers covered all topics during the interview, but the interviewer allowed the actual conversation to flow naturally to maximize the likelihood of obtaining a candid perspective from the respondent.

Cadmus scheduled interviews in advance of the call via email or telephone. Each interview took approximately 30 minutes.

Population	Data Source	Population Size	Selection Type	C/P	Minimum Target

General Instructions

- Interviewer instructions are in green **[LIKE THIS].**
- Skip pattern instructions are in red **[LIKE THIS].**

B.1 Email Invitation

To: **[EMAIL]**
From: Mark.Janett@cadmusgroup.com
Subject: NYSERDA needs your input on the lighting market!

Hello **[FIRST NAME]**,

The New York State Energy Research and Development Authority (NYSERDA) has contracted with The Cadmus Group to conduct a study to better understand the lighting market in New York State, specifically regarding how the market is reacting to changes in regulations. Given your role in the lighting industry, we thought you'd be able to provide valuable insights and feedback.

This interview should take a maximum of 30 minutes and will be conducted over the phone by a Cadmus team member. Information will be kept confidential to the extent permitted by law including but not limited to the Freedom of Information Law; NYSERDA's analysis will use only summary data and will not identify individual respondents or companies.

If you are interested in participating, please respond to this email with a few times over the next couple of weeks that would work for you and we can schedule the interview. If you are not the right person to speak with regarding lighting manufacturing and sales decisions, please put us in touch with the right person.

If you have any questions about the validity of this research, please feel free contact Mark Janett from Cadmus (617-673-7194; mark.janett@cadmusgroup.com) or Ryan Moore from NYSERDA (518-862-1090 x3267; ryan.moore@nyserda.ny.gov).

Thanks,

Mark

Mark Janett | Associate
Cadmus | 100 Fifth Ave Suite 100 | Waltham, MA 02451
Office: 617.673.7194 | Mobile: 973.715.1436

B.2 Introduction

Hello **[NAME]**. This is **[___]** from Cadmus. As we mentioned in the **[EMAIL INVITE/INITIAL PHONE CALL]**, we are conducting research on behalf of the New York State Energy Research and Development Authority, or NYSERDA, to better understand stocking and sales of screw-in light bulbs in New York. These include regular-shaped light bulbs (or A-lamps), reflector (or directional) bulbs, such as flood lights or bulbs designed for recessed sockets, as well as other specialty bulbs such as candelabra bulbs, which often have a smaller base, or globe-shaped bulbs, which can have either a small or regular-sized base, and specialty A-lamps such as three-way or "rough service" bulbs.

I expect this interview to take approximately 30 minutes. If you need to stop before then we can schedule a second call to finish. The information you provide will be kept confidential to the extent permitted by law including but not limited to the Freedom of Information Law.

B.3 Company Background

First, I have general questions about your company.

C1. What types of lighting products do you manufacture? **[PROBE FOR TYPES OF BULBS AND FIXTURES AND TECHNOLOGY TYPES; RECORD VERBATIM]**

C2. Approximately what proportion of the screw-in bulbs that you manufacture and sell in the United States are: **[READ ALL FOUR CATEGORIES BEFORE ASKING FOR PROPORTIONS]**
   D1. LEDs
   D2. Halogen lamps
   D3. CFLs
   D4. Incandescent lamps **[PROMPT FOR WHAT TYPE, LIKE SPECIALTY LAMPS SUCH AS THREE-WAY BULBS OR ROUGH-SERVICE BULBS THAT ARE EXEMPT FROM CURRENT EFFICIENCY STANDARDS]**

C3. Approximately what proportion of the screw-in bulbs that you manufacture and sell in the United States are: **[READ ALL FOUR CATEGORIES BEFORE ASKING FOR PROPORTIONS]**
   1. Directional lamps
   2. Specialty lamps

B.4 Manufacturing and Sales Practices

D1. What factors does your company consider when deciding what mixture of screw-in lamp technologies (by technologies I mean LED versus halogen, incandescent, or CFL) to manufacture and sell? **[LISTEN FOR THE INFLUENCE OF GSL DEFINITION AND LIGHTING STANDARDS RULINGS BUT DO NOT PROBE DURING INITIAL DISCUSSION]**
   1. Do any outside parties, such as a customer council or other advisory group, impact the decisions you make related to which lighting products to manufacture? **[PROBE FOR HOW THIS IMPACTS DECISIONS]**
   2. Does your company have agreements with specific retailers or distributors that impact the decisions you make related to which lighting products to manufacture? **[PROBE FOR HOW THIS IMPACTS DECISIONS]**

D2. On average, how long do you continue to manufacture a particular light bulb model before it is replaced by a newer model?
   1. Can you give me an example of what types of changes are made to specific models?
   2. How much advance notice do you give retailers/distributors before making a model change?

