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Xcel Energy
Home Lighting Product
2018 Evaluation

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FINAL
REPORT

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Introduction

The Home Lighting Product in Colorado provides discounts for customers to purchase ENERGY STAR LED bulbs through an "upstream" discount methodology. In the upstream discount method, program administrators (in this case, Xcel Energy) work directly with manufacturers and retailers to reduce the cost of specific lighting products within their service territory. The discounts are directly passed on to the end-user through a reduced purchase price. This methodology has the benefits of low implementation costs and minimal effort required for end-users. The 2018 Demand Side Management Evaluation Plan included both a process evaluation and impact evaluation for this product. As part of this effort, the evaluation team assessed forthcoming changes to the lighting industry, underserved markets, and net-to-gross. This summary includes the key findings and recommendations from the evaluation.

Methods

Manufacturer interviews (n=8)

Sales data model

Staff interviews (n=4)

Peer utility benchmarking (n=4 utilities)

Fielding: July 2018 – September 2018

Key Findings

The product has effective and mature partnerships between Xcel and the program implementer, as well as with retailers and manufacturers.

The product significantly increases the amount of LED bulbs sold in Colorado and increases consumer awareness of energy efficient products.

Implementation of the EISA backstop remains uncertain, causing ambiguity for manufacturers and utility lighting program plans.

Process Results

Changes to the Lighting Industry

The evaluation team found that manufacturers and utilities alike **remain perplexed as to the expected outcome of the EISA backstop**, but are planning for it to be enacted in some form.

The most common expected change to the lighting market, as seen by manufacturers, is **connected lighting products**, including advanced lighting products, being able to connect lighting and appliances to a phone, and controls.

The evaluation team expects **LEDs to remain a more expensive technology**, but not as costly as five to ten years ago. As such, there is still an incremental cost between LEDs and less-efficient technologies, indicating opportunities for utility programs to impact consumer buying decisions by lowering prices.

Three of the four peer utilities interviewed were **skeptical that the EISA backstop will be fully adopted in January of 2020;** All were conservatively planning adjustments to their residential lighting programs. Specific programmatic changes varied by utility and were largely still uncertain.

Impact Results

0.61 Recommended NTGR

Manufacturer insights show that **NTGR has been decreasing since 2017,** which is indicative of a market transformation toward LEDs and expected efficiency standards for lighting.

The sales data model shows that **program spending is responsible for an increased market share of LED sales,** and in particular ENERGY STAR LEDs.

Process Results

Underserved Markets

The two hard-to-reach population areas that manufacturers mentioned were **low-income populations and immigrant populations.** Manufacturers discussed that these two populations tend to shop less at large home improvement or club stores (such as The Home Depot or Costco) and more at local grocery and discount stores.

Manufacturers suggest continuing to **train staff and customers at stores** that hard-to-reach populations are more likely to visit, such as mass merchandisers and discount stores.

Manufacturers suggested hosting **give-away events at food banks and sporting events within low-income areas** to reach hard-to-reach populations, or by having an online option to the program, similar to the activities already conducted by Xcel Energy.

Conclusions & Recommendations

Implementation of EISA backstop and GSL expansion remains uncertain. Manufacturers express differing opinions on whether the backstop will be enacted in 2020 but are making plans as if it will take effect. However, in 2017, national efficient bulb sales stagnated, indicating that in the short term, opportunities still exist for utility programs to influence consumer lighting decisions.

Recommendation 1: Continue running upstream lighting programs until legislation solidifies or LEDs become the predominant technology. Xcel Energy can still influence consumer lighting decisions; however, the lighting market is expected to transform rapidly and this influence will likely decrease as LEDs become the predominant technologies and/or the EISA backstop legislation limits the availability of less efficient bulb technologies.

Recommendation 2: Reassess prospective NTGR value when the fate of EISA backstop implementation becomes clear. Xcel Energy needs to reassess savings opportunities when DOE or litigation determines how the backstop will be enacted.

Recommendation 3: Closely monitor legislative actions for direction on EISA. Decisions on this legislation will quickly impact the lighting market and provide direction on the future program opportunities, plus impact future NTGRs.

Manufacturers are planning for LED market dominance. Once this occurs, the evaluation team expects opportunities for influencing customer lighting decisions to decrease for LEDs.

Recommendation 4: Xcel Energy should plan for decreasing NTGR as options for inefficient bulbs diminish. While there may be opportunities for savings within limited channels or target populations, Xcel Energy should plan for the home lighting product to evolve with the changing market.

Manufacturers differ on how to impact hard-to-reach populations, indicating that there is not a method established as fully effective for reaching these market segments. However, educating staff and customers at mass merchandisers and discount stores were mentioned as helpful to increase education of these populations.

Recommendation 5: Xcel Energy will need to design and test a variety of methods if they choose to target hard-to-reach populations. Consider focusing staff and consumer education efforts on discount and mass merchandiser stores and bringing outreach events and giveaways to low-income and immigrant geographies.

1. INTRODUCTION

Xcel Energy offers a comprehensive array of demand side management (DSM) and other energy services and products to its customers. For the evaluations of its 2018 products, Xcel Energy sought to improve the customer experience, understand the role its products play in changing the marketplace, analyze the product influences on customer choices, and ensure industry-leading program performance. To accomplish this Xcel Energy contracted with EMI Consulting and its partners: Evergreen Economics, Apex Analytics, and Ridge & Associates (hereafter 'the evaluation team'). This team undertook evaluations of nine products offered in Colorado and Minnesota in 2018, including the Home Lighting Product in Colorado discussed in this report.[1] This introduction includes an overview of the product and the evaluation approach, and describes the organization of this report.

1.1 Product Overview

The Home Lighting Product provides discounts for customers to purchase ENERGY STAR LED bulbs[2], through an "upstream" discount methodology. In the upstream discount method, program administrators (in this case, Xcel Energy) work directly with manufacturers to reduce the cost of specific lighting products within their service territory. The discounts are directly passed on to the end-user through a reduced purchase price. This methodology has the benefits of low implementation costs and minimal effort required for end-users. The potential challenge of the upstream implementation structure is in the evaluation; the seamless discount structure often results in customers who are unaware of their participation and evaluators who have no record of which customers purchased the discounted bulbs. Compounding the evaluation challenges is the enormity of energy savings: as the largest electric program in the Colorado portfolio (estimated at approximately 25% of 2017 total energy savings and two-thirds of the residential program energy savings), this product evaluation needs to rely on highly rigorous and precise evaluation methods.

From November 2016 through October 2017,[3] the Colorado Home Lighting Product incentivized over 2.2 million lightbulbs, claiming over 90 GWh in energy savings (Table 1-1). The majority of these savings were claimed through LED bulbs, producing 82% of the savings for the program in 2017. The program no longer incentivizes CFLs in 2018 and beyond, as such, the evaluation team focused its efforts on the LED bulb incentives.

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[1] The products selected for evaluation in 2018 include: Custom Efficiency (CO), Evaporative Cooling (CO), School Education Kits (CO), Home Lighting (CO), Lighting Efficiency (CO), Motor Efficiency (MN), Multi-Family Building Efficiency (MN), Business New Construction (MN), Water Heater Rebates (MN).

[2] Xcel Energy also discounted a small number of LED lighting fixtures and CFLs in 2017, which were carried over from the 2016 program, but dropped CFLs from the Home Lighting product in 2017. These measures did not contribute a significant amount to the 2017 product and will not be evaluated at this time.

[3] Note the 2017 Home Lighting Program Year ran November 2016 – October 2017.

Table 1-1. Home Lighting Savings and Quantities, 2017 Program Year

Retail Channel	Bulb Quantity	Savings (kWh)	Savings (kW)
CFLs	485,276	14,519,837	15,232
LED Bulbs	1,751,591	74,227,896	66,799
LED Fixtures	36,322	1,965,550	1,810
Total	2,273,186	90,713,283	83,842

Source: Apex Analysis of Program Tracking Data. Population: PY2017 bulbs

As shown in Table 1-2, almost half of the incentivized LED bulbs were sold through the Club retail channel (42%), followed by Mass Merchandisers (23%) and Large Home Improvement (21%). There were a total of 15 retail chains selling Xcel Energy-incentivized lighting products, comprising over 350 storefronts.

Table 1-2. Home Lighting LED Bulbs, by Retail Channel, 2017

	Bulbs Incentivized	Percent of Total
Club (e.g., Costco, Sam's Club)	736,564	42%
Mass Merchandisers (e.g., Walmart, Target)	403,137	23%
Large Home Improvement (e.g., Home Depot, Lowes)	368,278	21%
Discount	97,185	6%
Small Hardware	66,260	4%
Xcel Energy Giveaways	60,904	3%
Specialty	11,436	1%
Grocery	7,827	<1%
Total	1,751,591	100%

Source: Apex Analysis of Program Tracking Data. Population: PY2017 bulbs

1.2   EISA Uncertainty

One important variable into this research for the Home Lighting Product is the expectation and impacts regarding the Energy Independence and Security Act of 2007 (EISA) backstop provision.[4] This section serves to introduce the issue and potential impacts on the Home Lighting Product; the evaluation team builds upon this background in subsequent sections.

The EISA backstop provision states that, assuming certain conditions are not met by January 1, 2017, including an assessment of the efficacy of the initial EISA phase in standards, all general service bulbs (GSLs) sold in the U.S. must meet or exceed a 45 lumen per watt efficacy standard after January 1, 2020. At the time of this report, the Secretary has not published a rulemaking that

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[4] Energy Independence and Security Act of 2017 full text can be found at https://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf

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assesses the initial phases of the EISA phase-in, nor has the Department of Energy (DOE) published a final rule turning the 45 lumens per watt standard into law. As such, there is debate in the lighting industry on whether the backstop has been triggered. If enacted, the baseline wattage for energy-efficient lighting would essentially decrease from a halogen technology to a CFL or CFL-equivalent technology and would substantially decrease claimable savings from the Home Energy Lighting Product in 2020 and beyond.

Expanding the debate, on January 19, 2017, the DOE filed two rules with the Federal Register that expanded the definition of GSLs, starting in 2020, to include specialty bulb types formally exempt from EISA legislation, such as candelabras, globes, and reflectors. As such, this expanded definition of GSLs without guidance on the backstop status has left many stakeholders in the lighting industry confused about expectations moving forward. To compound the situation, in August 2018, the DOE published a document on their website rescinding the GSL expansion. This rescinding document was immediately removed without explanation.[5] The lack of clarity on the implementation of the EISA backstop and of the expanded GSL definition has created significant uncertainty within the lighting industry and within utility programs that incent efficient lighting products.

1.3   Evaluation Overview

The evaluation team designed a comprehensive evaluation of the Home Lighting Product to provide information on three key research topics:

- Lighting Industry Changes
- Underserved Markets
- Program Attribution (net-to-gross)

Table 1-3 presents an overview of the research topics and data sources used in this evaluation of the Colorado Home Lighting Product.

