

Commercial Lighting: Market Actor Insights on a Dynamic Market

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ABSTRACT

While lighting markets across all sectors continue to change dynamically, program administrators are still often questioning – what have we missed? For the commercial sector, remaining potential varies regionally across the United States. A 2018 analysis of regional energy efficiency organizations completed for the DesignLights Consortium (DLC) estimated considerable remaining potential savings across several regions, with the highest remaining potential forecasted in the Southeast (Mellinger 2018). This study forecasted 90,000 GWh potential cumulative savings in non-residential applications between 2018 and 2035 from a combination of indoor and outdoor LED lighting, and controls in the southeast region alone, which is nearly 50% higher than the next region in terms of remaining potential. Given this, the question remained – how can we help businesses in the Southeast realize the benefits of energy efficient lighting, and take advantage of the remaining potential even as lighting markets are changing?

However, realizing this potential requires an understanding of commercial businesses, where end users represent very different businesses in a wide range of buildings and ownership models. Additionally, attitudes and perspectives on energy and energy efficiency can vary by region as well. In this paper, we describe a broad market research study completed in 2020, intended to provide a snapshot of the current state of underserved businesses in one state in the southeast, including their current installed and stored lighting stock, their installation practices and perspectives, and input from contractors and distributors on their views of where the commercial lighting market is headed next.

Introduction

A 2018 analysis of regional energy efficiency organizations completed for the DLC forecasted 90,000 GWh potential cumulative savings between 2018 and 2035 from a combination of indoor and outdoor LED lighting, and controls in the southeast region alone (Mellinger 2018). However, realizing this potential requires an understanding of commercial businesses, where end users represent very different businesses in a wide range of buildings and ownership models. To gain this understanding and to inform the future of commercial lighting programs, we studied the commercial lighting portfolio for a utility in the southeastern U.S. The utility's existing commercial lighting portfolio offers incentives on lighting measures across all commercial programs, including direct install and commercial and industrial custom and prescriptive programs. The programs work with networks of distributors, contractors, and installers to ensure customers install qualifying equipment and receive incentives. These market actors have intimate knowledge of how these programs play out “on the ground” and provided crucial input for the study.

To support the programs in identifying future lighting needs of commercial customers, ILLUME conducted a review of existing programs and collected primary data. In early 2020 we conducted interviews with 14 contractors and distributors, and in October 2020 we surveyed 312 businesses from the utilities' general population of business customers. We stratified the survey sample by business type, business size, and location – and oversampled sectors and geographies that have historically been underserved by the utility's programs. Utilizing both data sources we address the following research questions, focusing on differences by region (urban vs not) and business type. Combining interview insights with survey responses sheds light on the key decision-makers, and critical time points to target to optimize savings from upgrades.

There are a number of different studies that can support utilities in understanding existing markets for energy efficient measures as well as the remaining potential for energy efficiency programs to shift those markets, such as baseline studies and technical potential studies. The study completed as part of this research was not intended to estimate or extrapolate exact estimates of remaining potential; rather, to provide guidance and direction to program managers in a specific utility territory using both quantitative and qualitative market research, and feedback from participants and market actors. There are broader lessons gleaned from this research, however, that may be useful for other utilities in the region and elsewhere in the country when considering how to best understand and target businesses with remaining potential in their own commercial lighting markets.

This study sought to address the following research questions:

- **Understand the current installed lighting stock**, including the saturation of efficient lighting across the state, focusing on identifying groups that may have higher or lower opportunities for retrofits such as business sectors and/or geographical areas)
- **Characterize the national and regional lighting markets.** Identify potential emerging technology and trends that may be cost-effective for a future program offering
- **Understand motivations and attitudes of business owners** and facility managers around lighting projects, including whole-building retrofits
- **Understand business customer/contractor/distributor attitudes** and perceptions around lighting technologies and energy efficiency in general

Methodology

In-Depth Interviews

From mid-January through March 2020, we conducted phone interviews with 14 market actors through the state. Interviewees included 7 contractors and installers and 7 distributors and wholesalers from both urban and rural areas and different climate zones throughout the state. We recorded all the interviews and used interview transcriptions in addition to interviewer notes to code interviews for common themes and differences in perspective. Interview topics included: a) early drivers of LED adoption; b) the current state of the market including stocking practices, customer awareness, and business practices, and; c) perspectives on the future of the market include thoughts on controls.

