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Parking Lot Lighting Market Research Study

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Table of Contents

1. Executive Summary

In order to better understand the Luminaire Level Lighting Controls (LLLC) market for parking lot lighting, NEEA contracted with the Cadmus Group to complete a qualitative research study with installers and decision-makers. This study sought to answer two primary research objectives:

- **Research Objective 1 (RO1):** Determine and describe all items that trigger a parking lot lighting replacement or upgrade decision, as well as what factors go into the upgrade and/or replacement decision, so that NEEA can assess alignment of LLLC installed in exterior parking lots with their existent LLLC Program.
- **Research Objective 2 (RO2):** Assess the known and potential benefits of LLLC systems compared with other lighting solutions to assist NEEA in refining the value proposition for installing LLLC in exterior parking lots.

Cadmus interviewed four respondents—three installers and one decision-maker–for this study.

Cadmus found that, similar to LLLC in interior applications, failing lighting systems that were costly to maintain and the desire for energy savings were the primary triggers for exterior parking lot lighting retrofit projects. When scoping the project, numerous factors influenced the final purchase decision, including cost, security, product performance, and interoperability, showing the complexity inherent to these projects. During the decision-making process, many of the same people who make interior lighting decisions were also responsible for exterior lighting decisions. Decision-makers relied on insights from engineers, contractors, lighting consultants, manufacturers, and utility representatives to make a final product decision. Interviewees generally agreed on the benefits of LLLC in exterior parking lots, including energy savings/performance, security enhancements, and aesthetic improvements. However, interviewees also noted technical and cost drawbacks of LLLC in parking lots. While multiple sensor and network communication technologies already exist that may function well in parking lots, some have worked poorly, which has caused some negative perceptions of networked lighting controls in these spaces. Interviewees also shared that it could be complex to integrate LLLC with existing systems and that there were higher up-front installation costs and training needs.

2. Introduction

The Northwest Energy Efficiency Alliance (NEEA) contracted with Cadmus to conduct a market research study with the following research objectives and questions:

- **Research Objective 1 (RO1):** Determine and describe all items that trigger a parking lot lighting replacement or upgrade decision, as well as what factors go into the upgrade and/or replacement decision, so that NEEA can assess alignment of LLLC installed in exterior parking lots with their existent LLLC Program.
- **Research Objective 2 (RO2):** Assess the known and potential benefits of LLLC systems compared with other lighting solutions to assist NEEA in refining the value proposition for installing LLLC in exterior parking lots.

3. Methodology

To address these objectives, the research team conducted interviews with people who either directly made or heavily influenced the purchase decision for a parking lot replacement or upgrade, as well as lighting installers who provided parking lot lighting replacements or upgrades (see *Appendix A. Study Sample Criteria and Limitations* for detailed sampling criteria).

The research team conducted screening calls to confirm participant eligibility by assessing their role in parking lot lighting projects and the scope of the project. The research team invited those who met the criteria to a 30-minute structured interview, scheduled via email, and provided a $100 electronic gift card as a token of appreciation upon completion of the interview.

4. Results

There were four interview respondents, including three commercial lighting installers and one commercial building engineer who was involved in making lighting purchase decisions. Each were involved in parking lot lighting projects of varying sizes and space types in the last two years (see Table 1 for a brief description and *Appendix B. Project Descriptions* for more details).

Table 1. Survey Sample: Respondent Types and Projects

	Respondent type	Project Description	LLLC Installed?
1	Decision-maker	65 to 200 parking spaces	Yes
2	Installer	30 to 40 poles, 30,000 sq ft; 64 poles, 34,000 sq ft	Yes
3	Installer	1- to 2-acre industrial facility	Yes
4	Installer	K–12 school parking lots (likely ranging from 500 to 600 spaces across all parking areas).	Yes

4.1 Lighting Decision Process

Lighting purchase decisions in commercial buildings involve multiple actors from both within and outside of the organization that owns the property.