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[5] Further information on this issue can be found in the whitepaper "*Update on the EISA 2020 Backstop: Impact on Lighting Programs.*" By Apex Analytics. https://www.apexanalyticsllc.com/projects-and-publications

Table 1-3. Home Lighting Product Evaluation Framework

Evaluation objectives	Lighting Industry Changes	Underserved Markets	Net-to-Gross
Research topics	Prospective costs of LEDs Potential new energy-efficient lighting technologies EISA backstop expectations Peer utility lighting program plans	How to reach potentially underserved populations Underserved lighting technologies	LED market share, with and without program activities.
Data sources	Manufacturer Interviews Interviews of peer utility program managers	Manufacturer Interviews	Manufacturer Interviews Sales Data Modeling Interviews of peer utility program managers

Source: 2017 Evaluation Plan

1.4   Report Organization

The following chapters organize the evaluation findings into two components: impact and process evaluation results. As illustrated in Table 1-3, the data collection activities may have contributed to multiple evaluation objectives. Further detail on the evaluation approach is presented in the following chapters. Chapter 2 reviews the approach and results of the impact evaluation and the attribution of product impacts using a customized net-to-gross ratio (NTGR) analysis. Chapter 3 discusses the process evaluation components, which addressed changes to the lighting industry and underserved markets. Conclusions and recommendations are presented in Chapter 4. Detailed, descriptive methodology information, evaluation plans, and survey instruments can be accessed in this report's appendices.

2. IMPACT FINDINGS

A central component of this evaluation was the estimation of a recommended net-to-gross ratio (NTGR) for the Xcel Energy Home Lighting Product. This NTGR is an index representing the portion of the gross savings that are attributable to the product by accounting for factors that create differences between gross and net savings, such as free-ridership and spillover. The task of the evaluation team is to estimate and recommend a prospective NTGR for the Home Lighting Product to apply in 2019 and beyond, incorporating retrospective NTGR estimates, planned programmatic changes, and expected future program attribution. This chapter presents:

- **Key findings –** The key findings section presents the recommended NTGR based on the evaluation team's synthesis of findings from market actors and peer utilities.
- **Approach –** The approach section presents an overview of the evaluation team's methods to calculating the recommended NTGR.
- **Net-to-gross ratio inputs –** This section presents qualitative and quantitative data that support the NTGR calculations.

2.1 Key Findings: Net-to-Gross Ratio

The evaluation team recommends a prospective NTGR of 61% for the Home Lighting Product based on results from the sales data model and manufacturer interviews. This NTGR is indicative of a rapidly transforming market toward LED bulbs, as well as large uncertainty around implementation of the Energy Independence and Security Act (EISA) backstop provision.

The evaluation team examined the qualitative indicators of prospective NTGR, such as impacts of the EISA legislation, 2017 LED market share, and planned programmatic changes to the Home Lighting Product. For the EISA backstop legislation, manufacturers and utilities alike are uncertain as to when and how (and if) the legislation will be enacted, and the manufacturer prospective NTGR reflects this uncertainty. As a result, no further adjustment is necessary. Similarly, the Home Lighting Product does not have any significant changes planned, such as a change in customer- or bulb-type focus. As such, the evaluation team did not adjust the prospective NTGR to reflect planned changes. The sales data model, however, indicated that national sales for efficient lighting products stagnated between 2015 and 2017 at approximately 41%, indicating that there is still opportunity for program interventions to impact the sales of LED bulbs.

2.2 Approach

The evaluation team developed the recommended prospective NTGR for the Colorado Home Lighting Product using a combination of sales data modeling and manufacturer interviews. These two methods provided insight into both retrospective program attribution (sales data model) and prospective program impacts (manufacturer interviews).

The data inputs to the NTGR analysis included[6]:

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[6] Additional descriptive detail on these research activities appears in Chapter 3 and in the appendices.

- Manufacturer interviews – prospective product impacts, plans and expectations regarding EISA
- Lighting sales data – modeled retrospective estimate of product impact
- Product benchmarking data – providing a point of comparison
- Known product changes in upcoming years – factors any known implications for future changes in product design

The evaluation team used results from sales data modeling and manufacturer interviews to develop initial NTGRs. Data from the additional sources listed above were then used in constructing a logical narrative of product attribution, and in finalizing the NTGR for the product.

Sales Data Modeling

The underlying theory behind the lighting sales data net-to-gross model is that states that have strong upstream lighting program activity—compared to those with little to no program activity—should have higher market share (via sales) of efficient lighting compared to states with little to no program activity. This increase is known as "market lift." The model relied on full-category lighting sales data to estimate market lift as a function of program activity, while also controlling for other factors (e.g., household and demographic characteristics) that might impact efficient lighting sales. The result of the modeling is a comprehensive net-to-gross estimate that captures free-ridership, participant spillover, and nonparticipant spillover.

The evaluation team leveraged a variety of data sources for this model analysis, though the evaluation team relied primarily on sales data prepared by the Consortium for Retail Energy Efficiency Data (CREED),[7] which were mostly generated from two sources. These sources are point-of-sale (POS) state sales data (representing grocery, drug, dollar, discount, mass merchandiser, and selected club stores) and National Consumer Panel (NCP) state sales data (representing home improvement, hardware, online, and selected club stores, also referred to as non-POS). The evaluation team cleaned and processed all data for analysis. The model inputs also included a combination of program data collected by the evaluation team and household and demographic data collected through various publicly available websites. The primary model input data sources are listed below:

- POS data (grocery, drug, dollar, discount, mass merchandiser, and selected club stores)
- Panel data (home improvement, hardware, online, and selected club stores)
- U.S. Census Bureau import data (LED and CFL imports)
- DSM Insights, an E Source database of utility program data
- ENERGY STAR Lighting Program data (utility lighting program budgets)
- ENERGY STAR shipment data (released by the U.S. Environmental Protection Agency)
- North American Electrical Manufacturers Association (NEMA) shipment data

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[7] CREED serves as a collaborative effort of program administrators, retailers, and manufacturers to collect the necessary data to better plan and evaluate energy efficiency programs. LightTracker is CREED's first initiative, focused on acquiring full-category lighting data, including incandescent, halogen, CFL, and LED bulb types, for all distribution channels in the entire United States. As a consortium, CREED speaks as one voice for program administrators nationwide for requesting, collecting, and reporting on the sales data needed by the energy efficiency community. https://www.creedlighttracker.com.

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- American Community Survey (ACS) data (household characteristics and demographic data)
- Retailer square footage per state (based on the two primary retailer channel data sources)
- General population surveys, lighting saturation studies and other secondary data collection made publicly available through evaluation reports

In the sales data modeling approach, the evaluation team estimated net-to-gross ratios for LEDs in 2017 using the results of regression models, efficient bulb sales data, and the product tracking databases. The evaluation team first used the model to predict the share of efficient bulbs with and without a product (determining the counterfactual of no product activity by setting the product variable to zero). This change in share represents the product lift, or net increase in the share of efficient bulbs resulting from product activity.

To then calculate net-to-gross, the evaluation team multiplied the change in share by the total number of bulbs—for all bulb types—sold in 2017, as determined by the sales data analysis described above. This value represents the net impact of the product (i.e., the total lift in the number of LEDs sold), which the evaluation team then divided by the total number of program bulbs sold (i.e., the gross number of bulbs) to determine net-to-gross:

$$NTGR = \frac{(\#\ bulbs\ sold\ with\ product - \#\ bulbs\ sold\ with\ no\ product)}{\#\ of\ product\ incented\ bulbs\ sold}$$

While both the sales data model and the manufacturer interview estimates include participant and non-participant "like" spillover, the sales data modeling also modeled a product age variable, a proxy for market effects. This variable represents the portion of efficient lighting sales from potentially permanent changes in the market as a result of ongoing product activity. The model also scales the statewide lamp sales down to represent only the proportion of residential customers in the state served by Xcel Energy.

Manufacturer Interviews

Due to the transparent nature of upstream lighting programs, partner manufactures are often considered the "participants" of the program; they are among the most-qualified to discuss program administration, incentives, program successes, and market impacts. Corporate partner responses have the benefit of incorporating first-hand experience with program impacts.

The manufacturer interviews offer important insights into what LED sales would have been without the incentives, marketing, education, and other influences of the Xcel Energy product. Participant lighting manufacturers were asked to predict market share or sales for LEDs retrospectively for 2017 (thus proving a comparison with the sales data), and prospectively for 2020 and 2022, under two scenarios: (1) that the product continues with "business as usual", and (2) that the product ceased support for LEDs in 2017. Respondents were asked to make these predictions for A-line, reflector, and other specialty bulbs (e.g., globe, candelabra, appliance lamps, colored bulbs). The evaluation team calculated the NTGR as the net increase in LEDs resulting from the Home Lighting Product, or

$$NTGR = \frac{LED\ sales\ with\ product - LED\ sales\ without\ product}{LED\ sales\ with\ product}$$

Using the total *LED sales with product* metric as the denominator, however, provides a conservative NTGR estimate, since not every LED sold through retail channels is submitted for the product.[8] The *LED sales with product* metric, therefore, is adjusted to account for bulbs not incentivized through the Xcel Energy Home Lighting Product. On average, manufacturers reported that 76% of their LEDs sold in Colorado are incentivized through the Home Lighting Product. This adjustment essentially reduces the denominator by the percentage of bulbs expected to be sold outside the product, as reported by manufacturers.

Determination of Net-to-Gross Ratio

Given the fast-changing conditions of the lighting market, including the potential for the EISA backstop, along with rapidly decreasing prices and increasing availability of LEDs, the retrospective net-to-gross estimate may not be appropriate as a forward-looking or prospective value. While there is always uncertainty, the team assessed trends provided by trade partners and adjusted the retrospective NTG as needed to reflect expectations for the future.

To arrive at the recommended NTGR, the evaluation team first determined that the retrospective 2017 NTGR achieved from the manufacturer interviews aligned with the estimate determined from the sales data model. Specifically, the manufacturer estimated 2017 NTGR was 74%, and the sales data model revealed a NTGR of 68.4% and 82.5% (without and with market effects[9], respectively). The relatively close alignment of the sales data model and manufacturer interviews served as a validity check on the manufacturer estimates. This alignment provided confidence in the accuracy of the manufacturer estimated NTGR, allowing the evaluation team to adopt the manufacturer standard LED prospective NTGR (61%) for our recommended value. Due to the increased uncertainty in residential lighting from the backstop, the evaluation team recommends a point estimate instead of a continuous line.

The evaluation team first assessed the alignment between the retrospective NTG from the sales data model and from the corporate partner interviews. With that knowledge, the team estimated a NTGR based on the market share predicted by corporate partners, known changes planned for the product, and anticipated impacts of federal legislation. The evaluation team also conducted benchmarking research reviewing prospective net-to-gross values used in other states to inform the estimate.

Finally, the evaluation team used all the information collected about the product—through trade partner interviews, product benchmarking, and known product changes—to construct a logical, internally consistent, and coherent narrative of product attribution that attempted to identify all possible pathways of Xcel Energy influence. Based on these results, the evaluation team developed a final NTGR value that is consistent with all of the data collected as part of this evaluation.

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[8] LED bulbs that are not ENERGY STAR-certified, for example, are not incentivized; plus qualifying lamps do not always receive an incentive due to the timing of promotions/program campaigns, limited program budgets, etc.
[9] Program age might also be thought of as a simplistic proxy for market effects, meaning the portion of efficient lighting sales that are due to potentially permanent changes in the market as a result of ongoing program activity.

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2.3 Net-to-Gross Ratio Inputs

As described in the approach section, the recommended NTGR is based on four primary data inputs: sales data model, manufacturer interviews, changes to the Home Lighting Product, and peer program NTGR. This section explores each of these results in more detail, including qualitative data that supports the results.