Surveys

In October 2020, the ILLUME team mailed 6,298 invitation postcards to the utility's commercial customers offering a \$15 incentive to participate in the online survey. We sent reminder emails a week after customers received the initial invitation postcard. A total of 312 respondents participated in the survey, yielding a 5% response rate.

This survey asked respondents to detail the type of lighting they had in their facilities, As described above, this study was intended to be directional and guide marketing and outreach strategy. This study did not characterize lighting at the socket/fixture level, but rather asked customers to characterize the proportions (percentages) of each type of lighting they had installed or in storage. To help facilitate respondents accurately answering questions about different lighting technologies, the online survey provided visual descriptions and prompts to help respondents categorize their lighting, with examples shown below.



Figure 1. Visual Prompts Provided in Surveys

Of the 278 respondents who reported their job function, the majority (57%) were business owners. The remainder of respondents generally held decision-making positions as well (e.g., property manager, operations manager, etc.). Other characteristics of respondents include:

- **Region.** 35% of respondents' facilities are in the major metropolitan area, while the rest were distributed throughout the state.
- **Facility size.** 64% of respondents (179 of 279) have facilities that are 5,000 square feet or less.
- **Number of employees.** 76% of respondents (216 of 284) have 1 – 10 employees.
- **Own vs. lease facility.** Respondents were just as likely to lease their facility as they were to own it.
- **Responsible for electric bill.** 99% of respondents (including 145 of 146 who rent) are responsible for paying their electric bill.

It should be also be noted that this study intentionally oversampled underserved business types (including smaller and/or rural businesses). Larger businesses and businesses in metro areas may contain a significantly higher number of sockets/fixtures and may also have higher LED penetration. Results should be interpreted with this in mind.

Table 1 below summarizes the distribution of business types of respondents relative to the general population as provided by the utility tracking data. We targeted specific business types to ensure we heard from business types that constitute a significant portion of the general population but experience low rates of participation in utility programs. For instance, offices outside of metropolitan area make up 16% of the general population sample but only 6% of offices have participated in an energy efficiency program. As such, we oversampled offices to ensure adequate response rates from this business type. Note, we did not weight the results from this survey to the population given relatively small sample sizes amongst some of the business types below, and because the results from this research were intended to be directional. Additionally, this study occurred in the fall of 2020 – during the COVID-19 pandemic. Given the uncertainty in terms of how the pandemic affected businesses during that time, and may have affected who replied to our survey, our team decided not to weight results.

Table 1. Business Type, Survey Respondents and Population¹

Business Type	Survey Respondents - Count	Survey Respondents %	Population %
Office	78	25%	33%
Other Services ²	78	25%	25%
Commercial or mixed-use property management	36	12%	1%
Healthcare (including medical office or hospital)	30	10%	7%
Restaurant or food service	28	9%	8%
Retail space	28	9%	18%
Automotive	19	6%	3%
Warehouse, wholesaler, or storage	8	3%	1%
Industrial or manufacturing	7	2%	3%
Total	312	100%	100%

To simplify survey responses and more clearly identify lighting opportunities, we created LED penetration categories based on survey responses. On the survey, for each lighting type, we asked respondents to estimate what percent of their lamps are LED or non-LED. Based on these responses, we created categories of LED penetration by lighting type (see Table 2). We primarily focus on the low LED penetration group in our reporting as this is a sizeable group that offers substantial opportunity for lighting upgrades.

Table 2. Definitions Of LED Penetration

Category	Definition (based on self report)
Low LED penetration	Less than 25% of lighting mix is LED
Moderate LED penetration	25% - 74% of lighting mix is LED
High LED penetration	More than 74% of lighting mix is LED

Results

Below we provide some highlights of key insights derived from this research. As context and to help aid interpretation, where we discuss linear lighting and refer to T12 and T8 linear lights, we are frequently including both fluorescent tube lighting and the LED replacement to that lighting (as LED lighting is not defined exactly the same). Additionally, very few respondents reported having T5 bulbs installed (n=15). Therefore, in breakouts by linear bulb type, we exclude T5 lighting due to its small sample size.