D3. **[IF NOT ALREADY ADDRESSED]** Does your company have any environmental or "green" initiatives currently in place or planned for the near future?
   1. **[IF YES]** How does this impact your manufacturing and sales practices?

B.5 Awareness of Lighting Standards

I'd like to talk with you about federal lighting regulations first introduced under the Energy Independence and Security Act of 2007, or EISA. EISA covered a category of light bulbs called "general service lamps" and included a requirement that the U.S. Department of Energy implement new efficiency standards for these bulbs by 2017 that would be effective by 2020.

E1. Are you aware of EISA? **[IF NO, SKIP TO E10]**

E2. Are you aware that EISA includes what is called a "backstop provision"? **[IF NEEDED, PROVIDE DEFINITION: THE EISA BACKSTOP PROVISION STATED THAT, IF THE DEPARTMENT OF ENERGY FAILED TO ADOPT NEW ENERGY STANDARDS, A 45 LUMEN PER WATT MINIMUM EFFICACY STANDARD FOR GENERAL SERVICE LAMPS WOULD COME INTO EFFECT JANUARY 1, 2020]**
   1. **[IF YES]** When did you become aware of the original EISA backstop provision?

E3. Were you aware that, in January 2017, the Department of Energy, under President Obama, issued a ruling redefining the term "general service lamp" to include not just A-lamps, but other types of screw-in bulbs such as directional, candelabra, globe-shaped, and other specialty bulbs that were previously exempt from the higher-efficacy standards that would have come into effect in 2020?
   1. When did you become aware of this redefinition?

E4. During the year after this ruling expanding the definition of general service lamp, did this ruling influence any of your planning or considerations related to manufacturing and sales? How? **[IF NEEDED: PROMPT FOR GENERAL TIME PERIODS]**

E5. **[READ THIS QUESTION SLOWLY AS THERE ARE MULTIPLE COMPONENTS]** Were you aware that in August 2017, under President Trump, the Department of Energy issued an order that started a process of reviewing the definitions of different light bulb types and standards that led to rescinding the expanded definition of general service lamps in late 2019, around which time they also declined to enact the original EISA backstop provision, which would have instituted a 45 lumen per watt minimum efficacy standard for general service lamps?

E6. When did you first become aware that the ruling expanding the definition of general services lamps was likely to be rescinded?
   1. And when did you become aware of the final ruling on this rescission?
   2. How, if at all, did this rescission impact your planning or considerations related to manufacturing and sales?

E7. When did you first become aware that the EISA backstop MIGHT NOT be implemented in 2020?
   1. And when did you become aware that the Department of Energy WOULD NOT implement the backstop in 2020?
   2. How, if at all, did this rescission impact your planning or considerations related to manufacturing and sales?

E8. Were you aware that there is pending litigation regarding both of the late-2019 rulings? **[INTERVIEWER NOTE: THE NEW YORK STATE ATTORNEY GENERAL IS AMONG THOSE LITIGATING; AND THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION HAS ALSO INTERVENED]**
   1. What do you know about the content and status of such litigation?

E9. **[SKIP IF RESPONDENT IS NOT FAMILIAR WITH FEDERAL REGULATIONS]** Would the mixture of screw-in lamp technologies (by technologies I mean LED versus halogen, incandescent, or CFL) you manufacture, and sell be different if the regulatory changes had been announced earlier? In other words, to what extent was the mixture of screw-in lighting technologies you sold in 2020 impacted by regulatory changes announced late in 2019?

E10. In addition to federal lighting standards, several states have their own lighting standards. Are you aware of any of these state-level lighting standards?

1. **[IF YES]** What lighting standards are you aware of? **[PROBE FOR SPECIFIC STATES: CALIFORNIA, COLORADO, NEVADA, VERMONT, AND WASHINGTON]**
2. **[IF YES]** How, if at all, have these standards impacted your planning and manufacturing decisions?

B.6 COVID-19 and Regulatory Impacts

1. Has the COVID-19 pandemic impacted your sales of screw-in lighting? How?
2. How, if at all, has the COVID-19 pandemic impacted your manufacturing practices?
3. Have you experienced screw-in lighting supply chain or distribution channel disruptions due to COVID-19? **[PROBE FOR DETAILS]**

D5. **[IF YES]** Have these disruptions impacted sales?