Sales Data Model

While the primary objective of this model is to determine the impacts of product spending on the market share of LEDs to derive the state-level NTG estimates, a secondary, but no less important, objective is to help understand national lighting sales and program activity and to assess some of the key drivers behind the LED market share within Colorado. By having access to not only the national sales data but also the largest known compilation of state program activity (incentives, overall expenditures, bulb volumes), the team was able to analyze and compare Colorado lighting program activity with the other states. Some of the key attributes the team was able to develop include:

- Market share distribution: LED market share distribution for the U.S. as a whole, Colorado vs. the U.S., as well as across each state and across retail channels
- Program intensity: LED lighting market share relative to overall program expenditures per household (binned by three tiers of magnitude of spending),
- Program incentives: Average LED lighting program incentives per bulb
- ENERGY STAR market share distribution: LED market share distribution in Colorado compared to non-program states

Figure 2-1 shows market share of the four bulb types (incandescent, halogen, CFL, and LED) across three years. LEDs continue to gain substantial market share, rising from 19% to 35% market share, but have largely displaced sales of CFLs only. Shares of inefficient lighting (incandescent bulbs and halogens) still represent over half (59%) of the market and have largely stayed flat for three years.

Figure 2-1. Year-Over-Year Total US Market Share by Type
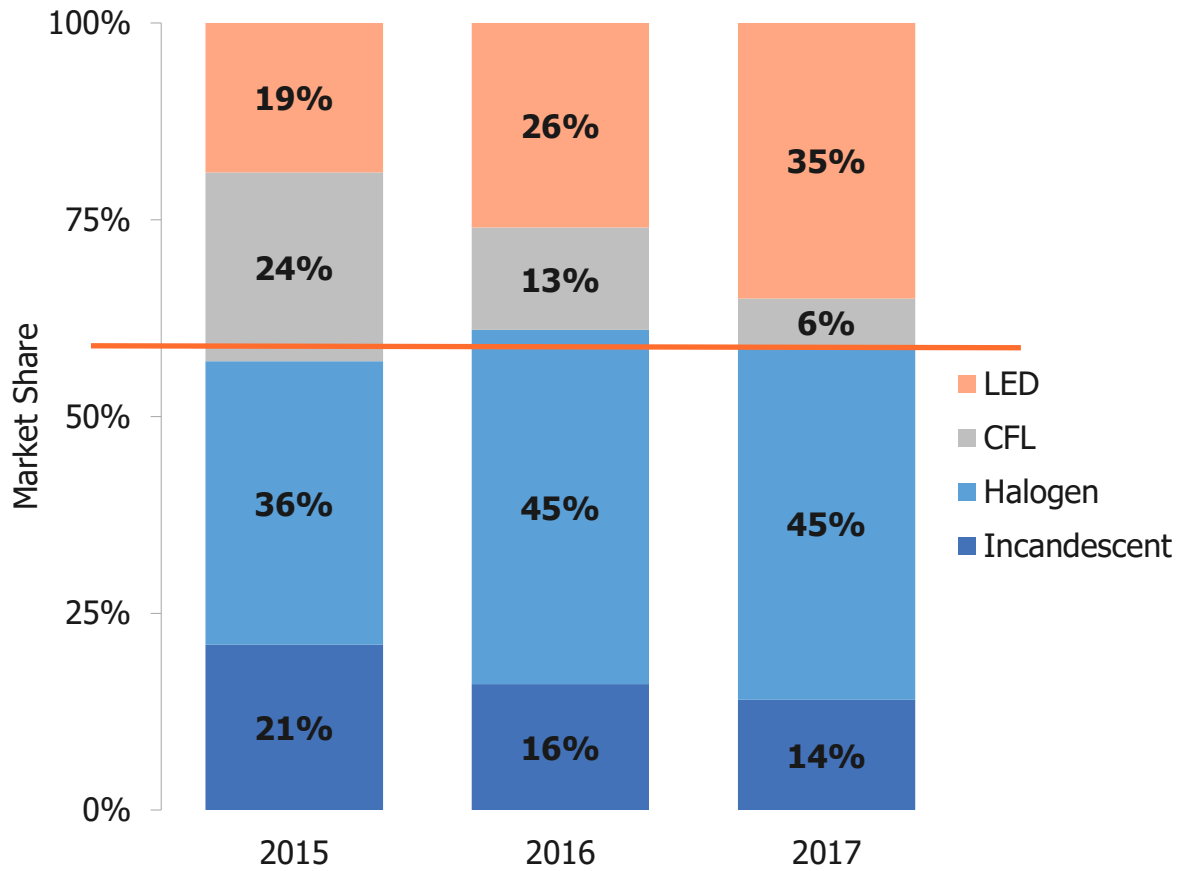
Source: Apex Analysis of Point-of-Sale Data

Figure 2-2 compares the data above to Colorado market shares. LED market share in Colorado have risen at a similar rate to the rest of the U.S. over the last three years, from 24% in 2015 to 39% in 2017, but remain ahead of the rest of the U.S. In 2015, Colorado had higher CFL market share than the U.S. However, in 2017, Colorado's CFL market share has largely converged with U.S. CFL share.

Figure 2-2. Colorado and Total US Year-Over-Year Market Share by Bulb Type
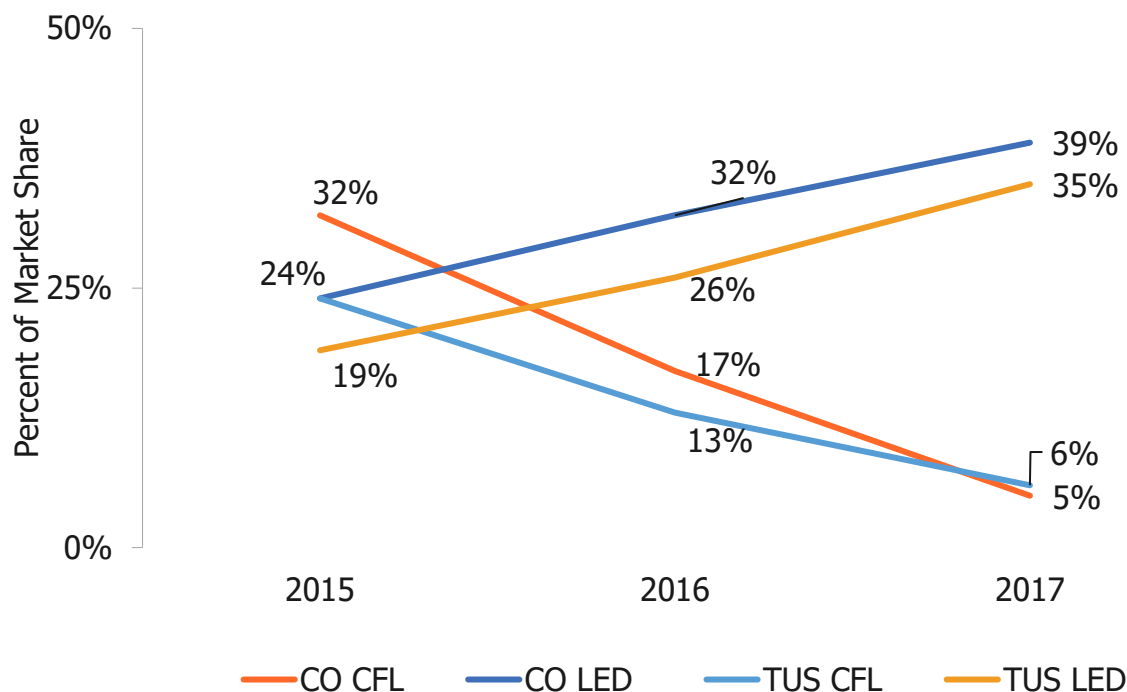
Source: Apex Analysis of Point-of-Sale Data

Figure 2-3 below shows the state-level LED share as a function of program spending. As clearly demonstrated in this graphic, LED share increases as program spending increases. In the 2017 program activity dataset, nine states did not run an upstream lighting program. On average, 26% of bulb sales are LEDs in these 'no program' states, which is on level with where lower-spending program states were in 2016.[10] Xcel Energy fell into the upper end of the moderate program activity category, spending less than $5 per household ($4.18/home) in the upstream lighting program. Overall, the state of Colorado also fell into the moderate program activity category ($4.82/home), with 35% of total 2017 bulbs sales being LEDs for these moderate program states.

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[10]The nine states that do not run an upstream lighting program (and hence have $0 program spending) that are included in the model are: AL, DE, KS, KY, LA, MS, NE, TN, and VA. Nevada was included in the model with $0 program spending, but was not considered a "no program" state since programs only ceased in 2016. Nevada was omitted from any descriptive statistics that break out no program states.

Figure 2-3. Relationship between Program Spending and LED Sales
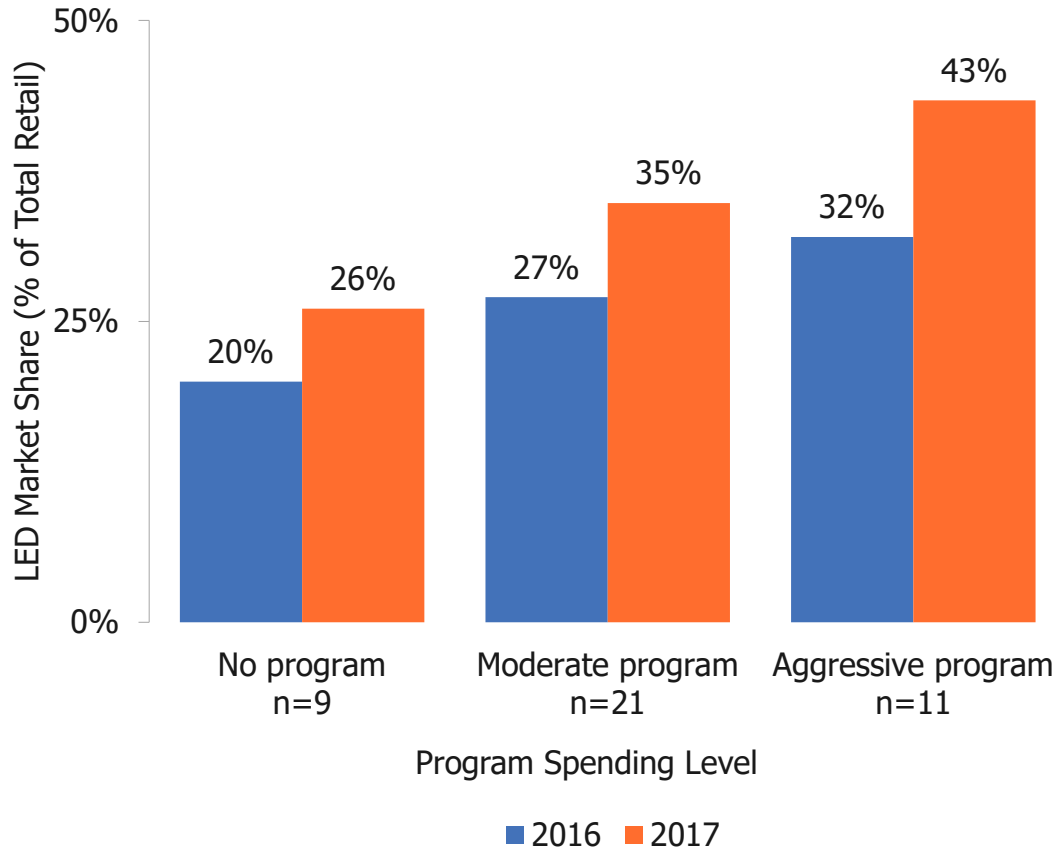
Source: Apex Analysis of Point-of-Sale Data

Similarly, Figure 2-4 below shows where Colorado is positioned in comparison to the modeled states when looking at LED sales. States highlighted green represent states with aggressive programs, spending more than $5 per household. States with gray bars spent an average greater than $0 and less than $5 per household. Colorado falls within the moderate program state in terms of program spending. Orange bars represent states that did not offer a lighting program.

