

# Memorandum

To: Jessica Aiona, Carrie Cobb, Bonneville Power Administration  
From: Kate Bushman, Katie Arquette, Rob Carmichael, Cadeo; Laura Tabor, Navigant  
Date: July 8, 2016  
Subject: TO24.7 Non-Residential Lighting Market Actor Interview Findings

This memo summarizes the Navigant and Cadeo team's (the research team's) findings from its interviews with non-residential lighting market actors conducted on behalf of Bonneville Power Administration (BPA). The research team conducted 50 long and 35 short interviews to investigate the five research areas described in Table 1.

Table 1: Areas of Inquiry

Market Aspect	Key Research Question
Market Evolution	How has the structure of the market and the flow of products changed recently?
Purchase Decisions	How, when and why do customers decide to purchase new lighting equipment?
Regional Variation	What differences exist within the Pacific Northwest lighting market?
Industrial Lighting	What are the key characteristics of the industrial lighting market?
Outdoor Lighting	What are the key characteristics of the outdoor lighting market?

Source: *Non-Residential Lighting Market Actor Interview Strategy, 2016.*

## Key Findings

These findings reflect the perspectives of market actors on the current state of the lighting market, as well as new insights into the non-residential lighting supply chain and customer decisions.

**Manufacturers are consolidating legacy lighting products and focusing on development of LED products.** All manufacturer interviewees noted that research and development (R&D) now focuses almost exclusively on LED products and controls. Although they continue to produce products in legacy technologies in order to meet the maintenance needs of their customers, manufacturers are reducing the number of products offered in those lines. Over time, this will hasten the market's transition to LED, as fewer legacy lines will be available for direct-replacement maintenance.

*Implications/opportunities: The reduced availability of legacy products may create an opportunity for program intervention in the maintenance market, as it will force decision makers to do something new—that is, replace legacy products with new alternatives. Secondly, the narrowing of legacy product lines has*

*implications for future Department of Energy (DOE) standards. It lowers the cost of complying with higher efficiency standards for manufacturers because they have fewer products to redesign, which in turn increases the likelihood of more stringent standards passing in the future.*

**Turnover of LED products may occur more often than expected given innovative products and business needs for improved lighting and controllability.** Market actors see the long lives of LEDs as a potential threat, particularly to their maintenance, repair, and operations (MRO) business. However, customers may retire systems earlier than expected if new products, that better suit their needs, become available. Customer-facing segments such as retail are particularly prone to faster turnover cycles, and will likely be among the first business segments to begin making LED-to-LED upgrades.

*Implications/opportunities: Monitoring LED system turnover by customer segment will improve regional understanding of turnover rates and where efficiency opportunities remain.*

**LED product offerings are expanding to good/better/best options.** For linear fixtures, for example, these options are TLED lamp replacement (good), LED retrofit kit (better), and new LED luminaire with embedded controls (best). Even within the TLED option, manufacturers have launched 'value' models to offer customers a shorter life alternative to the more expensive Design Lights Consortium-listed (DLC) TLEDs. This represents a change from earlier years in the development of LEDs, when customers considered any LED solution a premium option that came at a much higher price point. Now, with the development of good/better/best options, customers have access to an LED upgrade at multiple price points.

*Implications/opportunities: In the LED world, the difference in energy use between the good and best options may be minimal. As such, qualifying product lists (QPLs) and incentives targeting only premium options may in fact increasingly incentivize non-energy related bells and whistles. Energy efficiency programs should consider periodically reevaluating the goals of their QPLs and incentives with respect to the products they promote.*

**Competition is driving increasingly sophisticated sales strategies.** The threat of new entrants and declining MRO sales have driven both new and established market actors toward increasingly nuanced sales strategies. Chief among these is a consulting-style sales approach, which involves more sophisticated analytical services, nurturing long-term customer relationships, and an increase in customized outreach to customers.

*Implications/opportunities: There may be a need to reassess the education and training needs of end-users and trade allies as both the technology and sales tactics are changing. Similarly, this market change merits a reevaluation of which market actors require such support.*

**Large customers and small manufacturers drive "manufacturer direct" sales.** While the vast majority of the non-residential lighting market goes through wholesale electrical distribution channel, some market actors reported increased activity in the manufacturer-direct channel driven by two sources. First, new small manufacturers (typically new entrants hoping to benefit from the LED craze) often sell directly to end-users because they either lack access to distribution or purposely cut distributors out in order to reduce cost. Second, large customers often seek to negotiate directly with manufacturers to eliminate the middleman (the distributor) from their lighting transactions. Both types of direct sales can bring potential problems: large manufacturers can encounter logistical issues without distributor involvement, and small manufacturers can have quality problems when they cut corners to reduce costs. These issues can drive customers back to traditional channels, according to market actors.

*Implications/opportunities: Additional research, particularly on national accounts that may have manufacturer-direct arrangements, will clarify the scope and scale of this phenomenon in the Northwest, and whether there is a place for program intervention in this direct channel.*

**Industrial customers face competing priorities when considering lighting retrofits.** Many energy intensive manufacturing and processing facilities view lighting as ancillary to production-related energy uses that directly affect their core business, and this can lead decision makers to deprioritize lighting retrofits. Furthermore, lighting upgrades often require production to halt, which results in revenue loss. These barriers can make industrial customers reluctant to upgrade lighting systems, despite the energy and maintenance savings and the potential for improved safety and production quality. On the other hand, many large industrial facilities are highly sophisticated, with in-house maintenance and engineering staff capable of installing, operating, and maintaining lighting systems.

*Implications/opportunities: Industrial facilities with in-house engineering and maintenance staff may be an optimal market segment for implementing advanced lighting controls, because of their existing knowledge of controls systems for other equipment. Energy efficiency programs should consider timing marketing overtures during seasonal downtimes for each industry to reduce the burden of halting production.*

**LED street lighting is becoming the norm for retrofits.** LED street lighting projects previously required two decisions. The first was whether to do a retrofit project at all; the second was to choose LED technology for that project over other cheaper options. Now, the only decision is whether to do a retrofit. Virtually all new street lighting projects are LEDs. End-user and public perceptions of LED street lights have improved with LED street lights becoming mainstream in recent years, even in non-major urban areas. The majority of these projects have involved grant funding and/or utility incentive funding, and market actors say outside funding is an important driver for achieving cost-effective LED street light retrofit projects.

*Implications/opportunities: Incentive funding may primarily affect the timing of retrofits (and savings), rather than the choice of LED over incumbent technologies. With LED streetlights dominating the retrofit market, outside funding may become less critical in the future.*

The following sections of this memo outline the research team’s methodology for conducting this research and detailed findings organized by area of inquiry.

## Methodology

The research team followed a five-step approach to develop the interview strategy it used for this market research. First, the team conducted eight interviews with BPA program, planning, and engineering staff, Northwest Energy Efficiency Alliance (NEEA) program staff, and NEEA and BPA program implementers to solicit input on data and knowledge gaps and key areas of interest. Based on this input and the research gaps identified in previous lighting research, the team selected the five key research areas shown in Table 1.

Next, the team identified the types of market actors (distributors, manufacturers, etc.) who could illuminate these specific avenues of inquiry and developed a master interview guide with questions tailored for each of the identified market actor types. Finally, the research team allocated 50 long and 35 short interviews to the market actor types based on the level of uncertainty associated with a given research question and the expected variability in responses within a market actor group.

Based on this approach, the research team interviewed and surveyed the market actors shown in Table 2.

Table 2: Summary of Research Activities

Market Actor	Short Interviews or Online Surveys	Long Interviews
Manufacturer representatives		10
Manufacturers		2*
National account specialists		22
Outdoor and roadway lighting specialists	5	8
Industrial lighting specialists	5	8
Lighting installation and maintenance contractors	10	
Electrical Distributors (Online Survey)	15	
Total	35	50

Source: Interview tracking data, 2016

*\*The team interviewed two manufacturers for their general perspective on the market; however, other market actor categories also included manufacturers with specialized perspectives.*

These interviews amounted to more than 55 hours of conversation about the current state of the non-residential lighting market. The research team used NVivo, a qualitative analysis software tool, to map the detailed interview notes to the relevant research questions and uncover themes and findings. Appendix A includes additional details about the research strategy, areas of investigation, interview methodology, and the interview guide. Appendix B is the research strategy document.

## Detailed Findings

The following sections provide detailed results of the team's market actor interviews. These sections include input from various respondent groups. Where relevant, the text provides the number of respondents or responses supporting a finding. However, in all cases, the reader should recall that these findings are qualitative and not designed to be representative of any population.

### Market Evolution

LED lighting has revolutionized the lighting market in all sectors. According to recent forecasts from the DOE, LED lighting will account for over 80% of lighting sales by lumen-hours in the commercial and industrial sectors in the United States by 2030.<sup>1</sup> The rapid growth in the LED market has led to great opportunities for energy savings, but has also led to some changes in how lighting products get from the manufacturer to the end-use customer. This section describes how the market is evolving on five fronts: new entrants, LED product offerings, how market actors are adapting, manufacturer direct sales, and online sales of lighting products.

#### New Players in a Maturing LED Market

Nearly all interviewees commented on the continued influx of new LED products, manufacturers, and purveyors. However, market actors reported varying assessments of what was coming next. Several market actors stated that the LED market is becoming less hospitable to new entrants trying to compete on cost, and predicted that the influx of small new players will abate. Established players (e.g., large manufacturers) are increasingly innovative in the LED space, so new entrants do not have as much of an advantage as they did three to five years ago. On the other hand, many market actors predicted that there is no end in sight for the wave of new entrants into the lighting market. One market actor noted, for example, that for every company that goes out of business, another one starts up. These companies include:

- Manufacturers in Asia looking to market their products in the United States
- Small and medium-scale manufacturers in the United States developing new products
- So-called "re-labelers" who purchase (typically low-cost) products from Asian manufacturers and sell them in the United States
- Lighting consultants who develop lighting projects for end-use customers (market actors mentioned that these consultants range from highly experienced lighting experts to opportunistic start-ups with little expertise)

Market actors mentioned that there is a high rate of turnover among these new companies. This can cause problems for end-use customers, particularly when they have purchased a warranty-protected product from a company that then goes out of business. However, some of the new companies that have succeeded in the LED market have become a long-term part of the lighting market landscape. Companies like Digital Lumens, Lunera, and Start Lighting have grown into established competitors in the

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<sup>1</sup> DOE SSL Program, "Energy Savings Forecast of Solid-State Lighting in General Illumination Applications," 2014. [Online]. Available: <http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/energysavingsforecast14.pdf>

market.<sup>2</sup> In some cases, larger established market actors have acquired successful new entrants, leading to consolidation among successful market actors. Many recent acquisitions by large lighting manufacturers have focused on adding controls and software capabilities. For example, Acuity Brands recently acquired software company DGLogick, Inc., and Current, Powered by GE, acquired lighting controls manufacturer Daintree.<sup>3,4</sup> Three interviewees mentioned that major technology companies entering the lighting business are a new competitive force. A notable example is Cisco, which has recently partnered with Philips, Cree, and Eaton (among others) to develop their Digital Ceiling offering, a networked power-over-Ethernet lighting system with extensive controls and data collection capabilities.<sup>5</sup>

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<sup>2</sup> Electrical Trends. "Could the Future of the Big 3 Lamp Lines Be On a Dimmer?" 2014. Available online: <http://www.electricaltrends.com/2014/03/could-the-future-of-the-big-3-lamp-lines-be-on-a-dimmer.html>

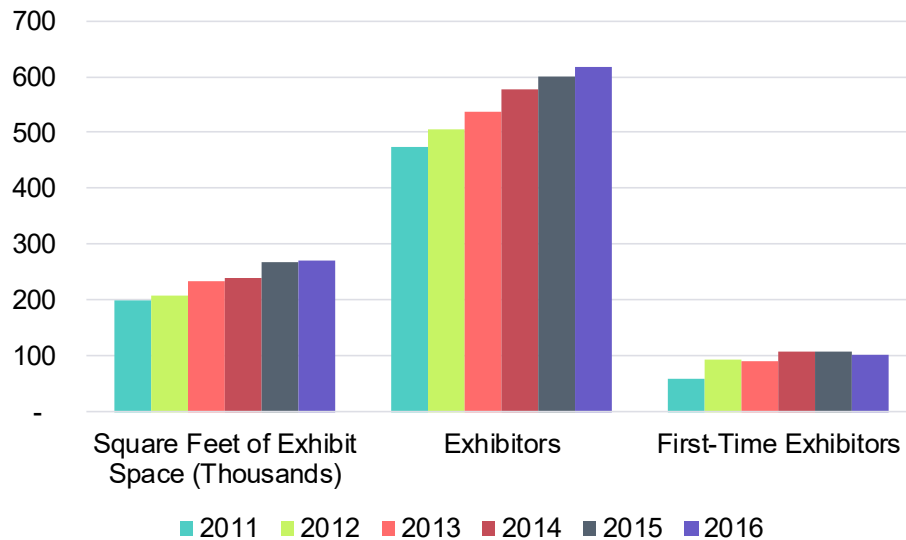
<sup>3</sup> Acuity Brands. "Acuity Brands, Inc., announces acquisition of DGLogick." 2016. Available online: <http://www.acuitybrands.com/investors/news-releases>

<sup>4</sup> LEDs Magazine. "GE's Current acquires Daintree Networks and SSL ControlScope Platform." 2016. Available online: <http://www.ledsmagazine.com/articles/2016/04/ge-s-current-acquires-daintree-networks-and-ssl-controlscope-platform.html>

<sup>5</sup> Cisco. "Cisco Digital Ceiling Partners." 2016. Available online: <http://www.cisco.com/c/en/us/solutions/digital-ceiling/partner-ecosystem.html>

The growth of LightFair, the leading trade show for lighting companies, reflects this proliferation of new actors in the lighting market in the last five years. As shown in Figure 1, there has been steady growth in the number of exhibitors at LightFair, with a growing number of first-time exhibitors attending each year until 2016.