While final approvals tend to fall under the purview of property owners or facility managers, respondents reported that the decision-making process is highly collaborative, with inputs provided by other parties such as engineers and contractors. The decision-maker, a commercial building engineer, described the lighting purchase process as “a team effort,” in which they worked closely with property owners to evaluate different options before making the final determination. Lighting installers shared that they provided technical expertise on performance benefits, compatibility, and ease of installation, as well as information about incentives and favorable rebate options for customers. One installer explained that their team collaborates closely with contractors and energy service providers to secure the most favorable rebate options for customers. One decision-maker indicated that their “lighting representatives,” most likely product suppliers and manufacturers, recommended products that met their specific needs and provided a cost breakdown detailing up-front expenses and long-term savings. One installer indicated that

their team works with both large and small lighting representatives and typically solicits bids from multiple vendors to ensure competitive pricing.

During the decision-making process, there can be competing values from different parties, as noted by one respondent. This respondent said that architects tended to focus on design while contractors prioritized costs, which made close collaboration essential. Relatedly, one installer noted that product availability and lead times can impact the final decision, giving more weight to a product that is more readily available to meet the project timeline.

> *"Our lighting reps presented the products they thought would best fit our needs and the costs associated with them."* – Commercial Building Engineer
>
> *"Myself, the building engineer, and ownership were all involved in reviewing options, but ultimately, I made the final call."* – Commercial Building Engineer
>
> *"[During this project's scoping], the architect focused on design while the contractor cared about cost. Coordination between the two was important."* – Installer
>
> *"We work with three big reps and another small one... for publicly bid projects, we typically include three or four vendors in the spec to keep pricing competitive."* – Installer

4.2 Parking Lot Purchase Triggers

Failing lighting systems, maintenance costs and the need to reduce energy costs triggered parking lot lighting replacements or upgrades.

The decision-maker reported that frequent ballast failures and the escalating expense of repairing existing lighting systems made legacy lighting systems an unsustainable long-term solution. The decision-maker explained that as fixtures age, they require frequent servicing due to issues such as ballast failures, burnt-out lamps, and sensor malfunctions. These recurring maintenance needs would demand both labor and replacement parts, resulting in escalating costs to keep the lighting system operational. This sentiment was shared by the installer respondents as well when discussing how their exterior parking lot lighting projects were sourced. Relatedly, one installer noted that the dimming capabilities of LLLC can help extend the life of fixtures, reducing maintenance costs.

> *"We were spending hundreds of dollars fixing ballasts, so we decided to take the plunge and switch to LED fixtures."* – Commercial Building Engineer

Cutting energy consumption was another primary motivator noted by respondents for lighting upgrades, particularly when paired with utility incentives to reduce initial investment barriers. The decision-maker interviewed specifically cited lowering operating costs and complying with sustainability initiatives were important reasons why they chose to upgrade their lighting. The installers interviewed corroborated this, stating that clients carefully evaluated cost savings against upfront expenses to determine whether the upgrade provided a strong return on investment.

4.3 Purchase Decision Influencers

Decision-makers consider many factors, including security, product quality, ease of installation/ interoperability with other systems, financial incentives, and regulatory compliance when purchasing parking lot lighting.

All interviewees shared security-related considerations when making parking lot lighting purchases. One interviewee considered motion-activated lighting to increase lighting brightness and deter trespassers. Installers also underscored that lighting must offer a sense of security to users, especially in spaces where dimmed lighting may cause safety concerns. For example, one installer indicated that a commercial property owner who had been dealing with frequent break-ins at his property observed a notable improvement in security after upgrading to an LLLC-equipped lighting system with motion-sensing capabilities. A property manager emphasized that optimal parking lot lighting is critical for occupant comfort, noting that, because tenants feel uneasy when it is too dark, ensuring good parking lot coverage was a top priority. Given the need for security in these spaces, enhanced lighting solutions are viewed as an investment in risk reduction by respondents.