Figure 2-4. LED Sales Distribution Across States (2017)
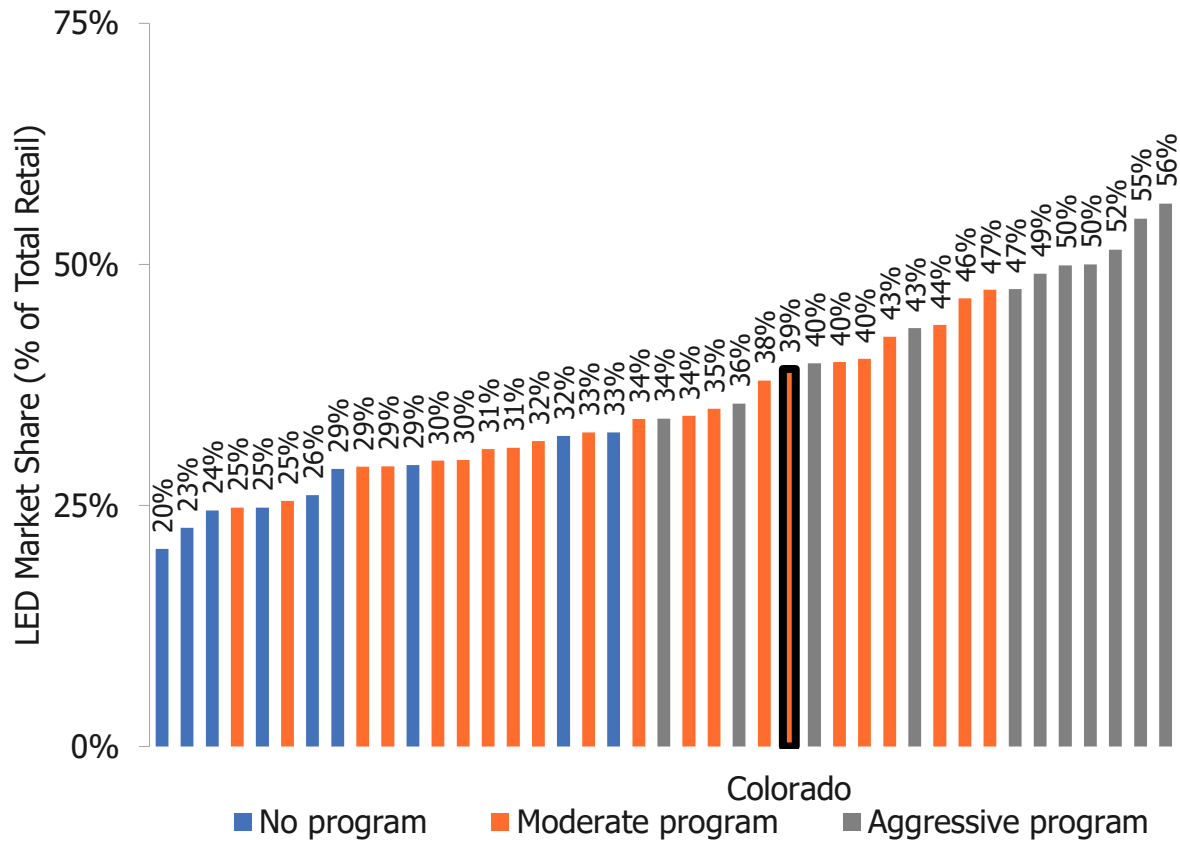
Source: Apex Analysis of Point-of-Sale Data

The evaluation team also compared the average incentive offered per LED across states in states where the team was able to collect LED incentive information. A simple calculation of incentive dollars divided by bulb units yielded average incentives per state. As shown below in Figure 2-5, LED incentives ranged from $1.00 to $4.86 per LED bulb in the 24 states that had sufficient data, with most states offering approximately $2 per LED (the average LED incentive was $2.08). Xcel Energy ranks near the lower end of incentives per bulb, offering $1.61 per LED. While this could lead to a lower NTGR (i.e., the program isn't providing enough of an incentive to "push" the market), the difference isn't that great from the median (only 23 cents), plus may reflect the high percentage (49%) of program lamps sold through club stores that are starting with a lower price point.

Figure 2-5. Average Upstream Lighting Incentive per LED
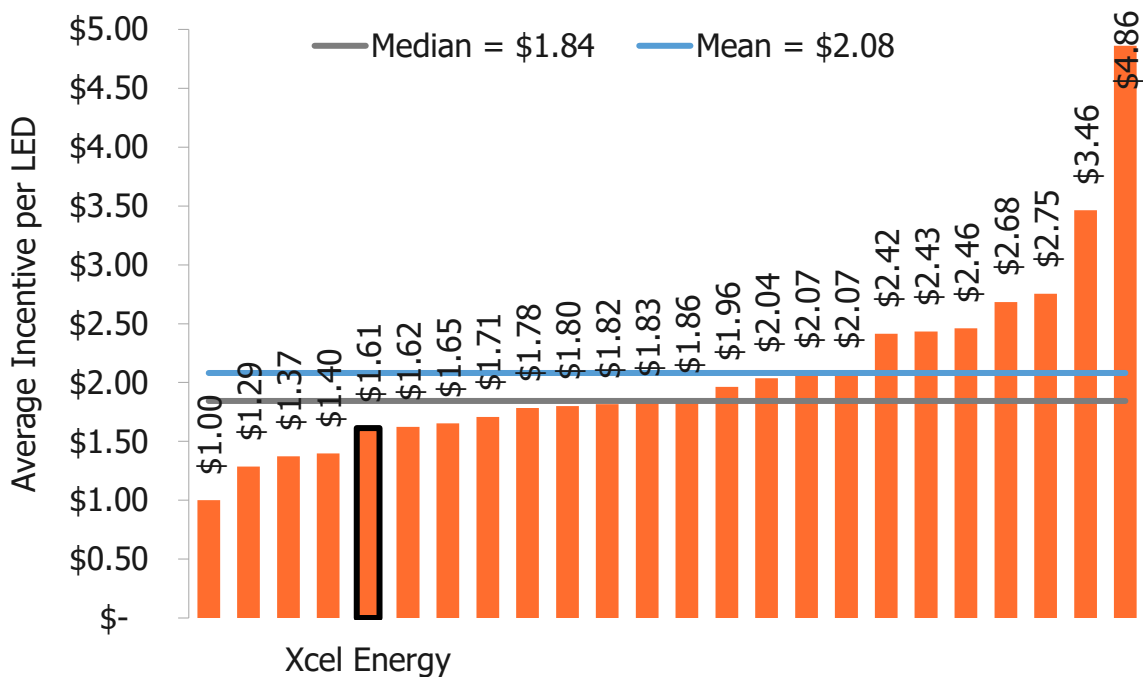
Source: Apex Analysis of Point-of-Sale Data

Analysis of the sales data model shows that market share for LEDs is greater in the non-POS retail channels (e.g., home improvement and club stores) than the POS retail channels (e.g., grocery, dollar, drug, and mass merchandiser stores).[11] As shown in Figure 2-6, in 2017 almost half (44%) of the lighting purchases made in the non-POS channel are LEDs, compared to only 33% market share for LEDs in the POS channel. This is an indication that the POS retailers have lagged behind the non-POS retailers in terms of LED adoption and sales. LED market share, however, has increased in both retail channels since 2016, and the gap between POS and non-POS is narrowing. While not explored as part of this study, one reason for this difference could be a result of POS channels catering more toward budget conscious customers and therefore more likely to stock and sell the lowest price lighting products (e.g. halogen bulbs). POS channels also may have a slower sell through of lighting products than the non-POS counterparts, allowing them a longer sell through of EISA restricted bulbs.

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[11] In total, however, 70% of bulbs are purchased in the non-POS channels, whereas only 30% are purchased in the POS channels.

Figure 2-6. Colorado LED Market Share by Retail Channel Year-Over-Year
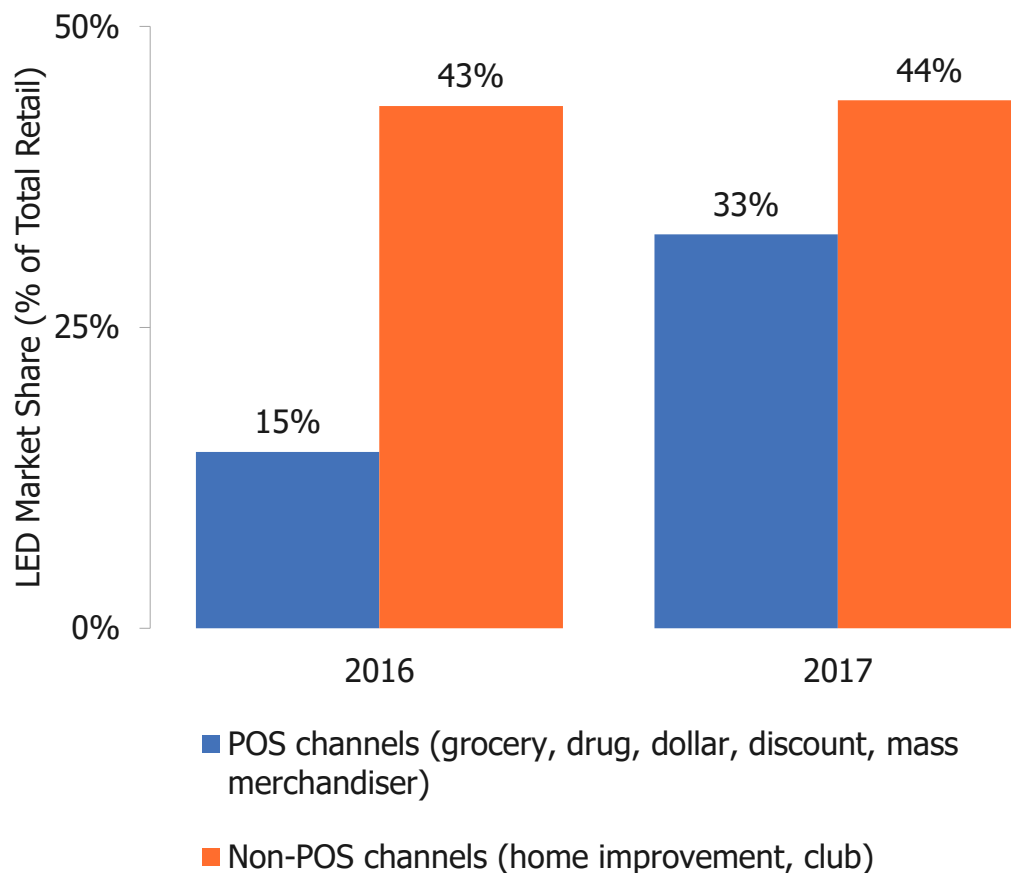
Source: Apex Analysis of Point-of-Sale Data

The evaluation team looked at ENERGY STAR LED distribution when there was sufficient resolution.[12] As shown in Figure 2-7, the POS retail channel shows that 78% of LED purchases in Colorado are ENERGY STAR LEDs, whereas only 59% of LED purchases in no-program states are ENERGY STAR LEDs.