Figure 1: Growth of Participation in LightFair from 2011 to 2016



Source: Analysis of LightFair International Press Releases. <http://www.lightfair.com/lightfair/V40/press.cvn>

With the proliferation of LED technology, many market actors mentioned that there are almost too many options – trade allies and end-users are getting overwhelmed at times. This has contributed to an increasing focus on customer and trade ally training and education. Manufacturers have invested in education initiatives like Cree’s Lighting Experience Centers, and the GE Institute. Beyond lighting showrooms, these provide in-depth training to end-users and trade allies.

### Differentiation of LED Offerings

Many market actors described a developing consensus in the linear fluorescent to LED retrofit market, with product offerings and contractor recommendations settling on a common set of “good/better/best” options.

- Good: TLEDs – a low-cost, easily installed way to save energy by switching from fluorescent tubes to TLEDs in existing fixtures.
- Better: LED Retrofit kits – manufacturers have developed retrofit kits with the aim of minimizing the labor required to install a new LED light fixture into the existing housing of the legacy linear fluorescent fixture.
- Best: New LED fixture with embedded controls – the most labor intensive and costly option is to redesign the lighting system fully, with new LED fixtures. Controls offer additional savings.

Market actor comments revealed that manufacturers have resolved many of the early problems regarding the quality and design of TLEDs. Most market actors recognized having seen issues in the past, but the vast majority of those who commented on TLED quality noted that they had not seen any

problems with the products themselves in the past two years. Contractors and customers are happy with TLED products available now.

Three main types of TLEDs are available, as defined by Underwriters Laboratories (UL):

- Type A: “Plug and Play” – these have an internal driver and wire directly to the existing LFL ballast.
- Type B: “Direct Wire” or “Ballast Bypass” – these wire directly to the main voltage after removing the existing ballast.
- Type C: “Remote Driver” – these require the installation of an external driver.

Market actors have some concern about Type B TLEDs, because of the potential safety risk if an end-user unknowingly replaces the TLED with a linear fluorescent tube. Market actors said there is a possibility that attempting to install a linear fluorescent tube in a fixture wired for a Type B TLED could result in electric shock and/or the tube exploding. Due to this potential safety risk, most market actors require extensive labeling of the fixture to warn users not to attempt installing a fluorescent tube after the fixture has been re-wired. However, some market actors find this risk unacceptable and avoid manufacturing and installing this type of TLED. While Type A “Plug and Play” TLEDs appear to be the preferred configuration in the market, a few market actors also have concerns about ballast compatibility with this design. One manufacturer interviewed noted that in order to mitigate compatibility issues, their company publishes and periodically updates a comprehensive list of ballasts that are compatible with their Type A TLEDs.

With the widespread availability of TLEDs, many customers are beginning to adopt them as a relatively easy way to take advantage of the benefits of LEDs. Roughly one-third (6 out of 15) of distributors responding to the web survey agreed that customers that used to buy low-wattage (25 Watt and 28 Watt) T8s are now buying TLEDs. Another six were neutral on the topic, whereas two disagreed with the statement.

## Market Actors Are Evolving to Meet New Challenges

Electrical distributors, one of the key market actors in delivering lighting products to end users, have faced increasing pressures in recent years. With the advent of LEDs, many distributors, especially those who rely on MRO sales as their primary business, have expressed concern about the foreseen drop-off in lamp sales as long-life LEDs take over from legacy technologies with shorter lives. Market actors (including three interviewees) have called this phenomenon “illumageddon,” referring to the threat of declining business. In response to this threat, distributors are developing sophisticated sales strategies in order to differentiate themselves within an increasingly complex market. One market actor noted that the way for distributors to stay in the market is to improve expertise and preserve relationships with their customers: “as long as they have that they’ll be an important element in the lighting market.” A manufacturer noted, “Larger distributors have a vehicle to drive customers to higher-efficiency and LED. They provide ROI<sup>6</sup> analysis and consultation to their customers. Some have an energy efficiency group or specialist.”

Many market actors noted that distributors will continue to play a large role in the non-residential market because they finance purchases for end-use customers (usually on a short-term basis), which facilitates

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<sup>6</sup> Return on Investment



large transactions. Furthermore, they play a logistics role by warehousing many products locally – not just lighting products, but many staples that electrical contractors rely on to do business.

The research team observed this evolution in their sales data collection and research on regional distributors as well, seeing a growth in “distributor consultants,” which tend to be smaller businesses focused on selling LED projects. However, in addition to these stand-alone consulting businesses, full line and MRO distributors have also incorporated consulting approaches into their broader offerings.

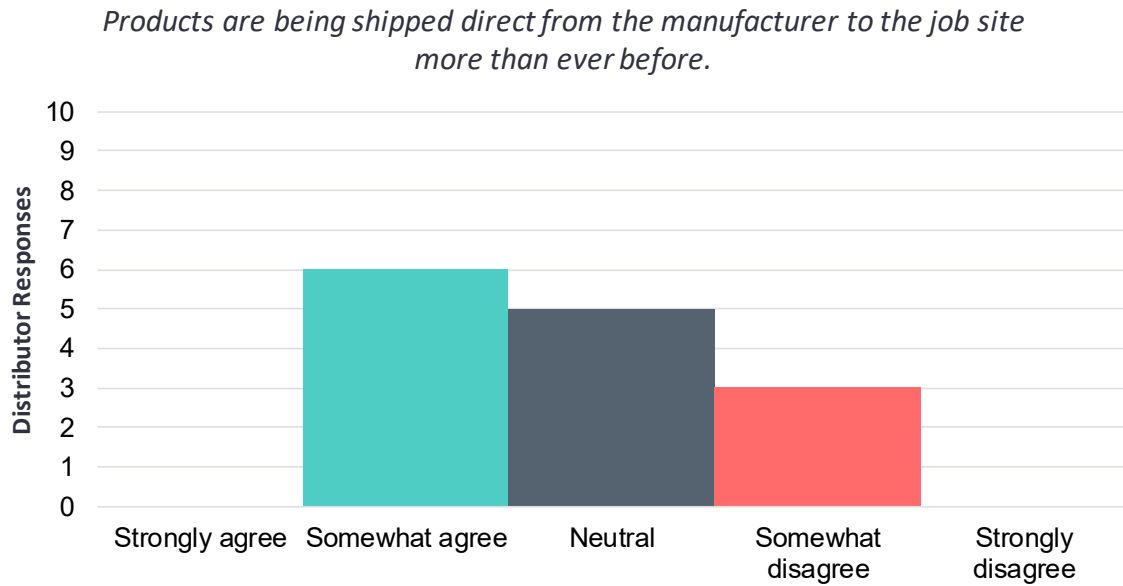
### End-Use Customers Buying Direct from Manufacturers

Manufacturers are also responding to the changing market, and 15 of the 27 market actors commenting on this topic believe that there is an increasing trend of manufacturers selling products directly to end-use customers, circumventing the traditional distribution channel. The remaining 12 interviewees were unsure whether these practices were increasing, but recognized that direct sales do occur sometimes. Interviewees mentioned two ways in which this is happening:

1. A re-labeler or small manufacturer tries to compete on price by cutting out the middleman. One market actor’s guess is that approximately 10% of the retrofit market goes through that channel, possibly less. That market actor noted, “Those smaller companies can come in with a 10% or 15% lower price because they don’t have the additional mark-up layer. That discount can be compelling for customers. They don’t have economies of scale, but they still can sell on price alone.”
2. Large end-use customers or national accounts (e.g., fast food chains, retail chains) typically use national account distributors to supply lighting products. A few market actors think there is a trend toward these large accounts purchasing lighting products directly from the manufacturer and circumventing the distributor. Others say this is not a growing trend, but rather simply an option that companies try out, while the distributor remains a strong and necessary actor in the market. One mid-sized manufacturer stated, “Today’s market requires an omni-channel approach. I work with national accounts who want to buy direct. As clients get larger they want to cut out the middleman, and they have huge purchasing power. So we call directly on them.”

Distributor opinions differed about whether manufacturer-direct shipments are increasing. Figure 2 shows the range of distributor responses.

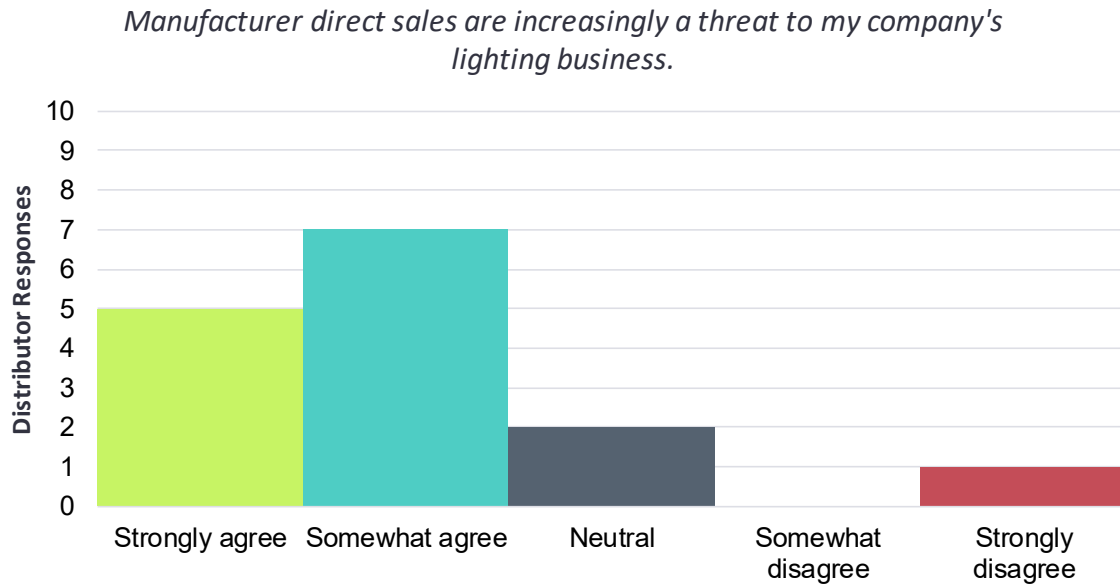
Figure 2: Distributor Views on Manufacturer Direct Shipment Trends (n=14)



Source: Online survey of Northwest distributors, 2016

Despite the lack of strong indication of an increase in direct shipments, 12 out of 15 distributors agreed that manufacturer direct sales are increasingly a threat to their lighting business, shown in Figure 3.

Figure 3: Distributor Views on Threat of Manufacturer Direct Sales (n=15)



Source: Online survey of Northwest distributors, 2016

### Increasing Competition from Online Sales

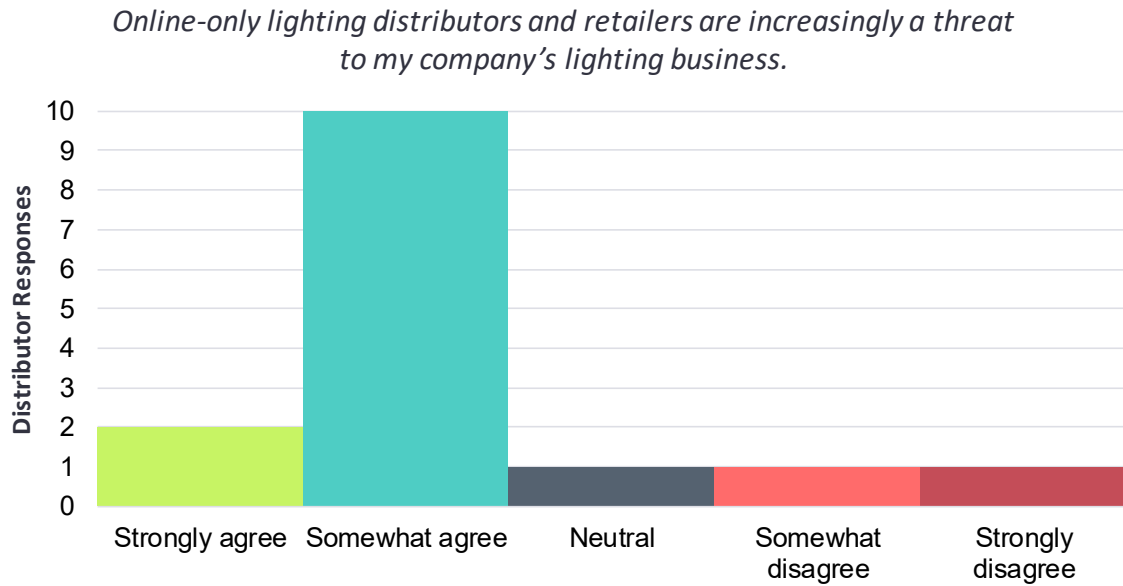
Twelve market actors reported that they have observed increased online sales of lighting products to non-residential customers, coming from at least three different types of online sources:

- Online-only purveyors of lighting products, such as bulbs.com and 1000bulbs.com
- Brick & mortar distributors with an online presence
- Manufacturers selling direct to end users online

Some end-users see an opportunity to change their purchasing strategy by buying products online while others maintain relationships with distributors. Some manufacturers and distributors expressed concern that customers unknowingly buy low quality products online. According to these market actors, customers purchasing lighting products online may find low quality options that distributors do not offer, since distributors vet the products they sell to ensure quality. Furthermore, customers may not have enough information to select the appropriate product for the application. One distributor stated, "With competition from online sales, we have to coach people to do good projects. When you go with us, we know the utilities, we also know the products and the market out there."

Figure 4 highlights the threat felt by distributors regarding online-only lighting distributors and retailers. The vast majority, (12 out of 15) agreed that these new market players were an increasing threat to their business. One distributor remained neutral, and two disagreed, not feeling threatened.