These results provide insight from both survey respondents (businesses) and market actors (contractors and distributors).

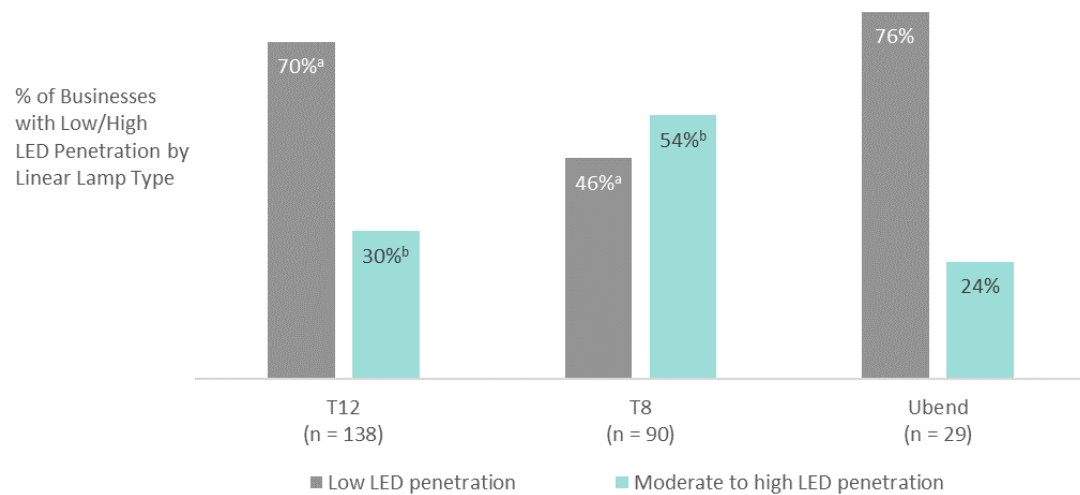
¹ Percents may not sum to 100% due to rounding.

² Other Services” captures businesses in the service industry exclusive of hospitality and restaurants (e.g., barber shops, dry cleaning services, nail salons, etc.)

Installed Lighting Types

Linear lights are the most prevalent lighting type across all survey respondents with 86% of respondents reporting having them. Among respondents with linear lighting, T12 lamps are the most prevalent: 55% of businesses have T12 lamps. Additionally, 35% of respondents with linear lighting reported having T12s only, and no other lamp types. As noted above, only 15 respondents reported having T5 or T5 high-output lamps.

Of the 248 respondents who estimated their mix of linear lamp types, 41% (102) reported having no linear LED lamps. Those who have T12 lamps are more likely to have low rates of LED penetration/replacement than T8 lamps. Seventy percent of respondents with T12 lamps said less than a quarter of their T12s have been replaced by linear LEDs and less than half (46%) of respondents said that less than a quarter of their T8s have been replaced by LEDs.



^{a,b} Statistically significant, $p < .001$

Figure 2. Linear LED Penetration

Sample sizes are too small to conduct statistical analysis of LED penetration by business type. However, examining LED penetration by business type can still provide insights on general trends of LED penetration. For instance, commercial/property management respondents have the lowest rates of LED penetration while restaurant respondents have the highest rate of LED penetration. We see this trend persist with screw-in lighting.