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[12] Because the ENERGY STAR website does not include the UPCs of qualifying lamps, the team had to identify ENERGY STAR-qualified lamps through a make and model lookup. In total, the evaluation team was successful at attributing 98% of LED sales with an ENERGY STAR attribute (whether an LED was designated ENERGY STAR or whether an LED was not designated ENERGY STAR). The remaining 2% of LEDs were remain unknown to the evaluation team and are excluded in **Error! Reference source not found.**. In addition, note this analysis is only conducted based on the POS data, as the panel data did not contain sufficient sample size to stratify by ENERGY STAR designation. Lastly, the no-program states with sufficient sales data to be included in the aggregate are AL, LA, MS, TN, and VA.

Figure 2-7. ENERGY STAR LED Market Share (2017 POS Channels)
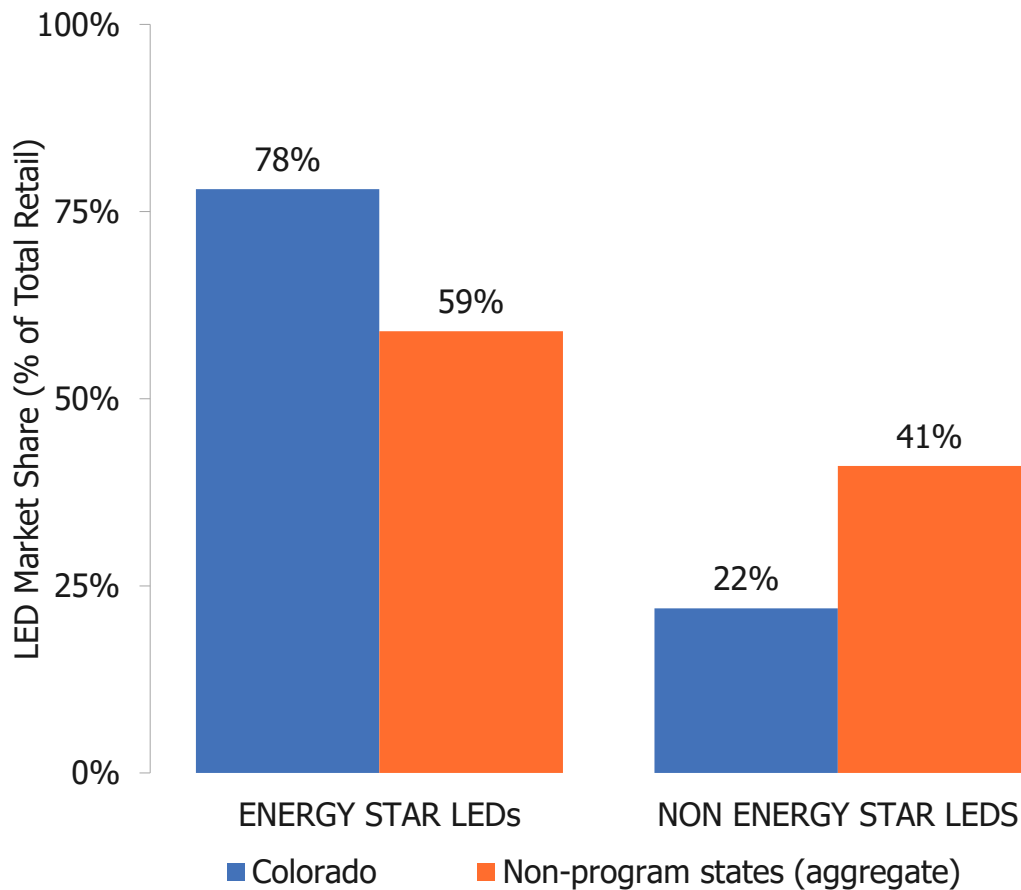
Source: Apex Analysis of Point-of-Sale Data

It is clear from the data used for the national sales model that program spending is at least partially responsible for an increased market share of LED sales, and in particular ENERGY STAR LEDs. While these illustrative graphics help paint the picture of program activity in relation to LED sales, the output of the regression model helps us to understand what other factors may be influencing the marketplace as well as to better understand the associated programmatic impacts.

The team explored different combinations of independent variables to enter and exit the model, and in general, the models gave very similar results. Table 2-1 displays the relevant statistics and outcomes from the final model specification.[13, 14] For the model details below, if an independent variable was included in the model, the regression coefficient and its associated p-value are included in the table. The p-value of the program spending term is highly significant. As shown in Table 2-1, the final set of explanatory variables included program spending per household, non-POS sq ft per HH and program age.

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[13] As noted above, the evaluation team selected to use an OLS model and weight by the number of homes for each state.
[14] Appendix F contains full details on the Sales Data Model

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Table 2-1. Model Summary Statistics (n=42 States)

Independent Variables	Model Coefficient	P-Value of Coefficient
Intercept	0.2045	0.000
Program Spending per Household (Sqrt)	0.0473	0.000
Non-POS sqft per HH	0.0155	0.080
Program Age	0.0023	0.072
Model Adjusted R-squared	0.67	

The positive coefficient for program age indicates that prior program activity does positively influence current year efficient market share. This may reflect a number of factors, including "momentum" in terms of customer awareness, education, and preference for efficient lighting, as well as retailer knowledge and promotion of efficient lighting. Program age might also be thought of as a simplistic proxy for market effects, meaning the portion of efficient lighting sales that are due to potentially permanent changes in the market as a result of ongoing program activity.

In assessing NTG, the evaluation team presented one way for treating the program spending counterfactual: by setting it to zero. However, the evaluation team presents two options for treating the program age counterfactual:

1. Programs have never existed (Program Age is set to 0), or
2. The programs did not exist in the year 2017 (subtract 1 year from the Program Age).

Table 2-2 presents the two options to treating the counterfactual and calculates NTG ratios. The NTG including both current and past program influence (i.e., setting past programs to zero in the counterfactual scenario) is 82.5%; if examining the influence of the current program, and assuming that influences up to one year prior would have continued if the current program was terminated, the NTG ratio is 68.4%.

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Table 2-2. Xcel Energy PY2017 NTG Calculations

Parameter	Calculation Term	Current and Past Influence	Current Program Spending and Age Influence
A	Total Xcel Energy Bulbs	12,351,817	12,351,817
B	Program $ per HH Actual	$4.18	$4.18
C	Program $ per HH Counterfactual	$0.00	$0.00
D	Program Age Actual	10	10
E	Program Age Counterfactual	0	9
F	LED Market Share Counterfactual	27.0%	29.0%
G	LED Market Share Modeled	38.9%	38.9%
H	LED Qty. Modeled (H=A*G)	4,810,828	4,810,828
I	LED Qty. Counterfactual (I= A*F)	3,336,674	3,587,787
J	Net LEDs Modeled (J=H-I)	1,474,154	1,223,040
K	Program LEDs	1,787,913	1,787,913
L	NTGR Modeled (L=J/K)	82.5%	68.4%

Source: Apex Analysis of Point-of-Sale Data

Manufacturer Interviews

The evaluation team conducted interviews with manufacturers participating in the Xcel Energy Home Lighting Product. This activity was intended to supplement the Sales Data Model as a secondary data point for estimating the retrospective NTGR, in addition to investigating future LED sales trends and NTGR. The interviews assessed the retrospective and prospective NTGR by asking about market share by lamp technology with and without the product (e.g., if the product were to end, what would the trajectory of LED market share look like). An important advantage of these interviews is that they explored, where possible, differences in LED past and future market share, as well as reasons behind those differences. The qualitative insight from the interviews are intended to provide important context behind the more quantitative sales data model.

The decreasing NTGR shown in the table below is indicative of a market transformation toward LEDs and expected efficiency standards for lighting (Table 2-3). For example, some manufacturers believe that the EISA backstop will be enacted and LEDs will be "the only thing anybody is selling." Another manufacturer stated they are planning to manufacture 100% LEDs for all bulb types starting in 2019 based on the EISA backstop. However, the fact that there is some increase in market share resulting from product intervention indicates that at least some of the manufacturers are not planning on EISA being enacted until after 2022, or are unsure if it will be enacted at all. The reflector and specialty NTGR manufacturer responses were limited, representing only 7% and 1% of program bulbs, respectively. As such, the evaluation team did not adopt or recommend these bulb specific NTGRs and instead recommend the A-line NTGR for the product. Adopting the A-line

NTGR is reasonable for this product as A-line bulbs represented the majority (80%) of the incentivized LEDs in 2017.

Table 2-3. Manufacturer Retrospective and Prospective NTGR, by Bulb Type

Bulb Type	2017	2020	2022
A-Line	74%	61%	61%

Source: Apex Analysis of Manufacturer Interviews.

Changes to the Home Lighting Product

The recommended prospective NTGR must account for any planned changes to the Home Lighting Product offerings, including planned changes to bulb type offerings or target populations, as these changes may impact our recommended NTGR. As of the writing of this report, no programmatic changes are proposed for the 2019 and 2020 Home Lighting Product; the evaluation team assumes the same measure mix and retail channel mix present in the 2017 product, and no adjustments are necessary.

Peer Program Net-to-Gross Ratios

Of the four peer programs the evaluation team interviewed, two do not have a prospective NTGR, one was cancelling their program in 2020 due to EISA, and only the final utility had a prospective NTGR to share for the evaluation. The prospective NTGR for this utility ranges from 25% to 45%, based on year and bulb type (Table 2-4). However, the program design of this comparison utility is significantly different than the Home Lighting Product, as they incentivize nearly 90% of all LEDs sold in the state. As such, they assume a higher percentage of purchasers will be free-riders.[15]

Table 2-4. Peer Utility Upstream NTGR, by Bulb Type

Bulb Type	2019	2020	2021
Standard	35%	30%	25%
Reflectors	45%	40%	35%
Specialty	45%	40%	35%

Source: Peer Utility Interview

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[15] For example, the NTG is calculated as the net (attributable) lift in sales divided by the gross (claimed) savings. So when the gross savings goes up by claiming a very high percentage of total LED sales (approaching total LED sales), the NTG decreases.

3. PROCESS EVALUATION

In addition to calculating a recommended NTGR, the evaluation team conducted a process evaluation focused on upcoming changes to the lighting market and potentially underserved markets. Specific research objectives of the process evaluation are listed below:

- Assess changes to the lighting industry, including: LED prices, new technologies, EISA preparations and predictions, and peer utility plans
- Assess potentially underserved populations and lighting technologies

To accomplish these objectives, the evaluation team elicited feedback from product staff, participant manufacturers, and program managers of similar programs. This chapter presents key findings from the process evaluation, the evaluation team's approach to conducting the process evaluation, and specific findings relating to each evaluation objective. These findings, along with findings from the impact evaluation, inform the conclusions and recommendations presented in the next chapter.

3.1 Key Findings

Manufacturers expect the price of reflector and specialty LEDs to decrease over the next three years, but not at the same rate as the past few years. A-line LEDs are near, if not at, the low end of their prices. Based on this information, the evaluation team expects LEDs to maintain a significant incremental cost over current baseline bulb options; incentive programs still have opportunity to decrease the cost of LEDs to match that of baseline bulbs.