Figure 4: Distributor Views on Online-only Lighting Sales (n=15)



Source: Online survey of Northwest distributors, 2016

## Purchase Decisions

Customers' decisions about lighting projects have become increasingly complex with the rapid increase in the number of products available. Retrofitting or installing a new lighting system requires a great deal of specialized knowledge, and the amount of knowledge required has increased with the advent of LED and the increasing prevalence of lighting controls. The team asked market actors about how customers are making lighting decisions today, who is involved in the decision chain, and what factors drive customers to retrofit their lighting systems.

### Turnover and Motivators for Lighting Retrofits

Most interviewees believe that technology innovation/advancement drives lighting system turnover. One market actor described this technology-driven pattern, saying, "It can be embarrassing, because 10 years ago we might have recommended something to a customer, and today we go back to that same customer and say, 'get that out of here!'"

Market actors noted that the more customer facing the business, the quicker they are to upgrade their lighting. Retail businesses are most likely to re-do their lighting on a frequent cycle, because lighting affects their bottom line in terms of sales, not just energy costs. Retailers are concerned with maintaining an aesthetically appealing store, and lighting upgrades are commonly included in aesthetic updates. Retailers also want to optimize color rendering to improve the appearance of their merchandise. Market actors say both these factors can drive retailers to install LED lighting. With these drivers, market actors estimate that retail businesses follow an approximately five- to seven-year system turnover cycle.

By contrast, the industrial segment reportedly follows a slower turnover cycle, estimated by market actors to be about 10 years on average. One market actor summed this up by saying, "Industrial will run them till they die."

Across the board, market actors believe that the most powerful motivator for a lighting retrofit is cost savings; the shorter the payback, the easier the sale. Financing can make a difference, especially for capital constrained businesses and institutions. For example, school districts often work with energy service companies (ESCOs) who finance their lighting purchases, and medium-sized commercial businesses with access to private financing sometimes utilize financing to implement lighting upgrades. Productivity and safety can motivate some commercial and industrial customers to retrofit.

The appeal of new technology, while not a primary motivator, can be a factor for some customers. For example, color-tunable LEDs, an emerging technology, can motivate some customers to conduct a retrofit. Availability of new technologies influences turnover rate. With the speed of the LED product cycle, new functionality is becoming available before the end of the last generation product's life. Market actors expect new functions and features to drive the "second generation" of LED retrofits. For example, if a customer installs LED luminaires with no controls, that product might have a 20-year useful life, but the same customer might decide to upgrade to a product with advanced controls after five years. In this way, the lighting turnover cycle is becoming more like the consumer electronics product cycle. One extreme example is smart phones, which consumers often replace long before the end of the phone's useful life. While lighting may not match the smart phone turnover cycle, market actors believe that features will increasingly drive turnover before burnout.

## How do National Accounts Make Decisions about Lighting?

The research team conducted 22 interviews with a variety of market actors that work with national accounts, defined in this context as large national or regional scale businesses with multiple commercial locations. These businesses include chain stores, restaurants, hotels, banks, and many other types of corporations. Most national accounts fall into one of two ownership models: chains or franchises. A chain business entails one parent company, which owns and manages all of the business locations. A franchise business consists of independent owners (franchisees) who operate individual stores, with overarching management occurring at the corporate (franchiser) level. They are large customers, and market actors tend to tailor their businesses to attend to their need. Many market actors mentioned every company has its own personality, approach, values, and priorities. They emphasized that it is necessary to customize services for these large entities.

### *National Account Lighting Project Process*

The research team compiled information about the typical decision makers and steps involved in a national account lighting project. However, this information reflects only a basic idea of the process, and further research will help to understand variations by project type, as well as across different segments and types of national accounts.

Corporate offices typically drive national account lighting projects. The top of the decision chain varies from company to company, but the key decision maker may be the Chief Financial Officer (CFO), Vice President of Finance, Head of Operations, Head of Engineering, or the owner or Chief Executive Officer (CEO).

Several national account-specific market actors specialize in serving these multi-site customers. These entities can be influential partners in large lighting projects executed by national accounts.<sup>7</sup>

- National Account Distributors – these companies operate as lighting distributors but serve national accounts primarily or exclusively. Examples of these companies include Regency Lighting, Capitol Light, and Weidenbach Brown.
- ESCOs – some national accounts work with ESCOs on their lighting retrofit projects, and they can be key decision makers in lighting maintenance. Amaresco and Facility Solutions Group are examples of ESCOs. Some market actors think that ESCOs are not a major player for national accounts, but others do consider ESCOs as competitors in this space. There is some crossover between ESCOs and national account distributors. Facility Solutions Group, for example, operates as both an ESCO and a distributor.
- Rebate Administrators – these companies help national chains make decisions about where to invest in energy efficiency projects by identifying the most cost-effective utility incentives. Examples include RealWinWin and Green Generation Solutions. Rebate administrators partner with national account distributors and ESCOs to assist their clients in prioritizing investments.

Many of the same market actors are involved in both new construction projects and retrofit projects. Both tend to involve a third-party architect and engineering firm in the design phase of the project,

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<sup>7</sup> The companies listed here are examples only. The research team did not interview all of these companies.

though there are cases where the end-use customer uses in-house specialists to perform design functions.

The general phases of the project process, as described by market actors, include the following.

1. **Initiation.** Some companies initiate lighting projects internally, addressing a need to upgrade or install new lighting equipment. Motivators can include energy savings, aesthetic refresh of space, rebranding of space, or expansion and addition of new locations. Alternatively, a third party may influence the initiation of a project, such as a manufacturer, distributor, or ESCO presenting a proposal.
2. **Design and Specification.** In developing project specifications, national account end-use customers rely on expertise from their design team (internal or external), as well as sometimes involving lighting manufacturers and distributors in selecting the appropriate solutions. According to market actors, manufacturer representatives are not typically involved in specification for national account projects, since they tend to have specific geographical territories. Specifications include a bill of material, which can give varying levels of detail about the specified products. Sometimes the bill of material identifies the exact product number from a particular manufacturer, while in other cases the bill of material gives general parameters that allow bidders to offer various suitable solutions. Notably, market actors mentioned that energy efficiency upgrades for national accounts are often bundled together: a project typically includes not only lighting but also other energy upgrades like HVAC, and potentially other non-energy-related work.
3. **Contracting.** Often, but not always, projects go out for competitive bid, with a national account soliciting proposals from contractors via a request for proposals. In other cases, national accounts have established dedicated relationships with contractors to whom they assign projects. Some national accounts have relationships with several local or regional contractors, while others have one national-level contractor that manages lighting retrofit work nationwide.
4. **Implementation.** National accounts investing in lighting upgrades (and other energy efficiency upgrades) typically prioritize the projects in geographical areas with the highest cost of power. National accounts typically implement projects in these areas first, and phase in projects in other areas if and when it is financially feasible. National accounts also prioritize areas with largest utility rebates, as those rebates contribute to projects with a more favorable ROI. Ease of participation in utility programs is sometimes a deciding factor as complying with utility requirements from hundreds of utilities requires significant work. The regional prioritization of energy efficiency projects often involves input from national market actors who advise national accounts on costs and benefits, such as national rebate administrators.

### *Processes Specific to Franchises*

The general process described above applies to both chains and franchises, but franchises have additional unique considerations. In most cases, the franchise operator (or franchisee – the owner of the individual business location) is responsible for the cost of upgrades to the property. However, the corporate management (the franchiser) often mandates specific requirements for the appearance of individual store locations. Franchisees typically agree to maintain these brand standards as part of their franchise agreement. Franchisers can require periodic updates to branded space, which franchisees are

responsible for implementing. For example, if a franchise business updates their aesthetic look and feel of their stores, they may require their franchisees to update their lighting systems as part of this “brand refresh.”

Some market actors that serve national accounts do not work with franchises. A national account distributor, for example, said their company does not work with franchises, because doing so would involve working with many individual franchise operators, rather than one centralized decision maker. Instead, this interviewee said that local contractors tend to serve franchises, and therefore they likely use local and regional distributors for purchasing lighting equipment.

### *California's Title 24 Energy Code*

While not directly applicable to Northwest business locations, many market actors mentioned California’s 2013 Building Energy Efficiency Standards as a Northwest-adjacent issue, commonly referred to as Title 24.<sup>8</sup> Title 24 has been a major driver of change in the non-residential lighting market in California, particularly in new construction, as well as in large retrofits that require code compliance. The research team asked market actors whether the strict energy efficiency requirements of Title 24 would affect national account business locations in the Northwest, and the consensus was that in some cases it would. Some national accounts develop a California-only specification to meet Title 24 requirements, and a different specification for the rest of the country. Others, however, will apply their California-ready, Title-24-compliant specification nationwide in order to maintain consistency across all locations.

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<sup>8</sup> The California Energy Code, or Building Energy Efficiency Standards, are part of the California Building Standards Code, which is title 24 of the California Code of Regulations. Market actors commonly used the term Title 24 to refer to the energy efficiency standards that affect lighting.



## Role of Utility Programs in Today's Lighting Market

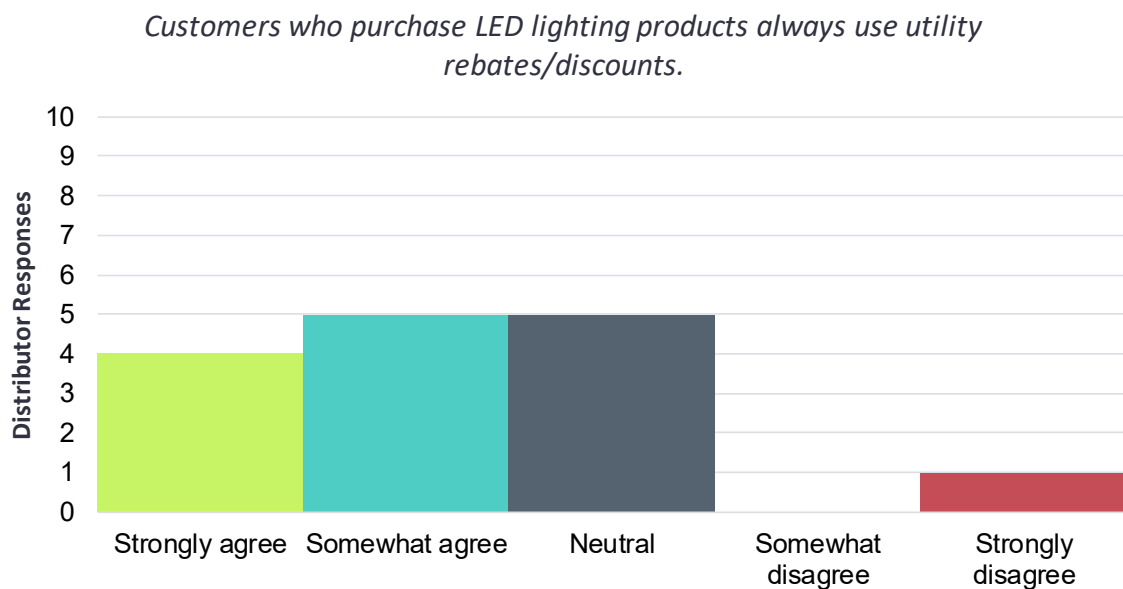
Of the 75 market actors interviewed, 44 of them mentioned utilities and utility programs as an important player in the non-residential lighting market. These market actors emphasized that utility incentives have driven lighting retrofits forward, and help make their job selling lighting products and services easier. They also emphasized that although LED prices are falling, utility rebates still play a very important role in non-residential customer decisions about lighting. The utility rebate sometimes pushes the decision to the "tipping point," making a project's ROI attractive enough for a building owner to move forward with it.

In addition to the general importance of utility incentives in lighting projects, interviewees pointed to three specific areas utility programs influence most strongly:

- Controls – three market actors mentioned that utility incentives are often the deciding factor that leads a customer to include controls in a retrofit project, because in some cases the additional incentive is enough to make the project highly cost-effective.
- Gas station lighting – one market actor pointed to the BPA program as the driving factor that caused many gas stations in the Northwest to convert their lighting to LED.
- Street lighting – all five utilities interviewed about street lighting projects noted that outside funding (from utility incentives or from other grant programs) are an important factor in driving street light owners (including the utilities themselves) to upgrade to LED.

As shown in Figure 5, a majority of the distributors responding to the web survey (9 out of 15) agreed that customers who purchase LED lighting products always used utility rebates or discounts. Only one distributor strongly disagreed, and the remaining five were neutral on the topic.

Figure 5: Distributor Views on Utility Rebates for LEDs (n=15)



Source: Online survey of Northwest distributors, 2016

## Lighting Maintenance Evolving with LED Penetration

Two general approaches to lighting maintenance are possible: either replace lamps and ballasts as they burn out (spot re-lamping), or replace all lamps and ballasts in a building or an area at a scheduled time (group re-lamping). Market actors reported that spot-lamping is the norm, with most customers performing maintenance on an as-needed basis. This corroborates the findings of the Building Owner and Operator Survey conducted under BPA's residential lighting study, which found that 18% of businesses perform group re-lamping.

The businesses that do conduct group re-lamping are motivated to maintain the highest quality lighting possible. Customer-facing and luxury businesses such as high-end retail stores tend to be among those that prefer scheduled group re-lamping. These companies do not want to have even a single lamp out in their stores, so they schedule group re-lamping at 75% of the life of the lamp.

Some companies hire maintenance contractors to maintain their lighting systems, while others perform lighting maintenance with in-house labor. Maintenance contracts take different forms, but often involve a monthly/bimonthly/quarterly visit to check for lamps that have burnt out and replace them. Two market actors mentioned that the market for lighting maintenance slowed down significantly during the recession, with companies extending their maintenance cycle to annual visits. Despite the improved economy, these market actors have found that companies have not switched back to more frequent maintenance.