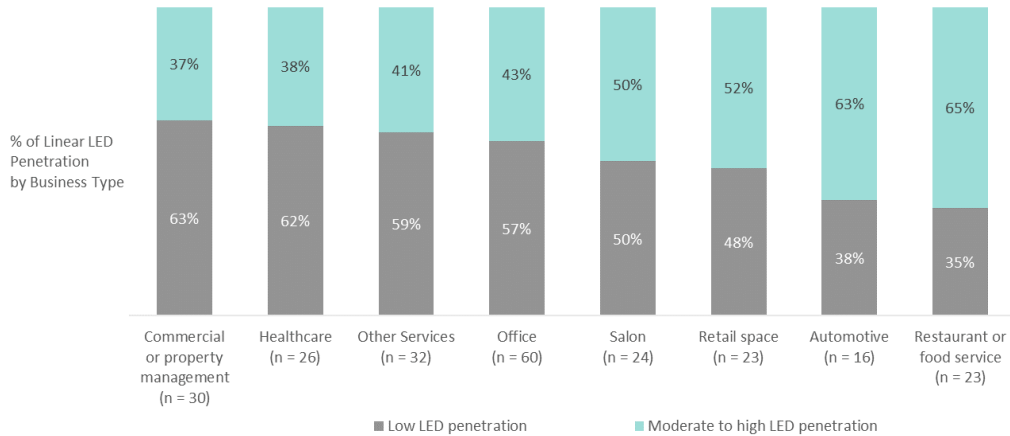
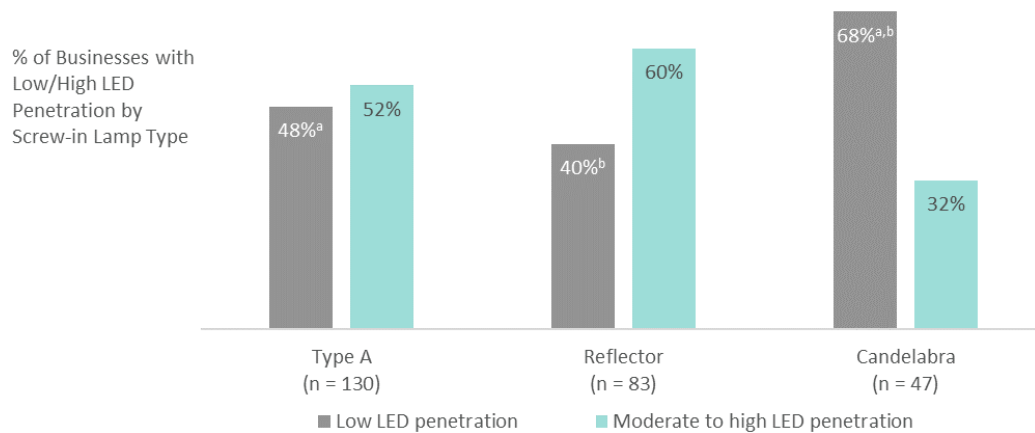


Figure 3. Penetration by Business Type

Of 311 respondents, 69% reported having screw-in lamps. Respondents reported having a mix of screw-in lamps but are more likely to have A-lamps than any other screw-in lamp. Of the 185 respondents who reported their screw-in lamp mix, 24% (45 respondents) have no LED screw-in lamps.



^{a, b} Statistically significant, $p < .001$

Figure 4. Screw-In Bulb Penetration

Out of all respondents, 65% reported having exterior lighting installed at their facility. Pole lights were the most common exterior lighting measure (Figure 15). Of the 175 respondents who reported their mix of exterior lights, 47% (or 82 respondents) have no LED exterior lights. The primary barrier to LED adoption for these respondents was a lack of LED availability for the fixture they had, followed by expense.

There are no differences in LED penetration across exterior measures (Figure 16). Pole lights, wall packs, and canopy lights experience similar rates of LED penetration. Pole lights are the most prevalent exterior light and 60% of respondents reported that, on average, the majority of their pole lights are non-LED.

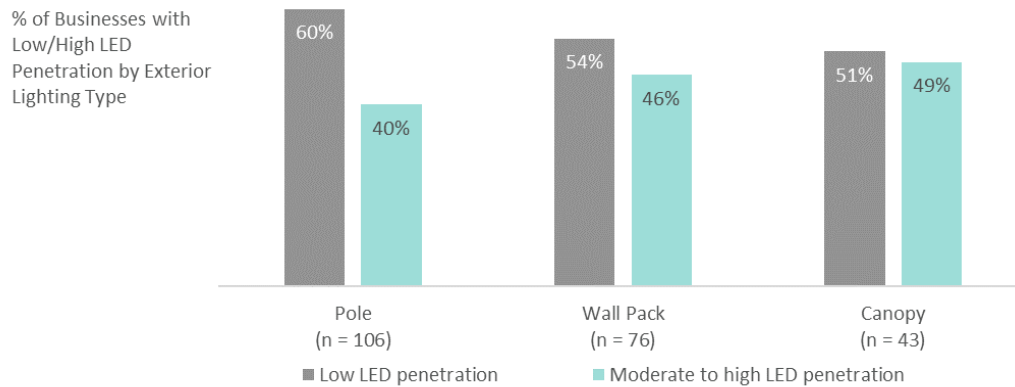


Figure 5. Exterior LED Penetration

Stored Lighting

Most respondents, 86%, have linear lamps installed and 30% of all respondents report storing linear lamps. T12s were the most prevalent linear lamp stored: 17% of all 312 respondents store T12 lamps. Of the 92 respondents who store linear lamps, 58% store T12s and 42% store T8s (across both fluorescents and LEDs that replace T8/T12 bulbs). Respondents reported storing anywhere from zero to 200 linear lamps at their facility, with an average of about 36 linear lamps in total in storage. Across all lamp types in storage, the mix of LED and fluorescent was roughly equivalent.