Manufacturers expressed differing expectations on the implementation of the EISA backstop. Twenty five percent do not expect it to be enacted, 25% believe it has already been triggered and will go into place in 2020, and 50% are uncertain. Utilities are more skeptical, with two out of three thinking it is unlikely to be enacted as written in 2020. However, both manufacturers and utilities are making plans to meet the backstop requirements, despite the uncertainty. Utilities are planning to change their measure mix and reduce savings goals, and manufacturers are switching their focus toward connected lighting products and retooling manufacturing plants from halogen bulbs to LEDs.

Manufacturers did not have a consensus on how to reach underserved markets, stating a variety of methods including online and mail-in options, outreach events at centralized locations, and engaging retailers within low income areas.

3.2 Approach

To accomplish the evaluation objectives for the Home Lighting Product, the evaluation team completed a suite of intersecting and complementary research activities in 2018. Detailed information on the sampling approach used for the research can be accessed in Appendix A. The following discussion highlights the research topic coverage contributed by each research activity: the staff interviews, manufacturer interviews, and benchmarking interviews.

Staff Interviews

In December 2017, the evaluation team interviewed six Xcel Energy and product implementer staff to inform this evaluation plan, discuss product goals, and review product processes, challenges, and successes. Those interviewed included current and former product managers, one team lead, one engineer, and two representatives from the product implementation contractor. They were conducted either in-person or by telephone and took between one and one and a half hours each to complete. These meetings, combined with the kick-off meeting, allowed the evaluation team to create this focused evaluation plan and proposed data collection activities.

The staff interviews covered the following topics:
- Assess the extent to which the product design supports product objectives and customer service/satisfaction objectives.
- Assess the degree to which product resources are sufficient to conduct product activities with fidelity to the implementation plan
- Collect staff feedback on implementation successes and challenges
- Identify themes and issues for possible revisions to the evaluation plan

Appendix B.1 presents the interview guide used for these discussions.

Manufacturer Interviews

The evaluation team completed interviews with participant lighting manufacturers. Due to the transparent nature of upstream lighting programs, partner manufacturers and retailers are often considered the "participants" of the program; they are among the most qualified to discuss program administration, incentives, program successes, and market impacts. These interviews took approximately 30 minutes each and discussed the following topics:
- Product satisfaction
- Market changes
- Expectations regarding EISA
- Potentially underserved market segments
- New lighting technologies
- Retrospective and prospective NTGR

The evaluation team originally planned to interview both retailers and manufacturers, however, participant retailer contact information was not available . As such, the evaluation team attempted a census of participant manufacturers, and completed interviews with eight of the 10 participant companies, representing 58% of bulbs sold through the program. The evaluation plan used for this project can be found in Appendix A.

The participant survey is presented in Appendix B.2.

Benchmarking Interviews

This evaluation team examined four peer utilities to benchmark the Xcel Energy product against others in the industry, assessing product design and delivery and key performance indicators (e.g., participation levels, free-ridership). The evaluation team conducted in-depth interviews with program managers to address the following topics:

- Savings impacts estimation methodologies, by measure type
- 2016 savings goals and results by product and for the product portfolio
- Baseline bulb types/wattage
- Net-to-gross methodology
- Net-to-gross ratio values
- Plans for program structure and products going forward
- Expectations regarding EISA backstop and expanded GSL definition

Appendix B.3 contains the interview guide used for the benchmarking interviews.

Data on all of the process evaluation topics are presented below. Because the sample frames were not stratified, no data weighting was applied in the analysis. The synthesis of findings places an emphasis on helping Xcel Energy navigate the changing lighting landscape.

3.3 Changes to the Lighting Industry (Research Objective 1)

An important objective of the process evaluation was to assess how the lighting market is changing, especially with respect to LEDs, within the next three to five years. The evaluation team found that manufacturers and utilities alike remain perplexed as to the expected outcome of the EISA backstop but are planning for it to be enacted in some form. The remainder of this section presents the interview results from manufacturers and peer utilities on this topic. Table 3-1 summarizes data sources used to develop these findings.

Table 3-1. Data Sources Used to Assess Changes to the Lighting Industry

Research Questions	Data Source	
	Manufacturer Interview	Peer Program Interview
How are lighting prices expected to change?	X	
What new technologies are manufacturers focused on?	X	
How are manufacturers preparing for EISA?	X	
What is the likelihood the EISA backstop provision will be enacted?	X	X
What measures are utilities planning to incentivize in the coming years?		X
How are utility upstream lighting programs changing going forward?		X

Source: 2017 Evaluation Plan

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Prices and Technologies

The evaluation team discussed expectations for LED prices with manufacturers. Changes in LED prices are important to utility lighting programs because, as LED prices drop, the incremental cost between efficient and baseline bulbs decreases. If LED prices drop to match baseline bulbs, utility incentives for LEDs could become unnecessary.

Manufacturers expressed that prices for standard A-line LED bulbs have largely stabilized. Two-thirds of respondents expect prices for standard LED bulbs to remain the same over the next three years, the remaining one-third expect prices to decrease. Several respondents who believe prices will decrease stated that prices for A-line bulbs are nearly at the bottom, stating prices will decrease "not much more" and they are "about as cheap as they can be." Respondent manufacturers all agreed that prices for reflector and specialty bulbs would continue to decrease over the next three years, stating that they "have a little more room to come down than A-lines" and "there's more room to play with those."

From these responses, the evaluation team expects LEDs to remain a more expensive technology, but not as costly as five to ten years ago. As such, there is still an incremental cost between LEDs and less-efficient technologies, indicating opportunities for utility programs to impact consumer buying decisions by lowering prices.

Manufacturers also commented on the primary changes and developments they expect in the lighting market. The most common expectation was the rise in connected lighting products, including advanced lighting products, being able to connect lighting and appliances to a phone, and controls. Others mentioned "better LED technologies" and options such as different filaments and more decorative fixtures.

EISA Expectations and Preparations

Manufacturers and utilities are not united in their expectations regarding the implementation of the EISA backstop. Half of the manufacturer respondents are uncertain regarding whether the backstop will be implemented in 2020, 25% believe it will not be enacted, and the final 25% believe it has already been triggered and will be adopted in 2020. Despite this uncertainty, manufacturers are planning to meet the requirements; for example, one is transitioning their manufacturing facilities from halogen bulbs to LEDs, and another is changing their focus to connected bulbs.

Utilities are more skeptical that the backstop will be enacted, although they are planning for it all the same. Three of the four utilities believe it is "very unlikely" to be enacted in 2020. The one utility that believes it will be triggered on schedule has eliminated their residential lighting program in 2020 as a result.

The evaluation team also questioned manufacturers and utilities about their expectations around the expanded GSL definition. In this instance, two-thirds of manufacturers believe it will not be enacted it its current form. Similarly, the same three out of four utilities thought the likelihood was low. The one utility who thought the EISA backstop and the expanded GSL definition were likely to go through as planned received information from their implementor, who they described as a trusted source of industry information. Regardless of what happens with the final ruling, all four utilities, and Xcel Energy, agreed that there would be a sell-through period of at least one year for halogen

and incandescent lamps (i.e., the legislation would *not* be enacted as written with a sales "ban" on non-qualifying products, but would instead be modified to allow for sales of existing stock of non-qualifying product, as was done under the first phase of EISA in 2012-2014).

Peer Utility Program Adaptations

As noted earlier, one of the four interviewed utilities said it plans to entirely eliminate its residential lighting program. The remaining three utilities, though skeptical that the EISA backstop will be fully adopted in January of 2020, were all planning adjustments to their residential lighting offerings in response. One utility said, "We're taking a conservative approach" and are planning to reduce their program significantly. Another said, "We are trying to figure out what our options are, and what we can do."

Several utilities are shifting promotional efforts to focus more on reflector and specialty bulbs, and to limit promotion of A-line bulbs to hard-to-reach customers. For example, two utilities, said their program is assuming A-lines (which currently comprises 2/3 of their program savings) will no longer be incentivized, while another said A-lines will be confined to discount stores targeting hard-to-reach customers.

Among the three utilities planning to keep their lighting programs, all were still unsure what specific products will be included post-2020, but they said they are watching "products getting ready to hit the market in 2019 and what their price points are." These program managers are looking for products that will be exempt from EISA and are assuming that the criteria for supported products will become stricter, such as having higher lumen per watt requirements. Two of the four specifically mentioned connected or "smart" lighting products gaining increased attention.
Two utilities told us they plan to change their baseline to CFLs, with one specifying that this will only last until CFLs are shown to be "out of the market," at which time the baseline will shift to the least-efficient LED. The third utility is planning on a blend of CFLs and halogens as a baseline but believe CFLs will soon be leaving the market.

Like Xcel Energy, two of the three utilities planning beyond 2020 predict savings goals for their lighting programs will drop due to the lack of inefficient baseline bulbs. The remaining utility said they believed goals would increase, but per-unit incentive levels would fall. All three of the program managers planning for 2020 and beyond said they were uncertain about what incentives would look like until more is known about the final EISA ruling, and until market conditions in 2020 are known as well.

3.4   Underserved Markets (Research Objective 2)

A final objective of the process evaluation was to determine what, if any, sectors could benefit from the Home Lighting Product, and what barriers still exist for LEDs. This objective was intended to inform future product plans, should product staff desire to reach new customers. The remainder of this section presents the challenges and proposed solutions provided by manufacturers on this topic.

The two hard-to-reach populations that manufacturers mentioned were low income populations and immigrant populations. Manufacturers discussed that these two populations tend to shop less at large home improvement or club stores (such as Home Depot or Costco) and more at local grocery

and discount stores. Similarly, manufacturers noted that the customers that shop at large home improvement stores are generally more educated on lighting technologies. The one explanation manufacturers provided as to why these populations do not shop at large home improvement and club stores was due to transportation, and that bringing product opportunities directly to these demographics would increase their participation. Product staff should not assume these segments will frequent the same retailers as their standard income counterparts.

Staff turnover was also mentioned as a barrier to educating low income and immigrant populations, as staff turnover is higher at retailers within low income areas. The higher staff turnover is, the less effective retailer training is long-term, and the less educated the staff are on LEDs. These two barriers are compounded, with a less knowledgeable customer having a lower likelihood of having an opportunity to interact with a knowledgeable employee.

While the manufacturers know staff turnover is out of the program's control, they do suggest to continue to market and train staff at stores where hard-to-reach populations are more likely to visit, such as mass merchandisers and discount stores. Additionally, any effort that Xcel Energy could put into getting these smaller stores involved with the programs could help manufacturers distribute to these types of stores.

Manufacturers suggested hosting give-away events at food banks and sporting events to reach hard-to-reach populations, or by having an online option to the program.[16] One manufacturer believes the give-away programs are essential for lower income populations to adopt LEDs: "Once they have an LED installed at home, they will get [the benefit] and come back for more." Another manufacturer depicted the success of handing out free LEDs at the front of the store by witnessing customers purchasing LEDs that same visit.

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[16] Note that Xcel Energy is already conducting several of these recommended actions.

4. CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the research team's key findings and associated recommendations regarding the Xcel Energy Home Lighting Product in Colorado. All recommendations are based on key findings from our evaluation research and are designed to reflect the context of future program years, acknowledging expected changes in the market and planned product changes.

Specific conclusions and recommendations follow.