Another factor affecting maintenance behavior is the advent of long-life LEDs. One manufacturer's representative stated, "Up until 3-4 years ago, large customers like grocery stores, they'd have scheduled re-lamps. They'd go through a store every three years and change out all the lamps. Nobody's doing that anymore – now they just go through and upgrade to LED fixtures. It's a no-brainer for those big customers. Group re-lamping customers are becoming fewer and further between – if I'm a big grocery chain, I'm not scheduling a group re-lamp three years from now anywhere. I'm changing all my locations to LED fixtures so I don't have to do that anymore." These factors point to a decline in group re-lamping as a lighting maintenance strategy, which will likely persist as LEDs continue to penetrate the market.

## Regional Variation

The research team asked market actors about variation in customer behavior or market characteristics within the Northwest region. Specifically, the research team wanted to find out whether there were notable differences between urban and rural customers or market actors.

The web survey asked distributors to compare purchasing behaviors between urban and rural customers. The majority (9 out of 14) distributors answered that their urban customers tend to purchase lighting equipment that is more efficient. The remaining five distributors answered that urban and rural customers purchase equipment of the same level of efficiency.

## Business Size is a Driver of Differences

Four market actors (out of 23 commenting on the difference between urban and rural customers) noted that larger businesses are concentrated in urban areas. These market actors believe there is no difference in customer purchasing behavior between urban and rural areas, but noted that large businesses are more likely to purchase new technologies (due to cost and sophistication of operation). One market actor noted the example of LED canopy conversions at gas stations, stating that the larger, busier gas stations along the I-5 corridor were the first to convert, and the remaining “hold outs” are small businesses that do not have the capital to invest in lighting upgrades. These smaller gas stations tend to be in rural areas.

## Urban/Rural Divide in Exposure to High-Efficiency Lighting

A few market actors mentioned that there is a difference in end-use customers' access to information about LED products between rural and urban areas. For example, manufacturer representatives are less likely to visit businesses in outlying areas. One contractor specializing in calling on rural customers noted, “In small towns you can walk in and say what you're here to do because they're not inundated with sales people. In a metro area you wouldn't be allowed in because they've had twenty people come in already, it's already been done, or you can't get in the door because it's handled out of a corporate engineering department.” Seven market actors (out of 23 commenting on the topic) specifically noted that rural customers lag behind urban customers due to lack of exposure to information about new products and technologies. Three market actors also mentioned that distributors and retailers in rural areas might carry fewer high-efficiency products, which would further limit access and exposure.

## Industrial Lighting

The research team interviewed market actors directly involved in serving industrial lighting customers. These included manufacturers of industrial lighting products, an industrial facility energy audit specialist, and an industrial specialist working for a distributor. They offered industrial-focused perspectives on the key market segments in the Northwest, the special lighting needs of their customers, adoption of high-efficiency lighting and controls, customers' motivations, and how facilities handle lighting maintenance.

### Industrial Lighting Segments

The market actor interviews identified the key segments of the industrial sector in the Northwest. Table 3 summarizes the characteristics of these key segments, as described by market actors.

Table 3: Key Industrial Lighting Segments

Key Segment	Characteristics
Manufacturing/Processing	Dominant types of manufacturing plants include food processing, lumber mills, and pulp, paper, and glass processing. Each plant tends to have unique lighting needs due to the variety in products.
Indoor Agriculture	This is a growing market segment, but not all facilities are optimal utility program candidates.
Warehousing/Storage	Includes manufacturing storage facilities and cold storage. High square footage and hours of operation represent a strong opportunity for controls. Some market actors do not include warehousing in their definition of industrial customers.

Source: Research team analysis of market actor interview results.

The main lighting application across all three key industrial segments is high bay. High Intensity Discharge (HID) was the traditional technology of choice for all of these segments, and market actors estimated that HID still dominates installed lighting. Some HID systems have been replaced by multi-lamp fluorescent fixtures, however many interviewees noted that HID is still a prominent technology in the industrial sector. LED is currently the preferred technology for retrofits, although adoption is slower than in the commercial sector. Facilities that have already upgraded to high-output T5 fluorescent fixtures are less likely to consider LED upgrades because the incremental efficiency gain is lower.

It is important to note that industrial facilities include attached office spaces and outdoor areas, such as parking lots and production yards, which are often included in a retrofit project. One market actor noted, "When you say 'paper mill' that also encompasses offices, warehouse, exterior warehousing, areas over paper machines, under paper machines. Each site encompasses so much." Market actors noted that lighting retrofits often include all areas of the facility, not just the processing areas, and that all areas (offices, outdoor areas, etc.) are moving toward LED.

### Lighting Needs and Considerations for Industrial Facilities

The needs and motivators of industrial facilities differ from their commercial counterparts. Across all three segments, employee safety is a primary concern. One interviewee explained, "We're talking about safety of human beings, and in commercial it's more about pleasantness and emotional impact. [We]

have to make sure people are safe regardless of how pretty it is. Safety, security, improvement of process.” The section below expands on these and other industrial-specific considerations.

- **Safety is paramount.** Safety can be a big motivator to upgrade to LEDs. Compared to existing lighting, especially older lights that have degraded over time, new LEDs are typically much brighter and often more controllable. The instant-on capability of LEDs is also attractive to industrial facilities. Many interviewees shared the sentiment that “a lot of facilities don’t even realize they’re working in dangerous conditions (...) a lot of customers have installed 1000-Watt metal halides that have depreciated 15% over 10 years so they are severely under-lit.”
- **Long operating hours (usually).** Compared to commercial facilities with shorter operating hours, ROIs for lighting upgrades at industrial facilities tend to be quite short because of the high hours of use. However, in energy-intensive manufacturing, processing, or cold storage facilities, lighting comprises a small portion of the overall operating budget. Therefore, lighting tends to be a low priority for upgrades or maintenance.
- **Mobile equipment.** Industrial facilities often have mobile equipment and sometimes reconfigure their facility space depending on changing needs. For example, storage and warehouse spaces are often reconfigured with wider or narrower aisles based on changing inventory. Manufacturing plants with mobile equipment need temporary mobile lighting, as well as task lighting for parts of their production process that require focused lighting. Mobile lighting typically needs to meet the same safety requirements as wall- and ceiling-mounted lighting (see below).
- **Food processing safety requirements.** Food processing facilities can require niche products. These are becoming more and more available in LED versions, according to interviewees.
  - Waterproof fixtures are often required for cleaning, as food processors must regularly spray down the whole production facility to comply with health standards. This can make TLEDs an attractive option: food processors often decide to use TLEDs in existing waterproof fixtures instead of upgrading to LED fixtures. The higher cost of waterproof fixtures decreases the potential ROI of a project that involves replacement of fixtures.
  - Glass is dangerous. Glass bulbs in the production area can shatter because of exposure to high heat or vibration. If this occurs, facilities must shut down production and dispose of all product potentially exposed to shattered glass. Therefore, food processors require glass-free or protected lamps and fixtures.
- **Hazardous conditions.** Especially in manufacturing and production facilities, heat, moisture, dust, and debris associated with industrial activities challenge standard commercial products. The most common needs follow.
  - Some facilities (e.g., bakeries, paper mills) require fixtures/lamps that can withstand extreme heat.
  - Some facilities require explosion-proof fixtures designed to avoid causing explosions due to flammable gasses or combustible dust. This poses a similar issue as with waterproof

fixtures – if a facility has already invested in explosion-proof fixtures, the cost of an LED fixture upgrade may be prohibitive or unattractive.<sup>9</sup>

Along with their specialized conditions and requirements for lighting, industrial facilities have specialized staff and contractors. Most industrial facilities have technical and engineering staff on-site at all times, including in-house electricians who regularly perform lighting maintenance. These employees may conduct lighting projects without the assistance of electrical contractors. In addition to their in-house staff, market actors said that larger industrial facilities tend to have relationships with electrical contractors. One market actor noted, “One interesting thing about the larger [industrial] plants is that they almost always have a relationship with a large electrical contractor. They have a sales rep or account manager who already has a sense of what’s going on because they are out there all the time. They trust that rep to only bring them good projects. That electrical contractor will be weeding out projects before they get to the end-use customer.”

### Some Industrial Facilities Slow to Upgrade Lighting, but LEDs are Gaining Ground

Lighting upgrades can be a low priority for industrial facilities: they want to invest in their production process equipment first, because that is most important to their business. One interviewee explained that for industrial customers, “the best lighting system is the one you can forget about.” Market actors identified two main drivers for industrial customers’ reluctance to upgrade lighting.

- Production is top priority, as stopping production to upgrade lighting can result in a huge loss in revenue. All eight industrial market actors mentioned this. Some industrial facilities will delay upgrading or maintaining lighting until it is truly necessary for this reason, and many market actors gave anecdotes of very old HID lighting installed in industrial facilities. One recounted visiting a facility “so dark it looks like you’re walking into a house of horrors dungeon.”
- Two interviewees noted that LED adoption is moving slowly because no facility wants to be the first to have a lighting upgrade fail or have a negative impact on production for an extended period. Industrial facilities need to see successful retrofits at other facilities before investing, because so much more than lighting is at stake for their facilities.

On the other hand, all eight industrial market actors mentioned that LEDs are gaining popularity with industrial customers. One noted, “LED is there in industrial now. It wasn’t there 2-3 years ago. But now customers see it as a good option.”

### Controls Compete with Safety Concerns

Industrial market actors reported that interest in lighting controls is just getting started in the industrial market. Interviews uncovered two main themes regarding controls: that there is great opportunity for controls in industrial facilities and that legitimate safety concerns exist about controls in industrial facilities. Six market actors focused primarily on the opportunity, three saw both opportunity and safety risks, and two interviewees focused their comments on the safety risks.

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<sup>9</sup> The National Fire Protection Association defines three classes of explosion-proof fixtures to meet the needs of facilities with various risks of combustion. For example, a Class I fixture is rated for safe use around flammable gasses, vapors, or liquids, while Class III fixtures are safe for use around easily ignitable fibers such as cotton.

Interviewees who see good industrial opportunities for controls cited the large square footage of industrial facilities as the driving factor for utilizing them. Many agreed that placing occupancy sensors in less trafficked areas, particularly in large warehouses or storage facilities, was an obvious choice. One interviewee explained, "You can put in an incredibly efficient driver and lamp, but if you don't include controls you're missing the trifecta." Others noted that controls provide additional savings for industrial customers, ranging anywhere from 20%-90%.

Interviewees cited safety as a major barrier to controls for some facilities, due to concerns that lights could turn off while someone is working with dangerous equipment or in an area not picked up by occupancy sensors. Liability concerns drive many industrial facilities to keep all lights on at all times, regardless of whether workers are in the area or not. One market actor noted that the only type of controls his industrial customers ask for is high-low dimming, because they want the lights to remain on for safety. The same market actor noted that some customers are not interested in controls at all, because in addition to safety issues, "they just view it as one more failure point in the fixture."

The types of controls utilized vary by facility. Occupancy sensing is the most common, with many facilities employing the technology in some portion of the space. Dimming is also a popular option, paired either with occupancy sensors or timeclocks. Daylighting is less common, and market actors reported this is due to safety concerns surrounding appropriate light levels. One market actor highlighted that integrated controls systems that are programmable and controllable via a back-end software system can help mitigate safety risks when properly implemented.

### Return on Investment is Key

Industrial customers are looking for payback periods of 1-3 years, according to all seven respondents commenting on this topic. They tend to be sophisticated about their capital investments, since many industrial facilities invest frequently in equipment repairs and upgrades to support their core business. One market actor explained, "Regarding financials, they always want an 18-month or less payback. Very quick payback requirements. It's interesting because they have such large investments in their facility already, you'd think they would have higher tolerance for payback. Lighting projects are so cost-effective especially with high hours of operation. But they really focus on the fast payback."

One market actor (a lighting manufacturer specializing in hazardous location lighting) stated that their customers do not care about energy savings, and instead are looking for a long-lasting, low-maintenance, durable product to meet their lighting needs. Non-energy benefits of an LED upgrade can be more difficult to quantify than energy savings, but are often influential in decision making, especially if market actors are able to monetize these benefits and include them in ROI calculations:

- Maintenance savings can be huge due to the reduced labor costs for less frequent re-lamping, and avoided shutdown time. As noted, not having to stop production is a high priority for industrial facilities, and this means reduced maintenance is an attractive benefit of upgrading to LEDs.
- Higher quality in production due to better light levels. For example, a lumber mill having a lower reject percentage on boards because workers can see problem pieces before sending them to a customer.
- Facilities can save on insurance premiums if they have higher light levels.

- Some facilities view LEDs as glamorous additions and are simply interested in doing the “cool, new thing”.
- Utility incentives are a huge selling point, sealing the deal by driving down cost and shortening the ROI.

### Diverse Approaches to Lighting Maintenance

There is no consistent lighting maintenance strategy across industrial facilities. Some facilities simply allow lamps to burn out until the facility is too dark for them to work in. Others conduct batch re-lamping and hire companies to replace all lamps at once. Facilities with in-house engineering staff or maintenance staff are more likely to do their own electrical work.

Industrial facilities that already have lifts typically do not hire outside firms to work on lighting equipment. One interviewee also explained that “most of them have O&M<sup>10</sup> work on millions of dollars of equipment every day, when they look at a fixture it’s almost like they see it as something a kid could do. They have nothing but bodies to do work, all they need is a sweet deal from their supplier and they’re off and running.” Often, maintenance or upgrades occur during scheduled production shut downs (holidays or mid-year). Some industrial facilities have energy efficiency managers who utilize supply networks to purchase equipment, but use in-house staff for maintenance labor. On the other hand, one market actor mentioned that large industrial facilities sometimes contract with ESCOs to perform major retrofits, and that those projects sometimes include an ongoing maintenance contract.

Market actors agreed reduced maintenance costs are a primary benefit of LEDs installations and can be a selling point. However, one market actor noted that he sometimes has difficulty convincing his customers of the magnitude of the maintenance savings because they are so accustomed to maintaining their legacy systems, which require frequent lamp and ballast replacements.

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<sup>10</sup> Operations and maintenance.