D6. **[IF YES]** Have these disruptions impacted the mixture of lighting products you offer?

4. Do you expect any of these COVID-related changes to be long term, or even perhaps permanent? If so, which ones?
5. Do you expect 2021 sales, in terms of quantity and technology mix, to differ substantially from 2020 sales?

1. **[IF YES]** How?
2. **[IF YES]** To what factors do you attribute these anticipated changes?
3. **[IF YES AND NOT ALREADY MENTIONED]** To what extent does uncertainty regarding regulatory changes factor into these anticipated changes?

6. What regulatory changes do you anticipate in the next two years? **[IF UNCERTAIN]** What is the likelihood that the current regulations will persist into 2021, including no expansion of the definition of a general service lamp and no increase in efficacy standards or backstop?
7. What, if any, contingency plans have you made related to regulatory uncertainty?
8. How do the arrangements you have with retailers impact the level of risk your company faces with regard to regulatory uncertainty?

B.7 Perspectives on Lighting Market

Now I'd like to wrap up with a couple questions about your perspective on the lighting market, recent trends you have observed, and where you think the lighting market is headed.

G1. What changes have you observed in the lighting market in the last year? **[PROBE FOR CHANGES IN TYPES OF BULBS BEING SOLD, SUCH AS BULB SHAPES AND REFLECTORS; RECORD VERBATIM]**

1. To what do you attribute these changes? **[RECORD VERBATIM]**

G2. Where do you see the market heading in the next three years? **[PROBE FOR CHANGES IN TYPES OF BULBS BEING SOLD, SUCH AS BULB SHAPES AND REFLECTORS AND THE EMERGENCE OF NEW TECHNOLOGIES; RECORD VERBATIM]**

B.8 Closing

H1. Is there anything else you would like to add?

Thank you for your input. We appreciate your time. Have a nice day.

Appendix C. Interview Questions for Email Responses

Hello **[NAME]**,

Thank you for speaking to us on the phone and being open to providing your feedback via email. Below are a few questions that ask about your lighting product sales and stocking practices. Specifically, we're interested in hearing about screw-in light bulbs, which refers to any light bulbs that you screw into the base, such as A-lamps ("classic" pear-like shape), flood lights, candelabra bulbs, and globe-shaped bulbs. If possible, please only think about your lighting sales in New York state.

What factors do you consider when deciding which screw-in light bulb models to stock?

1. How much inventory, in terms of days or weeks of sales, do you typically keep in stock? Is this level different for different types of screw-in light bulbs that you carry, such as ones that move faster or slower?
2. Do the proportions of bulbs currently on shelves correspond to the proportions of sales? For example, is the percent of bulbs on your shelves that are A-lamps (classic-shaped) the same as the percent of your sales that are A-lamps?
    a. If no, how do the proportions on the shelves differ from the proportions of sales?
3. Are you aware of the Energy Independence and Security Act of 2007, or EISA, which covered a category of light bulbs called "general service lamps" and included a requirement that the Department of Energy implement new efficiency standards for these bulbs by 2020?
4. If yes, were you aware of the expanded definition of "general service lamp" in early 2017 and the subsequent decision to revert that definition back to the original one in late 2019?
    a. How, if at all, has the COVID-19 pandemic impacted your lighting-related stocking practices? Have you experienced any screw-in lighting supply chain disruptions due to COVID-19?

Thanks,
[INTERVIEWER SENDING EMAIL]

Endnotes

[1] United States Department of Energy: Energy Efficiency and Renewable Energy, Appliance and Equipment Standards Rulemakings and Notices, https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=4

[2] Apex Analytics founded the Consortium for Retail Energy Efficiency Data (CREED) and started the LightTracker initiative, focusing on acquiring full-category lighting data, including incandescent, halogen, CFL, and LED bulb types, for all distribution channels and for the entire U.S.

[3] NMR Group, Inc. March 29, 2019. RLPNC Study 18-10 2018-19 Residential Lighting Market Assessment Study. https://ma-eeac.org/wp-content/uploads/RLPNC_1810_LtgMarketAssessment_FINAL_2019.03.29.pdf

[4] See more details about Parsehub on the company website: https://www.parsehub.com/

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York State since 1975.

To learn more about NYSERDA's programs and funding opportunities, visit nyserda.ny.gov or follow us on Twitter, Facebook, YouTube, or Instagram.

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