- **Key Finding 1: Implementation of the EISA backstop and GSL expansion remains uncertain.** Manufacturers expressed differing opinions on whether the backstop will be enacted in 2020, but are making plans as if it is coming into effect. However, in 2017, national efficient bulb sales stagnated, indicating that in the short term, opportunities still exist for utility programs to influence consumer lighting decisions.
    - **Recommendation 1a: Continue running upstream lighting products until legislation solidifies or LEDs become the predominant technology.** Xcel Energy can still influence consumer lighting decisions. However, the lighting market is expected to transform rapidly and this influence will likely decrease as LEDs become the predominant technology and/or the EISA backstop legislation limits the availability of less-efficient bulb technologies.
    - **Recommendation 1b: Reassess prospective NTGR value when the fate of EISA backstop implementation becomes clear.** Xcel Energy needs to reassess savings opportunities when the DOE or litigation determines how the backstop will be enacted.
    - **Recommendation 1c: Closely monitor legislative actions for direction on EISA.** Decisions on this legislation will quickly impact the lighting market and provide direction on the future program opportunities, plus impact future NTGRs.

- **Key Finding 2: Manufacturers are planning for LED market dominance.** Once this occurs, the evaluation team expects opportunities for influencing customer lighting decisions to decrease for LEDs.
    - **Recommendation 2: Xcel Energy should plan for decreasing NTGR as options for inefficient bulbs diminish.** While there may be opportunities for savings within limited channels or target populations, Xcel Energy should plan for the Home Lighting Product to evolve with the changing market.

- **Key Finding 3: Manufacturers differ on how to impact hard-to-reach populations.** This indicates there is not a fully effective method established for reaching these market segments. However, educating staff at mass merchandisers and discount stores were mentioned as helpful to increase education of these populations.
    - **Recommendation 3: Xcel Energy will need to design and test a variety of methods if they choose to target hard-to-reach populations.** Consider focusing staff and customer education efforts on discount and mass merchandiser stores and continue bringing outreach events and giveaways to low income and immigrant geographies.

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Xcel Energy
Colorado Home Lighting

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APPENDICES

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Appendix A: EVALUATION PLANNING DOCUMENTS

A.1 Evaluation Plan

To support the process and impact evaluation of the 2017 Xcel Energy efficiency programs, members of the EMI Consulting evaluation team from Apex Analytics will be conducting an evaluation of the Xcel Energy Home Lighting Product. This memo provides an updated plan for the 2018 Xcel Energy Home Lighting evaluation based on the original scope of work, staff feedback during the evaluation kick-off meetings, and staff interview findings.[1] This evaluation plan includes the following sections:

- Product Overview
- Evaluation Overview
- Data Collection Activities and Sampling Plans
- Net-to-Gross Approach

Product Overview

The Home Lighting Product provides discounts for customers to purchase ENERGY STAR LED bulbs[2], through an "upstream" discount methodology. In the upstream discount method, program administrators, in this case, Xcel Energy, work directly with manufacturers to reduce the cost of specific lighting products within their service territory. The discounts are directly passed on to the end-user through a reduced purchase price. This methodology has the benefits of low implementation costs and minimal effort required for end-users. The potential challenge of the upstream implementation structure is in the evaluation; the seamless discount structure often results in customers being unaware of their participation, and evaluators have no record of which customers purchased the discounted bulbs. Compounding the evaluation challenges is the enormity of energy savings: as the largest electric program in the Colorado portfolio (estimated at approximately 25% of 2017 total energy savings and two-thirds of the residential program energy savings), this Product evaluation needs to rely on highly rigorous and precise evaluation methods.

From January through October 2017, the Colorado Home Lighting Product incentivized over 1.5 million lightbulbs, claiming over 66 GWh in energy savings (Table 1).[3] The majority of these savings were claimed through LED bulbs through the club retail channel (30.8 GWh), followed by home improvement (12.9 GWh) and mass merchandisers (11.9 GWh).

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[1] The original scope of work is included in the evaluation team's contract with Xcel Energy for the 2017-2018 DSM evaluations.
[2] Xcel also discounted a small number of LED lighting fixtures and CFLs in 2017, which were carried over from the 2016 program, but dropped CFLs from the Home Lighting product in 2018. These measures did not contribute a significant amount to the 2017 product and will not be evaluated at this time.
[3] Data through December 2017 were not available at the time of this plan.

Table 1. Home Lighting Savings and Quantities, by Retail Channel, January – October 2017

Retail Channel	LED Fixtures		CFL		LED	
	Bulb Quantity	Bulb Quantity	Bulb Quantity	Savings (kWh)	Bulb Quantity	Savings (kWh)
Club Retail	-	-	7,838	287,552	667,924	30,865,432
Home Improvement	20,895	20,895	23,243	828,325	303,265	12,919,531
Mass Merchandisers	-	-	18	450	306,981	11,999,462
Discount/Dollar Stores	-	-	15,276	435,265	95,185	3,772,848
Small Hardware	-	-	2,033	60,038	54,183	2,193,568
Giveaway	-	-	-	-	32,500	1,561,395
Specialty	-	-	32	901	9,171	379,077
Grocery	-	-	-	-	7,827	301,106
Total	**20,895**	**20,895**	**48,440**	**1,612,532**	**1,477,036**	**63,992,419**
% of total	*1%*	*1%*	*3%*	*2%*	*96%*	*96%*

As shown in Table 2, during the first 10 months of 2017, most of the incentivized products were sold through the Club Retail channel (44%), followed by Home Improvement and (23%) and Mass Merchandiser stores (20%). There were a total of 15 retail chains selling Xcel Energy incentivized lighting products, comprising over 350 storefronts.

Table 2. Home Lighting Proportion of Products and Savings, by Retail Channel, January – October, 2017

Retail Channel	Product Quantity	Savings (kWh)
Club Retail	44%	47%
Home Improvement	22%	22%
Mass Merchandisers	20%	18%
Discount/Dollar	7%	6%
Small Hardware	4%	3%
Giveaway	2%	2%
Specialty	1%	1%
Grocery	1%	0%

During the Home Lighting Product evaluation kickoff meeting[4], Xcel Energy staff recognized the following goals of the Home Lighting Product for 2018 and beyond:

- Provide societal net benefits – spending ratepayer funds in the most effective manner
- Accomplish energy savings that reflect the unique generation profile of Xcel Energy
- Educate customers on energy efficient lighting technologies
- Increase customer satisfaction and awareness of efficient lighting
- Meet Public Utility Commission energy savings goals

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[4] Held at the Xcel Energy Denver office on November 9, 2017.

- Serve as a touch point for customers (i.e. connect Xcel Energy to customers)

Evaluation Overview

The 2018 evaluation will consist of a process evaluation and an impact evaluation. The process evaluation will focus on market actor experiences with the product, while the impact evaluation will focus on estimating a net-to-gross (NTG) ratio. This section presents the objectives of the two components of the evaluation. It is followed by a more detailed description of the evaluation activities.

Process Evaluation

The primary concern relayed during staff interviews and the kickoff meeting was the future of the Home Lighting Product. Specifically, the lighting market has changed rapidly over the last ten years, due to legislative action (i.e., the 2007 Energy Independence and Security Act) and technological advancement, and there is concern that the market for efficient lighting technologies has largely been transformed or that it will be very soon. If market transformation is near or has been already achieved, the current delivery mechanism for Home Lighting may no longer be a suitable channel for Xcel Energy to continue at the same scale as 2017. .

Therefore, the process evaluation will focus on informing future Product activities in the likely event that the Home Lighting Product changes its focus over the coming years. This includes exploring the impact of new lighting technologies on consumers purchasing decisions and determining what information consumers collect to inform lighting purchases. The evaluation team will also look at where to focus future Product offerings, establishing what technologies (e.g., bulb styles), customer segments, or retail channels would continue to benefit from Product activities. Finally, the team will look at the extent to which customers are familiar with the Xcel Energy lighting incentives, and assess ways to increase the connection between the lighting discounts and Xcel Energy. To summarize, the **objectives of the process evaluation** are to:
- Collect benchmarking data of program designs: What lighting measures are other utilities incentivizing going forward?
- How do manufacturers expect the lighting industry to change in the coming years: How do they think costs of LEDs may change over the next 1-2 years and 3-5 years? Are there any new products on the horizon?
- Are there specific segments/markets that manufacturers think are underserved? If so, what are they?
- Do the manufacturers need any additional support on this program from Xcel Energy?
- Analyze expected legislative changes: What is the expected baseline for savings in 2020 and beyond?

Impact Evaluation

The objective of the impact evaluation of the Home Lighting Product is to develop an NTG ratio documenting the extent to which program activities influenced on customer lighting purchasing decisions. Upstream lighting programs have challenges associated with the calculation of NTG ratios due to the virtual transparency of the incentives to program participants, the relatively small purchase price of the item (relative to high cost items, such as a furnace or insulation), and inherent lack of participant contact information. These attributes make traditional self-report NTG methods unfeasible. As such, the evaluation team proposes to use two methods to calculate NTG, including sales data analysis and supplier (corporate retailer and manufacturer) interviews. To summarize, **objectives of the impact evaluation** include:
- Develop an NTG ratio documenting the program's influence on customer's decisions.
- Estimate any market effects associated with the delivery of the Home Lighting Product
- Estimate how the NTG changes for different segments, channels, or bulb types.

- Benchmark Xcel Energy's NTG with those of similar utilities.

Data Collection Activities and Sampling Plans

To complete the above objectives, the evaluation team will conduct interviews with participant corporate manufacturers and retailers that manufacture and sell program incented lighting Products. These interviews will inform prospective net-to-gross estimates and round out the retrospective values obtained through the Sales Data Modeling activity.

Finally, the evaluation team will benchmark the program against up to six peer utilities, assessing plans for future program designs and net-to-gross estimates. Table 3 outlines each research task and their associated research objectives and explored more in remaining section. Note that because this is an upstream program with limited to no customer interaction, the sales data modeling do not follow the standard data collection activities used for other product evaluations.

Table 3. Home Lighting Research Summary

Research Task	Sample Size	Research Objective(s)
Staff Interviews	4	Inform evaluation plan and NTG
Corporate Partner Interviews	12-15	Net-to-gross, program satisfaction, future expectations for lighting industry, underserved markets, manufacturer support needs
Peer Utility Benchmarking	5-6 utilities	Prospective program planning, net-to-gross comparisons
Legislative Research	n/a	Prospective baseline and NTG recommendations
Sales Data Modeling	n/a	Net-to-gross

Staff Interviews

In December 2017, the evaluation team interviewed six Xcel Energy and program implementer staff to inform this evaluation plan, discuss program goals, and review program processes, challenges, and successes. Those interviewed included current and former Product managers, one team lead, one engineer, and two representatives from the program implementation contractor. They were conducted either in-person or over the telephone, and took between one and one and a half hours each to complete. These meetings, combined with the kickoff meeting, allowed the evaluation team to create this focused evaluation plan and proposed data collection activities.

Corporate Partner Interviews

The evaluation team plans to complete corporate partner interviews with participant lighting manufacturers and partner retailers. Due to the transparent nature of upstream lighting programs, partner manufactures and

retailers are often considered the "participants" of the program; they are among the most qualified to discuss program administration, incentives, program successes, and market impacts. These interviews will take approximately 30 minutes each and will discuss program satisfaction, market changes, potentially underserved market segments, and prospective and retrospective program impacts. To the extent possible, market impacts will be broken out by bulb style (e.g., reflectors, specialty, A-lamps) and retail segment, helping the team assess channels with the highest potential for future program intervention. The evaluation team will request contact information for these from the program implementation contractors. The evaluation team will attempt to contact a mix of large and small distributers in the final survey population.