## Outdoor Lighting

The research team interviewed 13 market actors specializing in outdoor lighting. They included five manufacturers producing outdoor lighting products, three large contractors specializing in outdoor lighting, and five representatives of utilities who have performed outdoor lighting retrofit projects. These market actors offered insight on the key applications in outdoor lighting, how street lighting projects work, the state of LEDs in outdoor lighting, and outdoor lighting maintenance.

### Outdoor Lighting Applications

Among the wide range of applications in outdoor lighting, the research team's interviews covered the categories described in Table 4. The outdoor lighting applications discussed here do not align with the lighting applications defined in the research team's momentum savings modeling and analysis. Rather, the applications shown here illustrate the areas of expertise of the market actors interviewed. The sections that follow give more detail about these findings.

Table 4: Outdoor Lighting Applications

Application	Market Insights
Building exterior	Many interviewees agreed that LED wall packs were one of the first applications embraced by early adopters in the outdoor market.
Signage	One market actor mentioned that many convenience stores and other chain stores are retrofitting signage to LED.
Street and Roadway	LED is becoming the norm. Retrofit projects vary with ownership of the lamps. End-users may be required to conform to a particular look and feel, with some steering away from "space age type fixtures."
Site and Area Lighting	This application includes parking lots, parks, yards, and open areas at commercial facilities. Utilities see opportunity in parking lot lighting after the success of LED street lighting projects. Maintenance benefits are important to commercial customers.
Car Dealerships	Car dealerships were an early adopter of LED outdoor lighting, because of the benefit of increased visibility and improved color rendering. Controllability is a draw too, as a way to save on power costs without losing nighttime visibility.
Petroleum Stations (Gas Stations)	A wave of gas station retrofits, driven in part by BPA's incentive program, has converted many of the region's stations to LED canopy and area lights.
Sports Venues	Sports venues have low hours of operation and stringent lighting requirements. However, they are also a highly public venue for demonstrating the effectiveness and savings of LEDs, making them attractive opportunities for market actors.
Marine Lighting	Customers more interested in durability than energy savings. Boat lights are generator-powered, but most marinas are utility customers.

Source: Research team analysis of market actor interview results.

## Street and Area Lighting Retrofits Are Predominantly LED

Many cities and towns still operate and maintain legacy HID systems, and some have installed induction streetlights over the past several years. However, according to interviewees, nearly all street lighting and area lighting retrofits in the past two years have installed LED systems. Of the eight outdoor lighting interviewees who sell lighting products, two stated that they exclusively sell LEDs, focusing their business on what they see as the future of outdoor lighting. Part of this shift stems from price, with LED prices dropping significantly in the past two years. In earlier years, LED projects had higher costs and the payback periods were longer than many customers required. Interviewees said most street lighting projects sought a 3- to 4-year simple payback, and now, most projects are falling under a 3-year simple payback due to the reductions in LED prices.

One utility interviewee described two street lighting projects in eastern Washington to demonstrate this change. A medium-sized city installed induction lights in 2014 and everyone involved considered them a great replacement for high-pressure sodium (HPS). Just two years later, in early 2016, a nearby town went through the process of upgrading their HPS street lights, and only considered LEDs. LEDs are now the norm in street lighting projects in that area, and induction no longer appears to be a viable option. The interviewee reported that cities have observed that LEDs look better aesthetically; the incremental cost is lower than it used to be; and market actors and end users now see LED as a proven technology.

The majority of interviewees noted that utility programs are an influential factor in most street lighting projects. One Washington utility reported the street lighting retrofit projects coming through the utility's incentive program have grown in numbers over the past two years, more than doubling between 2014 and 2016. All these projects have included LED lights, and the interviewee stated that these projects have now become sufficiently cost effective with the drop in LED prices and the support of utility incentives.

Another interviewee (a contractor), stated, "LED street lighting retrofits are becoming a commodity at this point... it's like what replacing T12s used to be." However, reasons for upgrading to LED differ depending on who leads the project. In some cases, the key decision factor is reduction in energy and maintenance costs with a favorable ROI, but for others it is a different aesthetic look, dark sky friendly fixtures, or a desire to increase sustainability or promote green practices. Regardless of the motives, projects all tend to focus on achieving a highly cost-effective solution, and outside grant funding (such as funds from the Washington State Transportation Improvement Board's Relight Washington program) and utility incentives are of utmost importance.

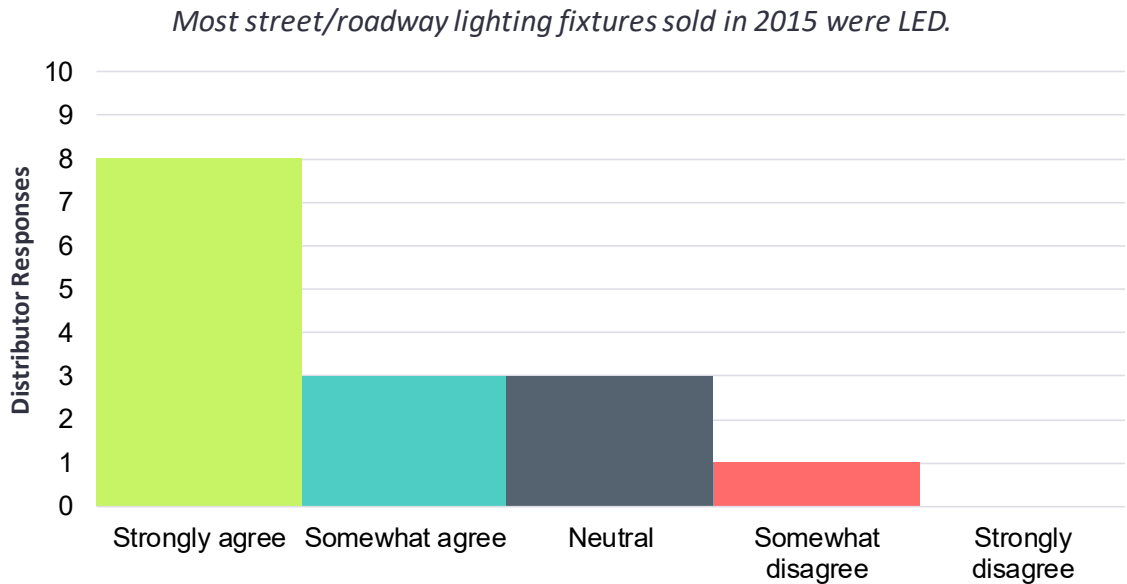
Dark Sky ordinances<sup>11</sup> can also be a driver for LED replacements because the directionality of LEDs makes compliance easier. Most market actors noted that while dark sky compliance was a consideration, it was not a primary driver of retrofit projects.

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<sup>11</sup> Dark Sky ordinances aim to limit light pollution by setting standards for outdoor lighting. See more information at the International Dark-Sky Association's website, <http://www.darksky.org>.

Distributors also see a trend toward LED street lighting in the Northwest. The majority of distributors responding to the web survey (11 out of 15) agreed that LED products comprised the majority of street/roadway fixtures sold in 2015, as shown in Figure 6.

Figure 6: Distributor Views on LED Street and Roadway Fixtures (n=15)



Source: Online survey of Northwest distributors, 2016

Similarly, commercial area lighting, such as retail parking lots and car dealerships have moved toward a norm of LEDs for lighting retrofits. Market actors mentioned that better color rendering (compared to HPS, for example) can be a major driver of LED upgrades in parking lots because of improved security. According to one market actor serving retail customers such as shopping mall tenants said of parking lot lighting, “it would be very hard for a smart landlord or tenant to look at anything other than LED, since it’s adaptable to connectivity and network controls.”

## Understanding the Street Lighting Retrofit Process

The research team collected information from utilities, contractors, and manufacturers involved in street lighting retrofit projects to understand how street lighting retrofits work and who is involved.

### *Ownership and Operation*

Street light ownership can be quite complex, with multiple public and private entities owning streetlights even within the same geographical area. Ownership falls into four general categories:

- **Municipality or county:** In many cities and towns, the municipality owns streetlights. Most municipalities have a 'streetscape standard' with requirements for streetlight appearance.
- **Utility:** Both public utilities and IOUs own streetlights, particularly those affixed to power poles.
- **State department of transportation or highway district:** A state department of transportation typically owns roadway lighting along state highways and interstates, while highway districts may own lighting along rural roadways.
- **Private entities:** Businesses and private individuals own some roads and roadway lighting.

There are some cases where the entity responsible for street lighting leases a lighting system, rather than owning it. However, leasing is much more expensive than owning, and it is not as common as the other ownership and maintenance arrangements. One interviewee stated, "Some commercial customers might be interested in private leasing options but government customers don't go down that path."

Operation and maintenance of roadway lighting adds another layer of complexity, since it is quite common for one entity to own a streetlight but a different entity to be responsible for its operations and maintenance. This split between ownership and operation can be a barrier to upgrading streetlights in some cases, since the operator may be more motivated to upgrade than the owner is. However, in other cases, maintenance savings are great enough that the operator is willing to fund upgrades on streetlights they do not own.

A common arrangement, according to interviewees, is for the municipality to own a town or city's streetlights and the utility to carry responsibility for operating and maintaining them. One utility we interviewed implemented a series of LED streetlight upgrades on lights the utility owned, and transferred responsibility for O&M to the city when the project was complete (while retaining ownership of the lights). This was possible because the O&M needs of LED street lighting are much less frequent, since LEDs have long lives.

### *Competitive Bids*

For public entities and utilities, most street lighting retrofit projects are required through a competitive bid process due to procurement requirements. This involves the leading entity developing specifications for the lighting upgrades they require, and then circulating these specs via an RFP to local contractors or distributors. Market actors noted that there is variation in how detailed these specifications are. Depending on the project, they can include over 200 pages of documentation with detailed engineering specifications, or as one distributor explained, it can be "the wild west – they might just say, 'Give me a 100 Watt lamp,' and select from the options they get in bids." The detail and specifications of the project

usually align with overall success and public acceptance of the lamps: those that put in the time and effort to plan the project have higher rates of success, according to interviewees.

Some utilities provide their own in-house labor for streetlight retrofits, while others hire contractors. Utilities source lighting equipment (as well as the other materials required for a retrofit project, like wire and poles) through a local distributor. Some projects purchase lamps or fixtures directly from manufacturers. However, interviewees said this was infrequent, and did not happen enough to suggest this is a trend.

### *Street Lighting Maintenance*

Street lighting maintenance strategies depend on ownership as well as responsibility for O&M. Regardless of who maintains the lights, LED upgrades lead to much less frequent maintenance. While some utilities and municipalities perform group re-lamping (particularly on legacy systems that require more frequent re-lamping) interviewees said the typical approach to streetlight maintenance is spot re-lamping in response to requests from customers.

One interviewee cited an example of a homeowners' association (HOA) that had O&M responsibility for the streetlights in their area. The HOA paid a flat fee to the city for the cost of power, but hired a contractor to perform maintenance like replacing burnt out lamps in their aging HPS streetlights. The HOA developed a plan to upgrade to LED lamps by retrofitting the existing fixtures, and went to the local utility to see whether they would be eligible for an incentive. Since they paid a flat fee for power, the HOA would not see any savings on their electric bill. Nonetheless, the HOA decided to move forward with the project: the maintenance savings, with the cost reduction from the utility incentive, were substantial enough to motivate the HOA to invest in LED streetlights. As far as the interviewee knew, the city never adjusted the flat energy fee the HOA paid to reflect the energy savings of the upgrade.

### *Specialty Outdoor Applications: Sports Venues, Gas Stations, and Car Dealerships*

The research team interviewed several market actors who had insight on specialized applications in outdoor lighting: sports venues, gas stations, and car dealerships. These findings represent a small number of interviews, so they are anecdotal and provide some insight into these particular niches within the outdoor lighting market.

#### *Sports Venues*

One interviewee specialized in retrofitting large sports venues with LED lighting. This contractor explained that sports venues are a very particular market, with different motivations from other non-residential end-users. Municipalities typically own major sports venues, which are often high-profile facilities that garner much public attention. For this reason, some facility owners and market actors see sports venues as good opportunities for energy-efficient retrofits because of the high visibility and the accompanying chance to promote programs, products, or values to viewers. For example, some of the contractor's customers collaborated with their local utility to implement an LED upgrade, with utility sponsorship, to promote their energy efficiency programs to spectators at games and events. Similar sponsorship arrangements occur with lighting manufacturers, with the sports venue benefitting from a price reduction on a lighting product and the manufacturer benefitting from the brand visibility and good publicity associated with the LED upgrade.

Despite the favorable opportunities for sponsorship, the contractor mentioned two barriers to upgrading sports venue lighting. One is that many professional sports leagues have very specific lighting requirements, and although LED products can meet these requirements, the testing and re-certification process can be arduous. The other barrier is that by nature of their use for special events, sports venues tend to have very low hours of use. Therefore, lighting retrofit projects often have a long payback period, making some facilities reticent to invest in an upgrade, particularly if there is no outside sponsorship.

### *Gas Stations*

Gas stations represent an attractive opportunity for lighting retrofit projects, as they tend to be brightly lit and have long hours of operation, with many stations open 24 hours a day. One manufacturer representative we interviewed had previously specialized in gas station lighting, and had converted a large number of Northwest stations to LED canopy lights and parking lot lights. This interviewee changed his focus to commercial and industrial customers in early 2016, because he observed that the gas station market has largely already converted to LED. The busy gas stations along the I-5 corridor were the first to convert, and he estimated that 70% of all gas stations and convenience stores in Washington have already converted to LED. Among the remaining locations, the biggest barrier to an LED retrofit is a lack of up-front capital. These businesses tend to be “mom and pop” locally owned small businesses, and they do not have the available capital to invest in lighting upgrades.