> *"Upgrading the lighting improved visibility and worked well with their security cameras."* – Installer
>
> *"We identified lighting to… [allow for] energy savings. Security first, energy savings second as factors."* – Installer
>
> *"Our tenants are not feeling great about how dark it gets, so parking lot coverage is our most important thing"* – Commercial Building Engineer

Product quality, including the perceived durability and reputation of the brand, were also factors that respondents said were influential to their purchase. Respondents specifically noted warranty coverage and performance guarantees, with some respondents noting negative past experiences in which misunderstanding warranty terms led to unexpected out-of-pocket expenses. One decision-maker explained that long-lasting LED fixtures with strong warranties were essential, because they helped keep maintenance costs low and minimize system downtime. Having learned from past retrofits that unreliable warranties and fixture failures can lead to unexpected repair expenses, this decision-maker said that they carefully review manufacturers prior to making a purchase. Installers also underscored the importance of selecting fixtures that would be easy to service, since simpler maintenance means fewer disruptions and lower long-term costs.

Respondents said that a key step in planning is confirming that the new lighting system will integrate smoothly with existing infrastructure. One decision-maker interviewed about retrofit projects reported that it was important to decide whether to implement networked lighting systems or simpler stand-alone solutions—a choice that often hinges on installation complexity and connectivity concerns. Installers reported suggesting simpler control systems when ease of use and minimal operational disruption were top priorities, especially in heavily trafficked parking lots where downtime needs to be avoided.

Several respondents cited the availability of utility rebates as an important deciding factor in their decision to install LLLC, since financial incentives helped offset initial expenses and improve return on investment.

Interviewees reported prioritizing rebate-eligible products when evaluating their options. One interviewee highlighted this approach, explaining that they considered their local energy provider's rebate offerings alongside product longevity and industry reputation.

> *"We looked at what our local energy provider was willing to give the best rebates on, as well as longevity and brand name—what is well-respected in the field."* – Installer

As noted by the interviewed decision-maker, it was required to align fixture selection with city codes on brightness levels, light spillover, and pole height restrictions. For the project the decision-maker completed, their parking lot was near a residential development, which introduced new regulations they needed to comply with. In some cases, fixture placement or color temperature settings needed to be adjusted to meet these requirements.

In certain instances, respondents noted that interest in upgrading parking lot lighting arose from the desire to comply with local energy regulations and building codes. As one respondent noted, new clean energy laws were driving compliance efforts, along with utilities now recommending parking lot lighting with LLLC as a solution.

> *"…we have a new clean energy law that we are trying to get our buildings in compliance with. One of the things that they recommend is parking lot lighting, and [our utility] had recently started including parking lot lights with Luminaire [Level] Lighting Controls [in their rebate program]."* – Commercial Building Engineer

One installer also shared that product lead time affects the decision process, depending on a project's timeline. Standard fixtures were typically available within a short timeframe (about two to three weeks), but custom fixtures with longer lead times might not be appropriate for all projects.

4.4 Benefits of LLLC

Benefits of LLLC in outdoor parking lots included energy savings, improved user experience, enhanced security, and aesthetic improvements.

Decision-makers and installers noted that LLLC helped businesses reduce operational costs by lowering their energy consumption while also meeting local energy mandates. Decision-makers initially anticipated substantial energy savings, and post-project feedback confirmed that these expectations had been met. As one respondent verified, the installation of LLLC "saved energy consumption," confirming the effectiveness of the system's automated dimming and occupancy-based adjustments. The dimming capabilities of LLLC played a critical role in the realized energy savings. Rather than lights running at full brightness all night, the system automatically reduced output when areas were unoccupied. This adaptability not only reduced electricity costs but also extended the fixtures' lifespan, reducing maintenance expenses in the longer term.

> *"Lights can idle at 25% and ramp up when motion is detected, which saves energy and reduces wear and tear."* – Installer

LLLC technology enhanced the overall user experience by making parking lots feel safer and more welcoming. In contrast to traditional lighting systems, which provide static brightness levels, LLLC adjusts

lighting based on movement to ensure that they display the appropriate amount of light. One decision-maker emphasized this benefit, mentioning that people appreciate how the lights brighten as they enter the parking lot. This feature was especially beneficial for high-traffic areas and businesses that operate at night, providing consistent, well-timed lighting that adjusted as people moved through the space. The gradual brightening effect not only enhanced visibility but also made the environment feel more secure and user-friendly.