Many respondents (69%) have screw-in lamps installed and over one third, 36%, of all respondents report storing screw-in lamps. A- lamps were the most prevalent screw-in lamp stored with 23% of all 312 respondents storing A-lamps. Stored A-lamps are more likely to be non-LED, just 19% of the A-lamps reported in storage are LED. Respondents reported storing anywhere from zero to 150 screw-in lamps at their facility, with, on average, about 54 screw-in lamps in storage.

Just 13% of all 312 respondents reported storing exterior lighting measures. Pole lights were the most common measure stored, with 13 respondents reporting they store pole lights. Respondents reported storing anywhere from zero to 100 exterior lamps, with about 50 exterior lamps, on average, in storage. Across all lamp types in storage, non-LED lamps were more prevalent.

Upgrade Decision-Making

To understand how customers make decisions around lighting replacements, we asked business customers if they schedule lighting replacements, coordinate lighting replacements with other upgrades (e.g., renovations), or if they replace lighting as it fails. Survey respondents overwhelmingly replace lighting as it fails but are more likely to do this with interior lights. Specifically, of 296 respondents, 86% wait until interior lamps fail to replace them compared to 71% of respondents (136 of 191) who wait for exterior lamps to fail before replacing them.

Barriers to LED Adoption

Key barriers to LED adoption for businesses are cost, program awareness, and understanding of LED benefits. However, the knowledge, experiences, and stocking practices of market actors also play an important role in what market actors recommend to businesses.

- **Cost.** Businesses cited upfront costs as the top consideration when purchasing new lighting. Surveyed businesses with low LED penetration were more likely to agree that switching to LEDs

costs “a lot of money”. A distributor mentioned that some businesses do not have the initial \$200,000 available to spend to qualify for a \$25,000 rebate and started offering financing to his customers to help overcome the cost barrier to LED upgrades.

- **Lack of Awareness of Other LED Benefits.** Market actors note that pitching the non-energy saving benefits of LEDs helps them sell LEDs. Key messages include reduced maintenance costs, safety and security, productivity, and reduced cooling load.
- **Program Awareness.** The utility’s rebates helped raise baseline awareness of the benefits of LED technology, but many commercial customers remain unaware of the utility’s commercial lighting program. Just 17% of surveyed businesses were aware of programs or incentives to help their business save energy. However, 40% of surveyed businesses do turn to the utility when they need information about lighting upgrades.
- **Corporate offices.** Corporate offices influence upgrade decisions. Many market actors we spoke with said corporate headquarters can be the ultimate decision maker in terms of moving forward with a full facility upgrade or with a staged upgrade approach. Corporate offices decide maintenance budgets and balance lighting upgrades against other business priorities. Even still, budgets change quite frequently, and a decision to upgrade the full facility can change at a moment’s notice and a project can be adjusted to a staged lighting upgrade.
- **Stocking and Replacement Practices.** Among survey respondents, 86% wait for interior lights to fail and 71% wait for exterior lights to fail before replacing them. Replacing on failure means that choices for replacements may be constrained by businesses’ access to contractors and what contractors have in stock or can get quickly from distributors. Among the market actors we interviewed, only 3 of 7 contractors kept lamps in stock, although many distributors reporting keeping basic lamps and fixtures in stock.
- **Market Inundation.** The commercial lighting market is inundated with multiple manufacturers, making some market actors apprehensive about product quality and fluctuations in product availability. This influences what and how market actors sell to businesses.
- **High Turnover in Manufacturers.** Some market actors are apprehensive about so many new manufacturers entering the market as the longevity of these products are untested, quality can vary greatly, and it is uncertain how long the company will be around.
 - One contractor summarized this when relaying the following, *“We go to large LED conferences and there’ll be 400 vendors and 30% of the vendors aren’t there the next year.”*

Staging vs Full-Facility Upgrade

This study also sought to understand how businesses plan and make lighting upgrades – whether that is in stages or all at once in a full facility upgrade. Below provides insight into how customers prioritized their projects and what influenced their decisions.