### *Car Dealerships*

Three of the market actors interviewed mentioned car dealerships as an eager adopter of LED lighting and controls. These retailers are highly motivated by the improved visibility and improved color rendering that LED lights can achieve, particularly in contrast to legacy systems using HPS lamps, for example. These factors motivate car dealerships to retrofit their lighting in hopes of increasing car sales. The energy savings and reductions in maintenance costs are also attractive, but market actors unanimously considered them secondary to the promise of increased sales in terms of their ability to motivate this customer segment.

Car dealerships behave similar to other retailers in terms of their emphasis on aesthetics and visibility, and accordingly they follow retailer behavior when it comes to maintenance. Market actors reported that car dealerships do not want a single light out on their lot. Therefore, the long lives of LED lights are also a key attraction for car dealerships.

Car dealerships often opt to include controls in their lighting retrofits. The typical controls described by interviewees included scheduled dimming after midnight (and perhaps a second dimming after 2:00 am), coupled with occupancy sensors that bring the lights back up to full brightness if someone enters the lot. This controls configuration is attractive to car dealerships both for 24-hour visibility and for security purposes, as well as the energy savings achieved by late night dimming.

## Appendix A: Interview Strategy and Methodology

This appendix includes additional detail about the research strategy, methodology, and interview guide.

### Research Questions

The research team developed research questions from each area of inquiry. Interview guides for each market actor incorporated specific questions from the below.

Table A-1: Research Questions by Area of Inquiry

Area of Inquiry	Research Question Number	Research Questions
<b>Market Evolution</b>	ME1	Has the product flow changed and are new or different market actors becoming influential? Are any market actors declining?
	ME2	What is the mix of applications in installed stock, and how has that mix changed?
	ME3	What is the mix of technologies within each application in installed stock?
	ME4	How do market actors foresee the mix of installed stock changing going forward?
	ME5	What is the mix of applications in sales?
	ME6	What is the mix of technologies within each application in sales?
	ME7	How do market actors foresee the mix of sales changing going forward?
	ME8	What new products are gaining market share? (Quality? Price?)
	ME9	How do the application mix and the technology mix differ between existing and new construction?
	ME10	Are distributors/retailers/manufacturers “destocking” any products this year? (i.e., getting rid of products that are not selling well)
<b>Purchase Decisions</b>	PD1	How does the product flow from manufacturer to end-user, and who are the market actors involved?
	PD2	What factors influence product choices?
	PD3	Do certain sectors choose higher efficiency products more often than other sectors?
	PD4	How do technologies compete with each other and what are the distributions of each competing technology within a given application?
	PD5	What is the turnover rate for non-residential lighting applications? What factors influence this rate? What triggers a system change-out?
	PD6	What happens in the field when equipment (lamps, ballasts, systems) fails?

	PD7	How are decisions made around lighting maintenance? (e.g., is lighting maintenance performed on a group or spot basis?) <i>Note: TO16 survey found 18% of businesses perform group re-lamping.</i>
	PD8	What are the current practices and industry recommendations regarding maintaining or changing light levels (lumens?) in retrofits?
	PD9	How do economic conditions affect purchase decisions?
<b>Regional Variation</b>	RV1	What differences exist between urban and rural markets for non-residential lighting?
	RV2	What differences exist between the Northwest states for non-residential lighting?
	RV3	How do urban customers' purchase decisions differ from those of rural customers?
	RV4	How does contractor behavior differ between urban and rural markets?
	RV5	Does the mix of applications in installed stock differ between urban and rural markets or between states?
	RV6	Does the mix of technologies in installed stock differ between urban and rural markets or between states?
	RV7	Does the mix of applications in sales differ between urban and rural markets or between states?
	RV8	Does the mix of technologies in sales differ between urban and rural markets or between states?
<b>Industrial</b>	IND1	What are the key segments within the industrial sector and what are their key characteristics?
	IND2	What market actors exist that serve industrial niche lighting needs?
	IND3	What are the dominant lighting technologies in industrial sites?
	IND4	What are the major applications within industrial lighting?
	IND5	What is the mix of applications in installed stock and in sales for the industrial sector?
	IND6	What is the mix of technologies within each application in installed stock and in sales for the industrial sector?
	IND7	What factors determine technology mix (end-use, industry, facility size?)
	IND8	What changes have occurred in technology mix during the 6th plan period? How do market actors foresee the mix changing over time?
	IND9	How do industrial sector purchase decisions differ from other sectors?
	IND10	What factors cause industrial customers to change their lighting systems?
<b>Outdoor</b>	OUT1	What are the key segments of outdoor lighting and what are their key characteristics?



OUT2	What are the major applications within outdoor lighting?
OUT3	What is the mix of applications in installed stock and in sales for outdoor?
OUT4	What is the mix of technologies within each application in installed stock and in sales for outdoor?
OUT5	How are the various segments of outdoor lighting serviced? (parking lots, street lighting, gas stations, others) How big are the various segments within outdoor lighting?
OUT6	What are the various forms of street lighting ownership, and how are decisions made around technologies? How do utilities track street and roadway lighting data?
OUT7	What are the average lighting systems at gas stations? What drives lighting demand at gas stations? (e.g., number of pumps? Convenience store?)
OUT8	How did the NW Power and Conservation Council model the outdoor sector?

*Source: TO24 Market Actor Interview Strategy, 2016.*

## Interviewee/Market Actor Descriptions

Table A-2: Market Actor Descriptions

Market Actor	Description
Manufacturer Representatives	Residential interviews (TO16) shed light on these potentially influential market actors at LightFair 2015, and additional interviews are needed to improve understanding of their role in the market.
National Account Decision Makers	Large chain businesses (also called national accounts) make choices about lighting retrofits for multiple business locations at the corporate level. Interviews with market actors involved in these decisions are needed to understand whether these purchases occur outside of distribution channel and what factors are influential.
Outdoor and Street Lighting Professionals	These experts on outdoor and street lighting, such as members of the Illuminating Engineering Society, or others are directly engaged in manufacturing, designing, and selling outdoor and street lighting products. Previous research has not focused on this sector, so interviews will be exploratory and inform future research plans.
Industrial Lighting Professionals	These experts on industrial lighting are directly engaged in manufacturing, designing, and selling lighting products for industrial applications. Particular focus on dominant Northwest industries like food processing, pulp and paper.
Electrical Distributors	Electrical distributors sell commercial lighting products at the local level. They provide sales data to the research team, which is a foundational input to quantifying momentum savings. Interviewees will be knowledgeable about industry and sales trends.
Manufacturers	Manufacturers of commercial lighting products are a key market actor: they have deep insight into market trends, new technologies and products, and market structure. Interviewees will be knowledgeable about non-residential lighting products specifically.
Installation Contractors and Maintenance Firms	Installation contractors install lighting equipment and perform lighting retrofits for commercial buildings. Maintenance firms provide lighting maintenance services (e.g., lamp replacement, repairs) to commercial buildings. There may be overlap between these categories and both may be trade allies of utility programs.

Source: TO24 Market Actor Interview Strategy, 2016.

## Types of Interviews

The research team conducted in-depth and short interviews depending on the market actor and target count. Table A-3 provides definitions to differentiate the two types of interviews.

Table A-3: Types of Interviews

Interview	Description
In-Depth Interview	These tend to be one hour long, and have the advantage of being able to collect detailed information about a topic in a semi-structured format that allows for probing for detail and asking follow-up questions. In-depth interviews are suitable for exploratory interviews and those looking to gather detailed and nuanced information about a market actor. Their disadvantages include requiring a substantial time commitment from the interviewee and requiring qualitative analysis, which can be time consuming.
Short Interview	These tend to be approximately 15 minutes long. They share some of the advantages of in-depth interviews without as much time burden. These are appropriate for market actors that are busy and difficult to schedule longer interviews with. They are also suitable for gathering information on targeted topics.

Source: TO24 Market Actor Interview Strategy, 2016.

## Interview Sampling and Outreach Strategy

### Sampling Considerations

The research team considered the following when selecting interviewees.

- High Priority Interviewees
- Population Size
- Variation within population
- Prior coverage by TO16

### Contact Sources

The research team utilized the following sources for each interview target category. The research team logged all contacts, communication efforts, and interview status updates in a tracker to maintain well-coordinated communication.

- **Manufacturer Representatives:** Snowball sample starting with prior interviewees.
- **National Account Decision Makers:** Work with NEEA, BPA program managers, and other stakeholders to identify decision makers. Snowball sample as necessary.
- **Outdoor & Street Lighting Professionals:** Trade Allies from Evergreen, Utilities involved in outdoor lighting projects via BPA.

- **Industrial Lighting Professionals:** Contacts made at LightFair, Trade Allies from Evergreen who have worked on industrial projects.
- **Manufacturers:** Contacts made at LightFair.

## Distributor Web Survey

In conjunction with the research team’s collection of sales data from distributors, the research team fielded a brief online survey consisting of seven questions to understand emerging trends in the non-residential lighting market. Fifteen distributors completed the survey. To avoid overburdening distributors participating in both BPA’s research and NEEA’s Reduced Wattage Lamp Replacement Initiative (RWLR), the research team did not ask RWLR participants to complete the survey. Therefore, the make-up of fifteen distributor respondents was:

- 8 full-line electrical distributors
- 2 lighting-only distributors
- 1 maintenance repair and operations (MRO) distributor
- 4 “other” lighting purveyors (these distributors identified themselves as a full service lighting contractor, energy service company, utility distributor, and a lighting manufacturer)

Of the respondents, 14 serve both urban and rural areas, with the one remaining distributor serving only urban areas. Roughly half of respondents (8 out of 15) noted that less than 25% of lighting sales (in terms of dollars) go to industrial customers. Nearly all of respondents (13 out of 14) noted that less than 25% of lighting sales go to agricultural customers.

## Master Interview Guide

The research team prepared a master interview guide, which we tailored to fit the specific role and expertise of each market actor group by removing or modifying questions as needed. The research team mapped each interview question to a specific research question, in order to facilitate adequate coverage of all relevant topics, as well as the analysis of response data.

## Interview Guide

Thank you for taking the time to speak with us today. This interview is part of BPA’s research on the Non-Residential Lighting market in the Pacific Northwest. The main goals of this research project are to inform energy efficiency program strategy and to understand the energy savings happening outside of utility programs in the region.

Today, we’re interested in understanding current trends and characteristics of the non-residential lighting market from the perspective of *[insert market actor group]*.

<b>Interviewee</b>	
<b>Company</b>	
<b>Position</b>	
<b>Interviewer &amp;</b>	

<b>Other Attendees</b>	
<b>Date &amp; Time</b>	

Research Question	Question Number	Question	Answer
Context	1	Please describe your role in your company as it pertains to non-residential lighting.	
Context	2	Do you specialize in any specific market segments or geographical areas?	
Context	3	Are your company's operations divided into regional territories? If so, which region(s) includes Washington, Oregon, Idaho, and Montana?	
ME9	4	Do you work with new construction projects, retrofit projects, or both?	
Market Evolution			
ME1	5	[Tailor to respondent's market role as needed.] Over the past year, have any new players become prominent in the lighting market (e.g., online-only resellers, LED resellers, new manufacturers)?	
ME1	6	[If Q5=yes] Is their market share increasing?	
ME1	7	[If Q5=yes] Are they influencing more customer decisions?	
ME1	8	Are there any types of companies (e.g., full-line distributors, MRO companies) whose market shares are declining?	
ME1	9	Are there any types of companies (e.g., full-line distributors, MRO companies) whose customer influence is declining?	
ME6	10	What categories of lighting are shifting toward LED the fastest? [Probe to cover all applications: Linear 4ft, General Purpose Screw-base, Downlight, Track lighting, High bay, Candelabra and Globe lamps, Street/roadway lamps, Parking lot, Parking garage, Building exterior, other]	
ME7	11	How do you foresee sales/use of high-efficiency lighting products (including, but not limited to LEDs) changing going forward?	
ME8	12	What new lighting products are gaining market share? [Specify: specific products, or categories of products.]	
ME8	13	Are these products becoming more popular because of increases in quality, decreases in price, utility incentives, or other reasons? Which factor would you say is most important?	

ME10	14	In addition to the new products coming into the market, we're interested in what products are phasing out. Have you (or your suppliers) stopped stocking/producing any products in the past year? Which ones? Why?	
ME9	15	Do new construction projects tend to include more high-efficiency lighting products than the average lighting retrofit project? If so, why?	
Purchase Decisions			
PD1	16	What percentage of your company's lighting product unit sales would you estimate are non-residential versus residential?	
PD1	17	Please walk me through how a typical large non-residential lighting project works from start to finish. [Probe for details: How do you identify/contact customers? Who makes the sale? Who on the customer side makes the decision? What other parties are involved in sales or decision making? Who pays whom? How do the products physically get to the customer site? Who installs products, etc.?]	
PD1	18	Do you work with national accounts? If so, can you walk me through a typical customer's decision making process for those projects? [Probe for details: Who are the key decision makers, how does the decision get made, what are the key factors that drive decision making, are there third parties involved, etc.?]	
PD1	19	For commercial and industrial lighting products, what percent of your sales revenue comes through: Contractors, End-user/building owners, Builders, Other	
PD2	20	What types of customers are most likely to purchase high-efficiency lighting products? (Contractors, End-user/building owner, Builders, Other)Please explain why.	
PD3	21	Does this differ in specific industries, and if so, how?	
PD2	22	Are there any particular distributors in the Northwest that specialize in high-efficiency products?	
PD5	23	We are interested in understanding how often customers change out their lighting systems (i.e., perform a lighting retrofit project). We know this can vary based on customer type. Can you estimate how often this happens for your customers? [Ask for specifics on outdoor and industrial if applicable; Probe for detail by CBSA building type – Office, Retail/Service, Warehouse, Assembly, School, Lodging, Residential Care Grocery, Restaurant.]	
PD5	24	Do particular customer segments change more often, e.g., retail, restaurant?	
PD5	25	Probe for each category: What factors influence this rate? What triggers a system change-out?	