> *"People like when they pull in the parking lot and the lights come up*." – Commercial Building Engineer

As noted above, security was cited as a major factor in the decision to upgrade to LLLC fixtures. Post-project feedback from an installer confirmed that installing an LLLC system contributed to increased safety, with the client experiencing "frequent break-ins before replacing their lighting… we set up the sensors to be extra sensitive for this client [to light up the lot more quickly.]" For businesses with late operating hours or locations in areas prone to security risks, the enhanced lighting contributed to a safer environment. Employees and visitors felt more secure walking through the parking lot, knowing that the lighting was designed to respond to their presence and could deter suspicious activity.

> *"When there is motion detected, [the lights activate] and you can see what's going on in the parking lot. It's a great deterrent—people think someone is watching [even if it's all automated]."* – Installer

Adopting LLLC fixtures also contributed to a more modern and visually appealing parking lot environment. An installer said that LLLC allowed for uniform illumination, with reduced glare and an overall well-balanced lighting effect. Respondents noted that the enhanced lighting gave the space a cleaner, more professional look, thus improving the overall aesthetic appeal. As noted by an installer, the LLLC fixtures, when installed to match the existing infrastructure, served to "increase value in real estate." Businesses that wanted to maintain a high-quality appearance while also addressing practical lighting needs found LLLC beneficial to their efforts. As might be expected, having a well-lit parking lot not only enhances security but also can improve visitors' perception of the business or facility.

4.5 Perceived Drawbacks of LLLC

Perceived drawbacks of LLLC in outdoor parking lots included the extra expense of a networked system without having consistent access to connected features, sensor reliability, integration difficulties, initial uncertainty about the technology, and cost barriers.

When looking at the various available lighting options, installers reported that some decision-makers considered purchasing networked lighting controls[1] (NLC) that used Wi-Fi or Bluetooth to enhance energy efficiency and automation. However, they encountered technical challenges related to connectivity, particularly in large parking lots, because maintaining a stable connection across long distances proved

[1] Luminaire level lighting controls (LLLC) are a specific type of networked lighting controls. Anytime networked lighting controls is mentioned, it also pertains to LLLC.

difficult. One decision-maker shared that their team initially intended to install a fully networked lighting system but encountered difficulties maintaining a stable connection between fixtures located at opposite ends of the parking lot. While there are additional communication protocols (including 'low energy') available for use to support connectivity in parking lots, it is unclear if the interviewees were aware of additional options. As a result, some businesses opted instead to use stand-alone or hybrid control solutions that provided automation, but did not require extensive network integration.

> *"We considered going with a full communication plan, but we couldn't figure out how to connect them on opposite ends of the parking lot, so we didn't go with that plan."* – Commercial Building Engineer

Respondents identified the performance of motion sensors in cooler weather conditions as a considerable challenge, though it is unclear what types of sensor technology they were considering in these applications. Sensors can utilize passive infrared (PIR), radar and microwaves, or a combination thereof to detect occupancy, and systems that rely on PIR are more likely to experience limitations in cold weather[2]. It is likely that respondents are reflecting on experiences with PIR sensors.

One installer noted that while the sensors functioned well most of the time, cold temperatures reduced their effectiveness. Interviewees raised concerns that the lights might not activate when needed, which could result in safety hazards in freezing temperatures. The decision-maker also expressed concern about possible sensors misfiring or not precisely detecting motion. One installer reported that the normal detection range for sensors was approximately 15 feet, which was not always enough to provide consistent coverage across a large parking lot. In an effort to address these issues, some businesses decided to install backup sensors or incorporate alternative detection methods, such as ultrasonic sensors. Although the backup sensors tended to perform better in cold weather, the technologies often featured higher price tags and were less practical for most installations compared to LLLC-only with no backup system.