The below factors were major considerations when businesses staged lighting projects:

- **Budget Constraints.** When budget constraints prevent a full facility upgrade, customers tend to prioritize staging certain areas over other. A restaurant may prioritize the *“back of the house”*, while another business may prioritize a parking garage. A contractor provided the following example: *“They won’t have enough money to change the interior, so we’ll change the exterior...the exterior lights are more problematic because they’re metal halide. They’re burning out all the time so it’s a safety issue; so that drives them a little more.”*
- **Testing new lighting.** One contractor mentioned that some customers stage lighting in order to test new lights in their facility. This is something we heard from distributors as well. One

warehouse customer tested 20 controlled lights before deciding to upgrade the entire warehouse with them.

- **Contractors stage too.** A staged lighting approach can also be used by contractors. One contractor said when he was hired to stage replacement lights in a 50-story building, he stages the replacements based on floors “...that will save the most money the quickest. Then that gives them [the customer] money on the back end to do other projects.”

The below factors were major considerations when businesses completed full facility upgrades:

- **Robust budgets.** Commercial customers are more likely to upgrade their entire facility at once if they have robust budgets. One contractor said that the majority of his projects are full facility upgrades where customers say, “It’s time, do the whole floor.”
- **Immediate need.** Some market actors say that immediate or urgent needs motivate customers to upgrade their entire facility rather than stage upgrades. For instance, a distributor mentioned that a warehouse customer of his was getting ready to rent the warehouse out, but the renter requested lighting upgrades before moving in. The renter said, “...we can’t see in there, it needs to have better lighting” before they move in. This immediate need prompted the warehouse manager to upgrade all the fixtures at the same time.
- **Facility size.** A contractor from one geographic area shared that staged lighting is not common there because the buildings in the area are small. Instead, he said that customers will stage types of work, like replacing all the lighting, then replacing the HVAC, etc.

Controls

Few respondents have lighting control technology; meaning anything more advanced than a light switch, including daylight or occupancy sensors as well as more advanced controls. Respondents were more likely to have controlled lighting for exterior lighting applications than interior lighting applications. This finding is corroborated by the market actor interviews. Market actors said exterior applications for controls are easier to sell because the savings tend to be greater than interior applications (due to longer operating hours for exterior lighting). Among survey respondents, adoption of controlled lighting for interior lighting is very low. Of 238 respondents, 63% reported having no control technology installed for interior applications. Less than 9% of businesses who responded to the survey have moderate to high levels of lighting controls for any of the control technologies.

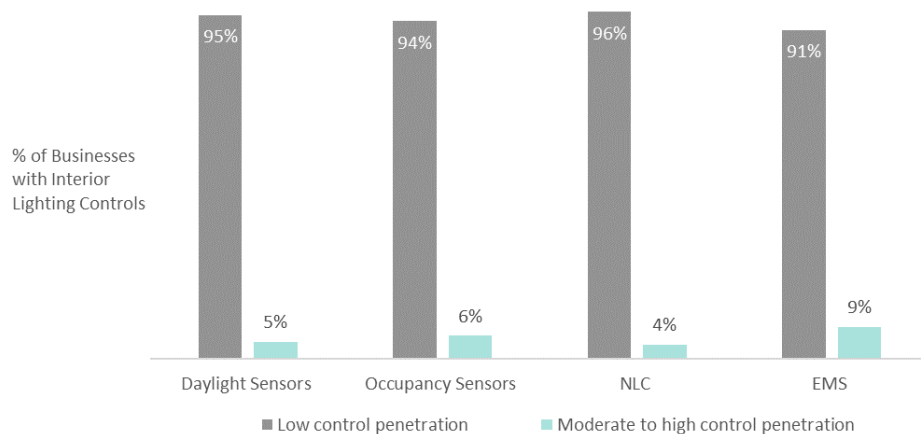


Figure 6. Interior Lighting Control Penetration

Respondents were more likely to have exterior lighting controls than interior lighting controls. Of 186 respondents with exterior lights, 88% reported having some exterior lighting controls. Daylight sensors experienced higher rates of adoption than other exterior lighting controls. Of 186 respondents 56% reported having moderate to high penetration (i.e., over one quarter of their lights have daylight sensors). Of 186 respondents, 41% reported that all of their exterior lighting are fitted with a daylight sensor. More sophisticated controls, like energy management systems, are less prevalent. Just 31% of 186 respondents reported that some proportion of their exterior lights are part of such a system.