PD1	26	Please walk me through how a typical large lighting project works from start to finish: who makes the decision, what types of vendors do you work with, who pays whom, who installs products, etc.?	
PD1	27	Are projects implemented regionally, nationally, on a store-by-store basis?	
PD6	28	When equipment (lamps, ballasts, systems) fails, how do your customers (or you) decide on what type of lighting to replace that failed equipment with?	
PD7	29	How are decisions made around lighting maintenance? (e.g., is lighting maintenance performed on a group or spot basis?) Note: TO16 survey found 18% of businesses perform group re-lamping.	
PD8	30	What are the current practices and industry recommendations regarding maintaining or changing light levels (lumens?) in retrofits?	
PD8	31	Does this vary at all by sector or building/space type?	
PD8	32	What about new construction?	
PD9	33	How do economic conditions affect purchase decisions?	
Regional Variation			
RV1	34	We're interested in understanding how urban markets differ from rural markets for non-residential lighting. In your business, how do the lighting needs in these markets differ? Please provide details about the products more frequently sold in one market or the other.	
RV2	35	Are there differences between the Northwest states for non-residential lighting? (Washington, Oregon, Idaho, Montana)	
RV3	36	If you serve different locations [mention specific urban and rural examples if possible], how do your customers' purchase decisions differ between those locations?	
RV4	37	Do you do business differently in urban and rural markets? E.g., do you market different products to urban versus rural customers?	
Industrial			
IND1	38	Do you work with industrial customers? If so, what are the main categories of industrial customers you work with? (e.g., manufacturing, food processing) [If not: skip to next section]	
IND1	39	Do you offer any industrial-specific lighting products?	
IND2	40	Can you walk me through how your company serves industrial lighting customers?	
IND2	41	What other companies/types of companies are involved in the industrial lighting market?	

IND4	42	Is there anything that makes industrial customers different from commercial customers?	
IND9	43	How is decision making about lighting different in the industrial sector compared to other sectors (e.g., commercial)?	
IND10	44	What factors cause industrial customers to change their lighting systems?	
IND1	45	For each category of industrial customer you mentioned, what factors determine which lighting systems those customers typically choose (e.g., price, lifetime, controllability, other functionality)?	
IND3	46	What are the dominant lighting technologies in industrial sites? (By segment if possible)	
IND6	47	Would your company be able to share any data about the types of products you sell to industrial customers in the Northwest?	
IND8	48	What do you foresee in the future of industrial lighting? Changes in product types?	



## Appendix B. Research Strategy Document

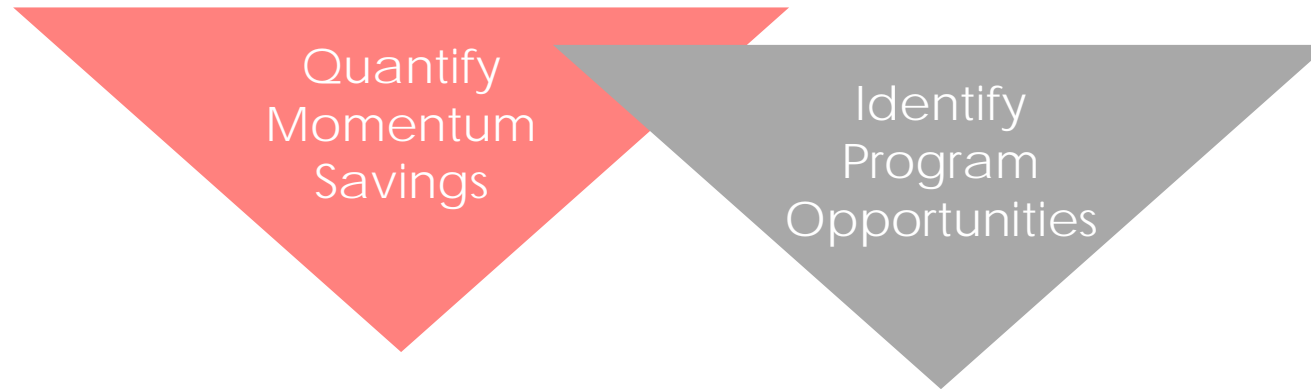
The following pages contain the research strategy document, which the research team developed with BPA's input at the outset of this research.

# TO24 MARKET ACTOR INTERVIEW STRATEGY

Final  
January 22, 2016

# Context

This market actor interview strategy is designed to support the two key goals of Task Order 24 Non-Residential Lighting Study:

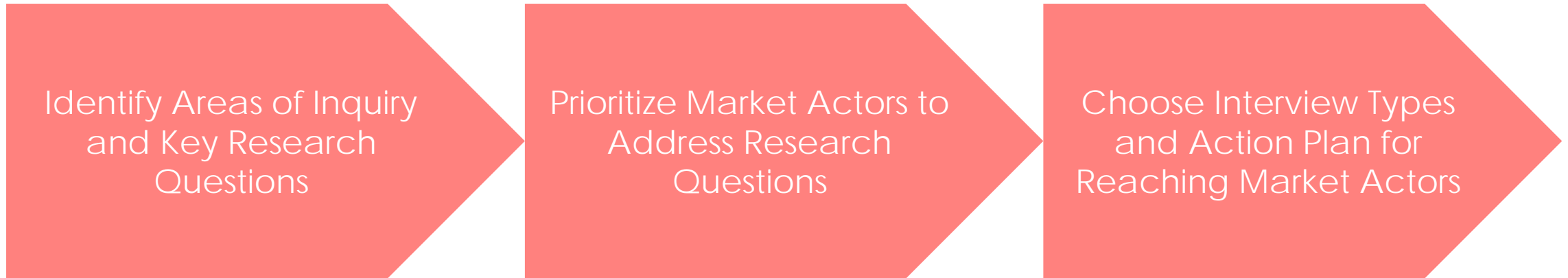


It is important to understand the whole of the market and the details of variation across the market in order to support the momentum savings analysis.

- Information gathered through market actor interviews can corroborate assumptions and inputs in the momentum savings model.
- Holistic market understanding ensures that the momentum savings analysis accounts for nuances in the supply chain and interprets the sales data correctly.
- Interviewing a broad set of market actors can uncover opportunities for program intervention.

# Interview Strategy Development

To support the goals of the project, the research team followed these steps in developing the interview strategy :



Together, these assessments (documented in the pages that follow) resulted in a comprehensive strategy for interviewing non-residential lighting market actors.

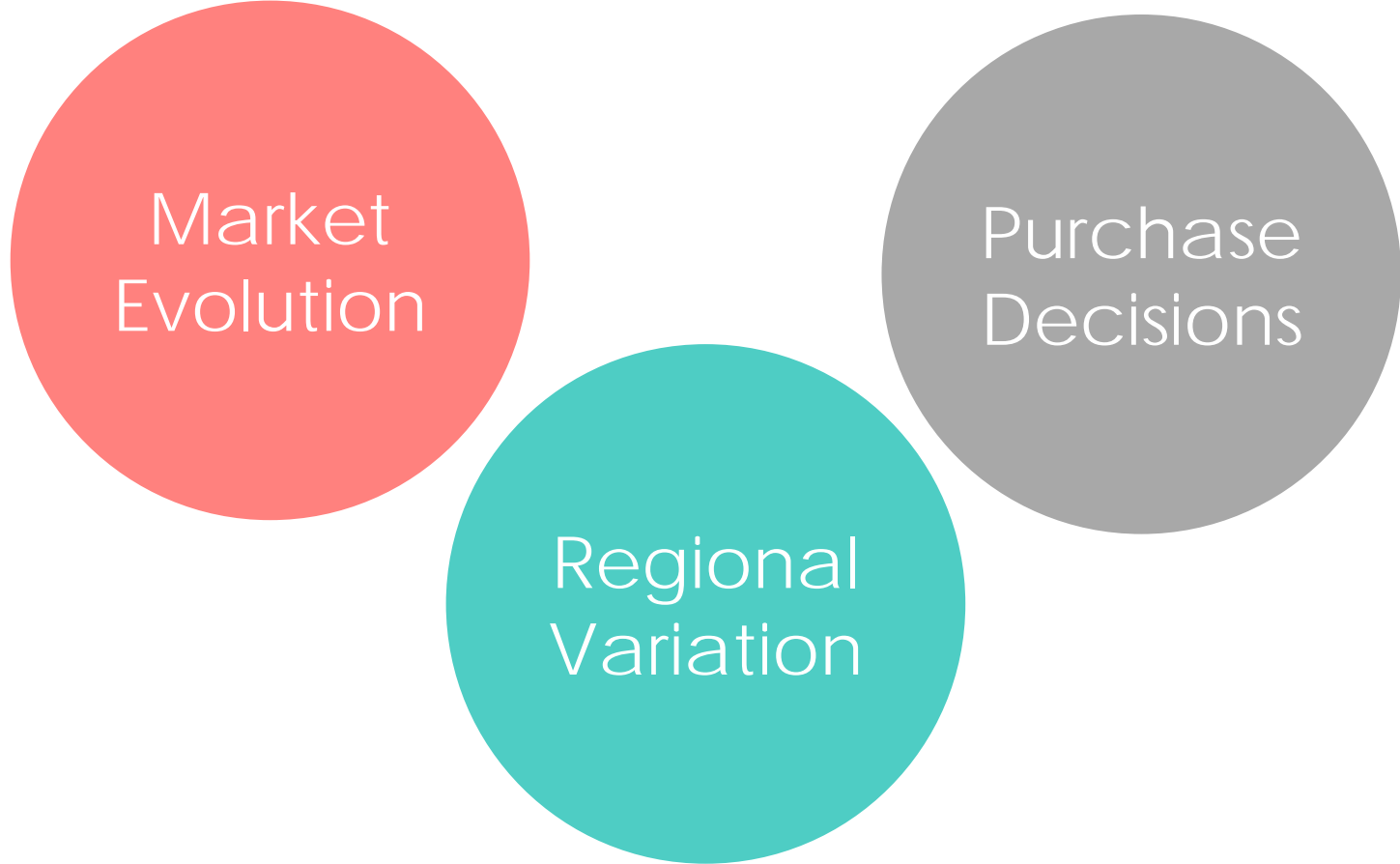
# Interview Strategy Development

1

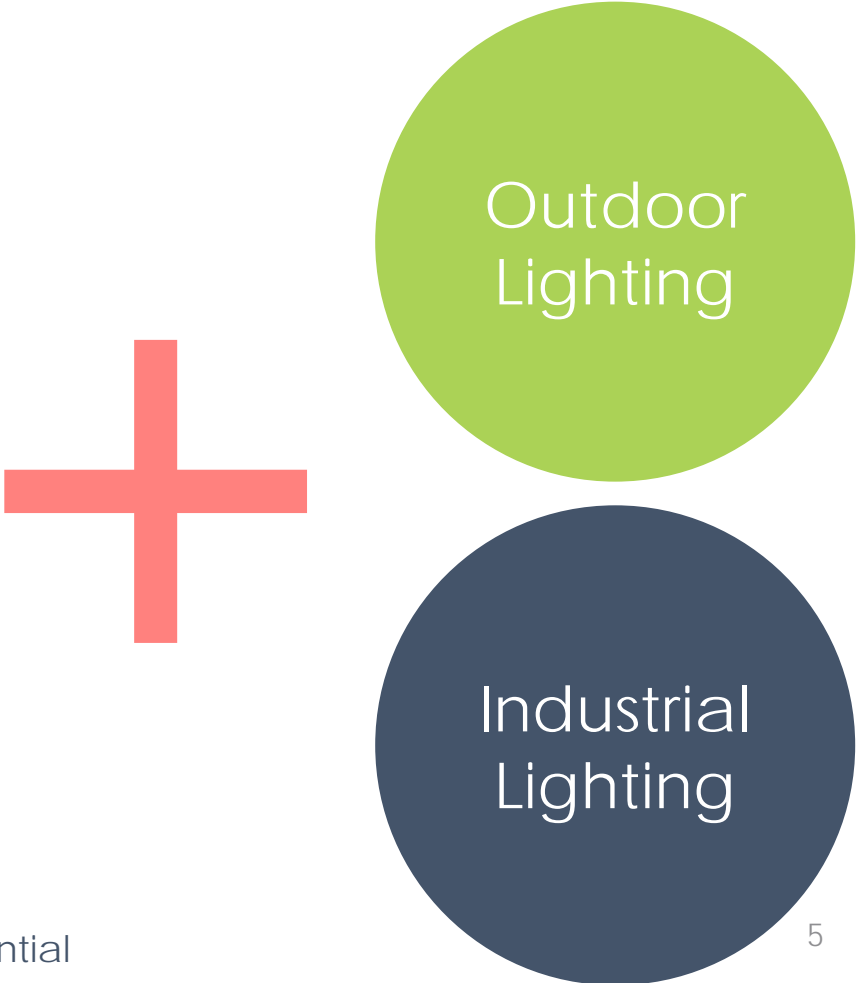
Identify Areas of  
Inquiry and Key  
Research Questions

# Areas of Inquiry

## Cross-Sector Areas\*



## Sector Focus Areas



\*Cross-sector areas apply to all sectors: Commercial, Industrial, Outdoor, and Residential

# Areas of Inquiry

Each area of inquiry will provide information to support the team's development of up-to-date market intelligence. These areas are defined below and their associated research questions are listed on the pages that follow.