> *"It works 90% of the time, but if [it's] too cold, it doesn't work as well."* – Installer

Another drawback respondents cited was the complexity of integrating LLLC with existing equipment. Some decision-makers said they initially hesitated to adopt the technology due to concerns about network connectivity and control settings. One interviewee pointed out that while networked lighting offers clear benefits, many customers lack awareness of how NLC function in outdoor parking lots.

Beyond connectivity, programming complexity presented another barrier, as some users said they found the interfaces unintuitive and the control settings difficult to navigate. One installer noted that many customers "aren't used to thinking about lighting as an interactive system", which made them hesitant to adopt more advanced controls. Due to this steeper learning curve, end-users needed additional efforts to better familiarize users with the system features and ensure effective operation.

[2] The Northwest Energy Efficiency Alliance is currently supporting sensor testing and development to learn more about sensor performance and support design improvements.

Several installers said their clients cited concerns about network connectivity issues because LLLC depends on Bluetooth or Wi-Fi communication to link the fixtures. One decision-maker recalled a past negative experience with connected lighting in which fixtures had been unexpectedly "kicked off the network." Reluctant to rely entirely on a networked system, the buyers opted for a hybrid approach that used localized controls instead of fully integrating everything into a central network. As noted by one installer, some customers expressed concerns about whether LLLC would provide consistent and reliable lighting coverage when relying on sensors to detect movement (rather than always being on).

Installers noted that cost presented another challenge for organizations. Although LLLC does demonstrably allow for long-term energy savings, the higher up-front costs—especially for advanced controls—made some decision-makers (as reported by installers) reluctant to invest. One installer explained that clients who were unfamiliar with the technology needed extra reassurance before making the decision, particularly when cheaper, non-networked lighting options were readily available.

5. Study Conclusions

Conclusion 1: Collaboration across a variety of stakeholders was critical for successful decision making.

Parking lot lighting upgrade projects require input from multiple stakeholders, with each party playing a distinct and crucial role in the decision-making process. While the property owners and facility managers typically hold final authority to approve lighting installations in parking lots, their decisions rely heavily on insights from engineers, contractors, lighting consultants, and utility representatives, specifically when project scopes included new technology like LLLC. Although not directly able to approve projects, these external stakeholders bring the technical expertise, financial insights, and installation guidance necessary to support decision-makers in assessing product compatibility and cost-effectiveness. The combined efforts of the various parties ensure that lighting enhancements correspond with financial objectives, operational requirements, and long-term maintenance factors.

Conclusion 2: Parking lot lighting upgrades are primarily triggered by the need to replace a maintenance-intensive failing lighting system or to reduce energy expenses.

Across the decision-maker and installer interviewees, the common thread connecting all parking lot lighting upgrade projects was either replacing a failing lighting system that was costly to maintain or to reduce how much building owners are paying for energy. While other factors influenced the scope of the project, these two factors were the triggers for building owners to pursue a lighting upgrade project.

Conclusion 3: Decision-makers are balancing numerous factors, including cost, performance, security, and product quality when making parking lot lighting upgrade decisions – needs which can be met by LLLC.

Several factors were influential in lighting upgrade decisions for exterior parking lots. While other factors may have triggered the project, the scope and final product choice are influenced by an array of factors, including product cost, product performance, security, and product quality. Utility incentives help lower initial costs and thus increase the market appeal of energy-efficient solutions to decision-makers. In addition, warranty coverage and long-term durability are key to avoiding unexpected expenses. Decision-makers often chose parking lot lighting systems that could provide better light coverage to address security

and visibility concerns. Moreover, parking lot upgrade projects are undertaken in an effort to meet energy efficiency goals through the adoption of dimming and motion-sensing technologies. Location-specific factors, such as the need to control glare and comply with city regulations, further influence product selection for parking lot applications.

Conclusion 4: The benefits of LLLC for exterior parking lots was recognized by all interviewees.