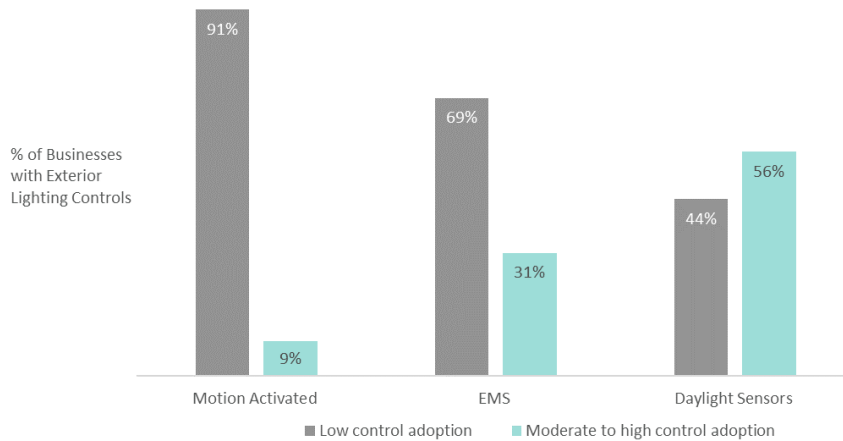


Figure 7. Exterior Lighting Control Penetration

Barriers to Adoption of Controls

Neither customers/end-users nor market actors have a solid understanding of lighting controls; however, regional efforts provide models for education approaches. The Southeast-based market actors we interviewed echo the findings of national research: customers (end-users) do not understand the benefits of controlled lighting, making the added cost seem unnecessary (Yamanda et al 2018). Southeast-based market actors agreed that many customers are not aware of the benefits of controlled lighting and, more generally, lack the comfort and familiarity required to adopt them. A lack of knowledge among contractors likely compounds low adoption rates. Some contractors confessed they themselves are not fully knowledgeable about more sophisticated controlled lighting measures or systems.

Distributors generally do not keep controls and controllable luminaires in stock. A distributor highlights this point by saying, *“If they want anything special, like a factory installed motion sensor on each fixture.... you have to wait for that. That’s not something that we’re going to have on our shelf. That’s pretty special.”*

Notable regional efforts include the California Advanced Lighting Controls Training Program (CALCTP) which partnered with utilities, manufacturers, electricians, lighting designers and electrical contractors to promote the design, specification, installation, and commissioning of advanced lighting controls. In the Northeast region, utility program administrators are focusing on training architects, designers, vendors, and contractors to increase knowledge around lighting controls in the marketplace. Additionally, the DLC supports their member utilities with a training module on connected lighting systems geared towards contractors.

Future Considerations

When asked to look to the future, contractors and distributors shared perspectives on their own priorities for the coming years. Overall, market actors recognize the longevity of LED technology will reduce recurring sales and are developing strategies to adjust their business models to adapt to the changes in the commercial lighting market.

Business strategies include:

- **Expanding to installation.** One distributor established an Energy Services Division, providing installation services to customers. This division was created to generate additional revenue in anticipation of waning lighting and fixture sales due to efficiency gains.
- **Technology drivers.** Market actors speculated that the future will be driven by various factors, including efficiency gains in drivers, fixtures requiring less voltage, and LEDs becoming even more efficient. Some expect the efficiency gains seen with LEDs will expand to fixtures and drivers. One distributor mentioned their fixture sales continue to increase and believes the future will be driven more by fixtures than lamps. Market actors did not anticipate another technology replacing LED, with one contractor saying, “in terms of the technology that is going to be used for innovations is absolutely LED.”
- **Advanced lighting controls are the future,** but customers need help getting there. Many market actors believe the future of commercial lighting will include some sort of advanced controlled lighting, but widespread adoption will require utility or policy intervention. Market actors seemed to agree that advanced lighting controls will be the next big trend in the commercial lighting sector but flagged that this technology is still “on the cusp” and “at its early stages.” Market actors agree that controls are by no means mainstream or top of mind for most commercial customers and most of their customers do not ask for controlled lighting. Even commercial customers familiar with controlled lighting (e.g., building engineers or facility managers) still require education and coaching around its application.
- **Expansion of LED adoption and technology.** Some market actors expressed uncertainty of what the future holds, but they all believe it will continue to grow, and that LED technology will remain the dominant technology available for the foreseeable future. Some market actors anticipate fixtures and drivers becoming more efficient and controls will become more prevalent (controlled lighting is discussed in further detail in the Controls subsection below).
- **Adding additional capabilities.** One contractor in the metro area said that his company is “looking beyond LEDs” and has recently become a licensed solar dealer. He mentioned that the non-metro area is ideal for solar, but they still recommend customers upgrade to LEDs before investing in solar technology.

Conclusions and Recommendations

This study overall pointed to the importance of understanding the unique environment – geographical and otherwise – that utility programs operate within. This study explored not only self-reported incidence of inefficient and efficient lighting across the state, but also explored the perspectives of numerous market actors and businesses of all sizes to understand the full picture of what opportunity remains.

In summary, national and regional data and feedback from Southeast-based market actors and business owners all point to ample opportunity for additional LED adoption within the commercial sector especially in the South, especially among segments that have been previously underserved. A 2018

analysis of regional energy efficiency organizations completed for the DesignLights Consortium found that the Southeast region had the highest proportion of commercial facilities with the lowest saturation of LED and efficient lighting. Most market actors that we interviewed believe there is significant room for additional LED adoption, with one distributor estimating that the vast majority of his 5,000 customers have yet to upgrade to LED technology. Market actors point to lower costs, increased quality, and phasing out of legacy technologies as contributing to LED adoption. Among survey respondents, over half (54%) of those businesses have few LEDs in their facilities. Forty-one percent of respondents with linear lighting and 24% of respondents with screw-in lighting report having no LED lighting at all.

Additionally, low LED penetration combined with low adoption of controls creates an opportunity to pair controls with LEDs in new installations for greater savings and functionality – a technology “leapfrog.” Adoption of control technology remains very low, especially among interior lighting applications. Over 90% of businesses surveyed reported having low or no adoption of occupancy and daylight sensors in their facilities. Other utilities are positioning themselves to push for controlled lighting adoption. Controls are more cost-effective to install when installation occurs simultaneously with new lighting.

Finally, evidence pointed to different parts of the state experiencing different barriers to adopting efficient lighting, resulting in varying adoption levels in urban, suburban, and rural areas. Contractor coverage was cited as a critical influence to encouraging efficient lighting projects. Office buildings were also underrepresented in terms of participating in lighting energy efficiency programs. It should be noted that the sectors and business types identified here as remaining targets (smaller and rural businesses) are often classified as “hard-to-reach” and may be less cost-effective to serve. Retrofitting a similar number of lamps, sockets, or fixtures for rural, smaller businesses requires significantly more time and cost for both utilities and contractors when compared with very large facilities. Ensuring contractors are engaged with the programs – and that contractor coverage exists across more rural areas in territories – may be the best way to penetrate these areas with low LED adoption.

To better understand the state of commercial lighting opportunity in their own territories, utilities can:

- **Review easily available key metrics to ensure program and contractor coverage geographically and by business type.** Mapping the location of active program contractors can provide an indication if there are areas of territory that are underserved. Additionally, comparing business types of customers who participate against customer or state-wide data can be helpful to understand if certain customers are underserved.
- **Review available rebates, participation, and opportunities for control measures.** Consider whether there are similar opportunities to help businesses “leapfrog” – for businesses with low LED penetration, consider if it’s possible to promote LED and control packages to more quickly accelerate adoption of controls.
- **Conduct primary research with customers and market actors to further understand opportunity and perspectives on priorities and barriers.** If possible, this research could cost-effectively be incorporated into already-in-progress evaluation contractor and nonparticipant customer research.

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