**Market Evolution:** How has the structure of the market and the flow of products changed recently?

**Purchase Decisions:** How, when, and why do customers decide to purchase new lighting equipment?

**Regional Variation:** What differences exist within the Pacific Northwest lighting market?

**Outdoor Lighting:** What are the key characteristics of the outdoor lighting market?

**Industrial Lighting:** What are the key characteristics of the industrial lighting market?

# Market Evolution Research Questions

1. Has the product flow changed and are new or different market actors becoming influential? Are any market actors declining?
2. What is the mix of applications in installed stock, and how has that mix changed?
3. What is the mix of technologies within each application in installed stock?
4. How do market actors foresee the mix of installed stock changing going forward?
5. What is the mix of applications in sales?
6. What is the mix of technologies within each application in sales?
7. How do market actors foresee the mix of sales changing going forward?
8. What new products are gaining market share? (Quality? Price?)
9. How do the application mix and the technology mix differ between existing and new construction?
10. Are distributors/retailers/manufacturers “destocking” any products this year? (i.e., getting rid of products that are not selling well)



# Purchase Decisions Research Questions

1. How does the product flow from manufacturer to end-user, and who are the market actors involved?
2. What factors influence product choices?
3. Do certain sectors choose higher efficiency products more often than other sectors?
4. How do technologies compete with each other and what are the distributions of each competing technology within a given application?
5. What is the turnover rate for non-residential lighting applications? What factors influence this rate? What triggers a system change-out?
6. What happens in the field when equipment (lamps, ballasts, systems) fails?
7. How are decisions made around lighting maintenance? (e.g., is lighting maintenance performed on a group or spot basis?) *Note: TO16 survey found 18% of businesses perform group re-lamping.*
8. What are the current practices and industry recommendations regarding maintaining or changing light levels (lumens?) in retrofits?
9. How do economic conditions affect purchase decisions?

# Regional Variation Research Questions

1. What differences exist between urban and rural markets for non-residential lighting?
2. What differences exist between the Northwest states for non-residential lighting?
3. How do urban customers' purchase decisions differ from those of rural customers?
4. How does contractor behavior differ between urban and rural markets?
5. Does the mix of applications in installed stock differ between urban and rural markets or between states?
6. Does the mix of technologies in installed stock differ between urban and rural markets or between states?
7. Does the mix of applications in sales differ between urban and rural markets or between states?
8. Does the mix of technologies in sales differ between urban and rural markets or between states?

# Industrial Research Questions

What are the key segments within the industrial sector and what are their key characteristics?

What market actors exist that serve industrial niche lighting needs?

What are the dominant lighting technologies in industrial sites?

What are the major applications within industrial lighting?

What is the mix of applications in installed stock and in sales for the industrial sector?

What is the mix of technologies within each application in installed stock and in sales for the industrial sector?

What factors determine technology mix (end-use, industry, facility size?)

What changes have occurred in technology mix during the 6th plan period? How do market actors foresee the mix changing over time?

How do industrial sector purchase decisions differ from other sectors?

What factors cause industrial customers to change their lighting systems?

# Outdoor Research Questions

1. What are the key segments of outdoor lighting and what are their key characteristics?
2. What are the major applications within outdoor lighting?
3. What is the mix of applications in installed stock and in sales for outdoor?
4. What is the mix of technologies within each application in installed stock and in sales for outdoor?
5. How are the various segments of outdoor lighting serviced? (parking lots, street lighting, gas stations, others) How big are the various segments within outdoor lighting?
6. What are the various forms of street lighting ownership, and how are decisions made around technologies? How do utilities track street and roadway lighting data?
7. What are the average lighting systems at gas stations? What drives lighting demand at gas stations? (e.g., number of pumps? Convenience store?)
8. How did the NW Power and Conservation Council model the outdoor sector?










# Interview Strategy Development

2

Prioritize Market  
Actors to Address  
Research Questions

# Non-Res Market Actors: Potential Interviewees

 = High Priority for TO24, as described on following pages

	Residential (TO16)	Market Evolution	Purchase Decisions	Industrial	Outdoor
Manufacturer Reps 	•	•		•	
Municipalities				•	•
Commercial Chain Decision Makers 			•		
Lighting Showrooms	•	•			
Outdoor & Street Lighting Professionals 		•	•		•
Utility Outdoor Lighting Experts					•
Gas Station Lighting Suppliers & Maintenance Firms					•
Industrial Lighting Professionals 		•	•	•	
Lighting Designers/Specifiers		•	•		
Trade Associations		•		•	
National and Regional Lighting Experts	•	•			•
Retailers 	•	•			
New Construction Market Actors	•	•	•		
Commercial & Industrial Building Owners & Managers 	•		•		
Electrical Distributors 	•	•		•	•
Manufacturers 	•	•			•
Installation Contractors & Maintenance Firms 		•	•	•	

# High Priority Interviewees

High-priority market actors are identified as those who are crucial to our understanding of the market for this round of market research.

**Manufacturer Reps** – Residential interviews (TO16) shed light on these potentially influential market actors at LightFair 2015, and additional interviews are needed to improve understanding of their role in the market.

**Commercial Chain Decision Makers** – Decision makers for large chain businesses (also called national accounts) make choices about lighting retrofits for multiple business locations at the corporate level. Interviews are needed to understand whether these purchases occur outside of distribution channel and what factors are influential.

**Outdoor & Street Lighting Professionals** – These experts on outdoor and street lighting, such as members of the Illuminating Engineering Society, or others are directly engaged in manufacturing, designing, and selling outdoor and street lighting products. Previous research has not focused on this sector, so interviews will be exploratory and inform future research plans.

**Industrial Lighting Professionals** – These experts on industrial lighting are directly engaged in manufacturing, designing, and selling lighting products for industrial applications. Particular focus on dominant Northwest industries like food processing, pulp and paper.

# High Priority Interviewees (Continued)

**Retailers** – Representatives of major retailers, specifically buyers who are knowledgeable about lighting products that are likely to be used in non-residential applications, and sales via contractor “pro-desks.”

**Commercial & Industrial Building Owners & Managers** – Owners and managers of non-residential buildings are the end-users of the non-res lighting market, and the target audience of downstream utility programs. Residential lighting (TO16) conducted a survey with a sample of these market actors to gather insight on their lighting decisions.

**Electrical Distributors** – Electrical distributors sell commercial lighting products at the local level. They provide sales data to the research team, which is a foundational input to quantifying momentum savings. Interviewees will be knowledgeable about industry and sales trends.

**Manufacturers** – Manufacturers of commercial lighting products are a key market actor: they have deep insight into market trends, new technologies and products, and market structure. Interviewees will be knowledgeable about non-residential lighting products specifically.

**Installation Contractors and Maintenance Firms** – Installation contractors install lighting equipment and perform lighting retrofits for commercial buildings. Maintenance firms provide lighting maintenance services (e.g., lamp replacement, repairs) to commercial buildings. There may be overlap between these categories and both may be trade allies of utility programs.



# Interview Strategy Development

3

Choose Interview  
Types and Action  
Plan for Reaching  
Market Actors

# Types of Interviews

**In-Depth Interviews** – These tend to be one hour long, and have the advantage of being able to collect detailed information about a topic in a semi-structured format that allows for probing for detail and asking follow-up questions. In-depth interviews are suitable for exploratory interviews and those looking to gather detailed and nuanced information about a market actor. Their disadvantages include requiring a substantial time commitment from the interviewee and requiring qualitative analysis, which can be time consuming.

**Short Interviews** – These tend to be approximately 15 minutes long. They share some of the advantages of in-depth interviews without as much time burden. These are appropriate for market actors that are busy and difficult to schedule longer interviews with. They are also suitable for gathering information on targeted topics.

**Trade Shows** – Trade shows are a venue for conducting interviews: both in-depth and short interviews can occur at trade shows. Trade shows are an effective venue for learning about current market trends, and can allow researchers to connect with multiple market actors in an intensive effort over a short number of days. This can increase the efficiency of interview efforts. Further, trade shows offer the opportunity to understand the zeitgeist of the industry from an insider's perspective.

**Surveys** – Surveys are suitable for collecting specific information from a large quantity of respondents. Their advantages include the potential for statistically representative sampling, and the ability to reach a large number of respondents. Disadvantages include the inability to gather nuanced information or ask follow-up questions.

# Action Plan Overview

	In-Depth Interviews	Short Interviews	Trade Show	Survey
<b>High Priority Interviewees</b>				
Manufacturer Reps	10			
Commercial Chain Decision Makers	22			
Outdoor & Street Lighting Professionals	8	10		
Industrial Lighting Professionals	8	10		
Commercial & Industrial Building Owners & Managers				70**
Electrical Distributors				20+
Manufacturers	2	10		
Installation Contractors and Maintenance Firms		10		
<b>Total</b>	<b>50</b>	<b>40+*</b>		<b>90</b>

\*Wherever possible, short interviews to be conducted at LightFair – see pg. 24. Interviewees not reachable at LightFair will be contacted by phone.

\*\*Building owner & manager survey is a proposed add-on to TO24, not originally included in the scope.

# Action Plan: Task Order 24 and Beyond

## Clarifying Scope of TO24

Task Order 24 includes up to 50 long interviews and up to 40 short interviews. Some of the interviews included in this action plan extend beyond the TO24 scope. This table (a reorganized version of the summary on the previous page) shows which interviews are included in TO24.

	In-Depth Interviews	Short Interviews	Survey
<b><i>Included in Task Order 24 Scope</i></b>			
Manufacturer Reps	10		
Commercial Chain Decision Makers	22		
Outdoor & Street Lighting Professionals	8		
Industrial Lighting Professionals	8		
Manufacturers	2		
Installation Contractors and Maintenance Firms		10	
Outdoor & Street Lighting Professionals		5	
Industrial Lighting Professionals		5	
Electrical Distributors			20+
<b><i>Task Order 24 Totals</i></b>	<b>50</b>	<b>40</b>	
<b><i>Proposed Beyond Task Order 24 Scope</i></b>			
Outdoor & Street Lighting Professionals		5+ (LightFair)	
Industrial Lighting Professionals		5+ (LightFair)	
Manufacturers		10+ (LightFair)	
Commercial & Industrial Building Owners & Managers			70
<b><i>Proposed Additional Totals</i></b>		<b>20+</b>	<b>70</b>

# Action Plan: Short Interviews (TO24)



10 Installation  
Contractors &  
Maintenance  
Firms

## Sampling Considerations:

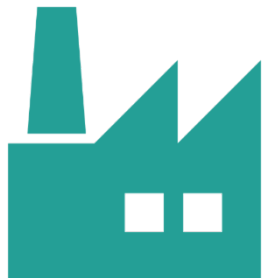
- High-Priority
- Need for exploratory or preliminary interviews prior to in-depth interviews
- Variation within population
- Prior coverage by TO16



5 Outdoor &  
Street Lighting  
Professionals

## Contact Sources:

- Installation Contractors & Maintenance Firms: Trade Allies From Evergreen, BPA.
- Outdoor & Street Lighting Professionals: Trade Allies from Evergreen, BPA.
- Industrial Lighting Professionals: Trade Allies from Evergreen who have worked on industrial projects.



5 Industrial  
Lighting  
Professionals

## Value Proposition: Industry Collaboration.

Wherever possible, the team will make contact with market actors via trusted messengers to establish trust.

# Action Plan: In-Depth Interviews



## In-Depth Interview Plan: 50 In-Depth Interviews

### High Priority Interviewees

	In-Depth Interviews
Manufacturer Reps	10
Commercial Chain Decision Makers	22
Outdoor & Street Lighting Professionals	8
Industrial Lighting Professionals	8
Manufacturers	2
<b>Total</b>	<b>50</b>

### Sampling Considerations:

- High-Priority
- Population size
- Variation within population
- Prior coverage by TO16

### Value Proposition:

**Industry Collaboration.** Wherever possible, the team will make contact with market actors via trusted messengers to establish trust.

### Contact Sources:

- Manufacturer Reps: Snowball sample starting with prior interviewees.
- Commercial Chain Decision Makers: Work with NEEA, BPA program managers, and other stakeholders to identify decision makers. Snowball sample as necessary.
- Outdoor & Street Lighting Professionals: Trade Allies from Evergreen, BPA.
- Industrial Lighting Professionals: Trade Allies from Evergreen who have worked on industrial projects.
- Manufacturers: Contacts to be provided by NEEA.

# Action Plan: Distributors



## Staged Approach for Distributors

### Considerations:

1. Important to avoid over-burdening them, especially RWLR participants
2. We have collected a lot of information from them already
3. Research questions include:
  - a. Regional variation in efficiency across states or urban versus rural
  - b. Sales to Res New Construction (TO16)
  - c. Lighting characteristics of key industrial segments
  - d. What outdoor lighting products come through distribution channel

**Stage 1:** Brief Survey Conducted Concurrently With Sales Data Collection.

- Implement online
- 5 questions or less

**Stage 2:** Review findings from RWLR evaluation interviews

**Stage 3:** As needed, target distributors at LightFair (see pg. 24) or via phone for additional interviews

### **Value Proposition:**

**Market Intelligence.** This survey request will be packaged with the sales data collection, which offers market intelligence in exchange for data.

# Action Plan: Non-Res Building Owners



Continue Research  
on Non-Res Building  
Owners

## Considerations:

1. TO16 conducted a survey and gathered info about decision-making:
  - a. Small sample and diverse population
  - b. Larger sample will enhance value of the results
2. TO16 survey instrument will be updated
3. Contact list will be revisited and unused sample will be used for TO24

Proposal:  
Add to the TO24 scope: A second round of survey data collection, approximately 60 completes.

Build on TO16 research, conducting a second round of data collection using the TO16 survey instrument (or slightly modified version thereof) to build a more robust sample. Non-residential building owners are a fragmented population, so a larger sample would enhance the value of the TO16 results



# Action Plan: LightFair



## LightFair Interview Plan:

Proposal:  
Add to the TO24 scope: LightFair attendance with the goal of conducting up to 40 short interviews.

Target interviewees include:

Manufacturers

Manufacturer Reps

Industrial Lighting Professionals

Outdoor & Street Lighting Professionals

Lighting Designers/Specifiers



LightFair is a major lighting industry event, attracting attendees from all parts of the lighting market. It is an opportunity to connect with a large number of market actors over a short period of time.

Research questions include:

- Market trends for 2015 & beyond
- Lighting characteristics of key industrial segments
- Market map for outdoor and industrial lighting (ownership, purchase decisions)
- How often do lighting system changeovers happen, and what are decision factors?