In contrast to conventional parking lot lighting systems, LLLC technology offers such benefits as energy efficiency, cost savings, enhanced security, and aesthetic improvements. LLLC lowers maintenance and operating expenses by extending fixture lifespan and reducing energy waste by automatically adjusting brightness based on occupancy. The interviewed decision-maker who adopted LLLC technology for parking lots reported substantial energy savings, better visibility, and a more user-friendly lighting experience. Additionally, motion-activated lighting was found to serve as an effective crime deterrent, integrating seamlessly with security systems to enhance surveillance. The customization and control features of LLLC, such as Bluetooth and app-based settings, allow businesses to fine-tune lighting schedules and comply with energy mandates. Despite businesses' initial skepticism, post-installation feedback confirmed that LLLC delivered measurable improvements in both efficiency and security, making it an attractive investment for businesses seeking long-term operational benefits.

Conclusion 5: Technical and cost barriers to LLLC adoption in exterior parking lot applications remain.

While LLLC technology provides substantial energy savings, enhanced security, and operational flexibility for exterior parking lots, its adoption has been hindered by integration complexities and concerns about sensor reliability and network connectivity. Cold weather performance was a common concern, with installed motion sensors sometimes failing to detect movement accurately in freezing temperatures, leading to potential safety risks. Additionally, some businesses struggled with network connectivity problems, particularly in Bluetooth or Wi-Fi-controlled systems, prompting some to opt for hybrid or localized controls instead. The learning curve for LLLC technology was another barrier, as decision-makers and installers in parking lot projects required additional training to effectively use and integrate the system. Finally, higher initial costs made some businesses hesitant to invest in parking lot projects, despite the long-term savings potential. Addressing these concerns will be crucial for expanding the adoption of LLLC in exterior parking lot applications.

Appendix A. Study Sample Criteria and Limitations

Table 2 shows the study's sample criteria.

Table 2. Study Sampling Criteria

Criterion	Description
Timeframe	Respondents must have replaced or upgraded exterior parking lot lighting within the past two years.
Parking Lot Setup	All exterior parking lots are acceptable; parking garages and covered parking are not included in the study.
Project Size	Projects of all sizes are eligible, with a preference for larger parking lot projects.
Location	Respondents should be drawn from across NEEA's territory, with at least two respondents from Idaho and/or Montana to ensure regional representation.
Respondents	Respondents must be final decision-makers for lighting upgrades, such as building/parking lot owners and asset managers. Other parties involved in the decision-making chain (e.g., facility managers, procurement officers) could also be included.

While the study provides valuable insights into LLLC adoption in exterior parking lots, certain limitations should be taken into consideration, as detailed in Table 3.

Table 3. Study Limitations: Constraints and Considerations

Limitation	Description
Sample size constraints	Due to the targeted nature of the interview respondent sample, findings are not statistically generalizable, but they provide deep qualitative insights.
Response bias	Respondents' perspectives may be informed by prior experiences, financial interests, or familiarity with LLLC technology.
Recruitment challenges	Securing participation from busy decision-makers and installers required extended outreach efforts. A $100 incentive was offered to encourage participation.

Despite these limitations, the study delivered actionable insights that will help NEEA enhance the effectiveness and reach of its LLLC Initiative.

Appendix B. Project Descriptions

Table 4 contains a short description of each project included in the study.

Table 4. Project Descriptions

Project Type	Location	Property Type	Key Features	Notable Aspects
Retrofit	Tukwila, WA, USA	Commercial parking lots (7 lots)	LLLC, LEDs, sensors, app-based control	Focus on energy savings and system flexibility
Retrofit	Mukilteo, WA, USA	Corporate campus	LLLC, LEDs, Bluetooth zones, occupancy/ daylight sensors	Customer concerns about sensor reliability; emphasis on rebates
Retrofit	Undisclosed industrial facility	Industrial	LLLC, LEDs, occupancy/ daylight sensors, dimming, WiFi, app	Security-driven upgrades with motion detection
New Construction/ Retrofit (combination project)	Issaquah, WA, USA	K–12 school campus	LLLC, LEDs, dimming, sensors, WiFi/ Bluetooth, app	Focus on glare control and municipal code compliance