Table 4. Corporate Partner Interview Population and Interview Targets

Corporate Partner Type	Population Size[a]	Interview Targets[b]
Participant Manufacturers	11	5-7
Corporate Retailer Partner	14	7-8
Total	25	12-15

a. Population size represents program activity January-October 2017.
b. Proposed targets rely on Xcel Energy providing accurate contact information for their partners.

Peer Utility Benchmarking

The objective of the peer utility benchmarking task is to understand the future of residential lighting programs and NTG estimates by comparing the Xcel Energy Home Lighting Product with six similar peer utility programs. The evaluation team will select a comparable cohort so that Xcel Energy has an "apples-to-apples" comparison, and evaluate the set of circumstances (such as regulation, retail channels, demographics) that impact program plans at the peer utilities. The evaluation team will aim to benchmark the Xcel Energy program to utilities with similar budget, incentive levels, and types of bulbs incented in order maximize the value of the effort.

Based on our recent experience with utility benchmarking, we will first work with Xcel Energy to identify an appropriate peer cohort of six utilities for the benchmarking study, as well as the critical program components to be compared. We will then develop a peer utility interview guide that is customized to the desired benchmarking components, to be provided to Xcel Energy for approval prior to beginning any data collection. Finally, we will summarize the results of our benchmarking analysis in a summary within the final evaluation report. The summary will include a description of the comparability of each utility, based on the factors identified during the planning task.

Sales Data Modeling

The underlying theory behind the lighting sales data net-to-gross model is that states that have strong upstream lighting program activity—compared to those with little to no program activity—should have higher market share (via sales) of efficient lighting compared to states with little to no program activity. The model relies on full-category lighting sales data to estimate market lift as a function of program activity, while also controlling for other factors (e.g., household and demographic characteristics) that might impact efficient lighting sales. The result of the modelling is a comprehensive net-to-gross estimate that captures freeridership, participant spillover, and nonparticipant spillover.

The evaluation team will leverage a variety of data sources for this model analysis, though we rely primarily on sales data prepared by the Consortium for Retail Energy Efficiency Data (CREED),[5] which were mostly generated from two sources. These sources are point-of-of sale (POS) state sales data (representing grocery, drug, dollar, discount, mass merchandiser, and selected club stores) and National Consumer Panel (NCP) state sales data (representing home improvement, hardware, online, and selected club stores). The evaluation team will then clean and process all data for analysis. The model inputs also include a combination of program data collected by the evaluation team and household and demographic data collected through various publicly available websites. The primary model input data sources are listed below:

- POS data (grocery, drug, dollar, discount, mass merchandiser, and selected club stores)
- Panel data (home improvement, hardware, online, and selected club stores)
- U.S. Census Bureau import data (LED and CFL imports)
- DSM Insights, an E Source database of utility program data
- ENERGY STAR Lighting Program data (utility lighting program budgets)
- ENERGY STAR shipment data (released by the U.S. Environmental Protection Agency)
- North American Electrical Manufacturers Association (NEMA) shipment data
- American Community Survey (ACS) data (household characteristics and demographic data)
- Retailer square footage per state (based on the two primary retailer channel data sources)
- General population surveys, lighting saturation studies and other secondary data collection made publicly available through evaluation reports

Net-to-Gross Approach

The evaluation team will rely on two primary methods to assess NTG: (1) sales data modeling and (2) corporate partner interviews. It will then synthesize these results to estimate a proposed NTG ratio. This section presents the evaluation teams two primary methods to estimating NTG inputs and concludes by describing how the evaluation team will synthesize data to estimate the NTG ratio for this product.

Sales Data Modeling

In the sales data modeling approach, the evaluation team will estimate net-to-gross ratios for LEDs in 2017 using the results of regression models, efficient bulb sales data, and the program tracking databases. The evaluation team first uses the model to predict the share of efficient bulbs with and without a program (determining the counterfactual of no program activity by setting the program variable to zero). This change in share represents the program lift, or net increase in the share of efficient bulbs resulting from program activity.

To then calculate net-to-gross, the evaluation team multiplies the change in share by the total number of bulbs—for all bulb types—sold in 2017, as determined by the sales data analysis described above. This value represents the net impact of the program (i.e., the total lift in the number of LEDs sold), which the evaluation team then divided by the total number of program bulbs sold (i.e., the gross number of bulbs) to determine net-to-gross:

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[5]   CREED serves as a collaborative effort of program administrators, retailers, and manufacturers to collect the necessary data to better plan and evaluate energy efficiency programs. LightTracker is CREED's first initiative, focused on acquiring full-category lighting data, including incandescent, halogen, CFL, and LED bulb types, for all distribution channels in the entire United States. As a consortium, CREED speaks as one voice for program administrators nationwide for requesting, collecting, and reporting on the sales data needed by the energy efficiency community. https://www.creedlighttracker.com.

$$NTG = \frac{(\# \; bulbs \; sold \; with \; program - \# \; bulbs \; sold \; with \; no \; program)}{\# \; of \; program \; incented \; bulbs \; sold}$$

While both estimates include participant and non-participant "like" spillover, the sales data modeling will also model a program age variable, a proxy for market effects. This variable represents the portion of efficient lighting sales from potentially permanent changes in the market as a results of ongoing program activity.

Corporate Partner Interviews

As mentioned in the previous section, net-to-gross value developed from corporate partner responses has the benefit of incorporating first-hand experience with program impacts. Additionally, respondents may be able to break out impacts on different LED bulb styles (e.g., reflectors, specialty, A-lamps) and provide qualitative insight to how they see the market changing. This methodology will be used to estimate both prospective and retrospective NTG estimates.

The manufacturer and retailer interviews offer important insights into what LED sales would have been without the incentives, marketing, education, and other program influences. Participant lighting manufacturers and retailers will be asked to predict market share by bulb type (i.e., LED, CFLs, halogens, and incandescents) retrospectively for 2017 (thus proving a comparison with the sales data), and prospectively for 2020 and 2022, under two scenarios: (1) that the program continues with "business as usual", and (2) that program ceases support for LEDs in 2017. They will make these predictions for A-line, reflector, and other specialty bulbs (e.g., globe, candelabra, appliance lamps, colored bulbs).

Prospective NTG Ratio

Given the fast-changing conditions of the lighting market, the team will review the retrospective net-to-gross estimate to provide a more accurate forward looking, or prospective value. While there is always uncertainty, the team will assess trends provided by trade partners and adjust the retrospective NTG as needed to reflect expectations for the future. Similar to the retrospective approach, our prospective NTG estimate recommendation includes data from mixed methods research – both quantitative data and qualitative data. The evaluation team will first assess the alignment between the retrospective NTG from the sales data model and that from the corporate partner interviews. With that knowledge, we will create an adjusted NTG estimate based on corporate partner predicted market share, known changes planned for the program, and anticipated impacts of federal legislation. These adjustments are important as corporate partners may not have the most up to date information on the forthcoming federal lighting standards, and the impact those standards have on the lighting market share. Similarly, changes to program delivery mechanisms, target segments, and technologies would impact the prospective NTG to the extent they have differing NTG estimates. We will also conduct benchmarking into prospective net-to-gross values used in other states to inform the estimate. In the event that no clear picture emerges from the prospective research, the retrospective NTG value will be recommended.

Estimating NTG Ratio

The evaluation team will assess the validity of both sales data modeling and corporate interview net-to-gross values when determining the final program net-to-gross estimate. Similarly, we will use the benchmarking task to compare Xcel Energy values with those from similar upstream lighting programs. The evaluation team will

also rely on feedback from product staff relating to expected product changes to provide insight into prospective NTG ratios.

By design, our final NTG estimate recommendation includes data from mixed methods research – both quantitative data and qualitative data. The initial NTG estimates will be calculated through sales data modeling and corporate reported NTG interview responses. After the initial NTG estimate is calculated, we will then utilize the quantitative and qualitative data to construct a logical, internally consistent, and coherent narrative of program attribution that attempts to identify all possible pathways of Xcel Energy influence. We will rely on the following data sources to construct the NTGR:

- Trade-partner interviews -
- Sales data, historic data -
- Program benchmarking data – provides point of comparison
- Known program changes in upcoming years – factors any known implications for future changes in program design

Based on these results, we then may adjust the NTG to create a final recommended NTGR that is consistent with this narrative and that should be applied to the program subsequent to the completion of this report. The final NTG recommendation is based on the professional judgement of our team after considering all available quantitative and qualitative data.

Additional Scope and Objectives

During the staff interviews and kickoff meeting, several objectives were highlighted as important to the process evaluation, but were eventually dropped due to budget constraints. These objectives are:
- Assess market potential: Which segments or technologies have the most remaining savings potential? How can Xcel Energy target these segments?
- Explore decision making processes: How are customers making lighting decisions? What information would be useful? Where are customers getting their information?
- Understand customer awareness of product: Is Xcel Energy effectively driving awareness of the lighting program? Are people aware of the discount? What are methods to increase customer connection between Xcel Energy and the discounts?
- Analyze expected legislative changes: What is the expected baseline for savings in 2020 and beyond?

The evaluation team proposed the following activities to satisfy these objectives: focused shelf stocking study, shopping survey, and legislative research. Each activity is detailed below.

Table 5. Home Lighting Research Summary, Additional Scope

Research Task	Sample Size	Enhanced Scope	Research Objective(s)
Focused Shelf Stocking Study	70 stores	✔	Potential assessment
Shopping Survey	100	✔	Program awareness, decision making process
Legislative Research	n/a	✔	Prospective baseline and NTG recommendations

Focused Shelf Stocking Study

The primary objective of the focused shelf stocking study is to assess potential retailer segments in Colorado where LEDs are under-represented, providing information on retailers with the highest potential for future program intervention. This activity, therefore, will consist of limited data collection while in the store, collecting only information on the availability of LEDs and the proportion of shelf space LEDs represent. The visits will be conducted within a three-week time period, to hold constant potential seasonal (or program promotional) stocking differences, and should take less than a ½ hour per store to complete.

Previous studies have found little variation in availability and relative shelf space allocations among club retail, large home improvement, and mass merchandise stores of a given retail chain. Therefore, the evaluation team will under-sample these channels to focus more attention on retail chains with higher variability in terms of LED availability and shelf space allocations, such as grocery, drug, discount, grocery, and specialty stores. **Error! Reference source not found.** describes the distribution of shelf study store targets, by retail channel.

Table 6. Focused Shelf Stocking Study Targets, by Retail Channel

Retail Channel	Target Completes
Mass Merchandisers	4
Club	4
Discount/Dollar	18
Drug/ Grocery	19
Home Improvement	4
Small Hardware	13
Specialty	9
Total	70

Shopping Survey

The evaluation team plans to conduct online surveys with residential Colorado customers that recently purchased lighting products. To achieve this, we plan to use InfoScout. InfoScout[6] is a data collection company that pays a panel of participants to scan receipts of purchases through their smartphone and answer targeted surveys about their purchases. In lieu of a non-participant or general population telephone survey, the evaluation team plans to use this service to locate and survey recent lightbulb purchasers in Colorado and discuss program awareness and their lighting decision making process. The benefit of this type of service is that we can be certain of the type of bulb, the date purchased, the price paid, and the purchase location. This eliminates recall bias regarding these factors, providing more confidence in the validity of responses.

To the extent InfoScout can accommodate, the evaluation team will focus on recent bulb purchasers, and stratify the population based on income level. If a representative sample cannot be achieved, the evaluation team will weight the results to the population of the Xcel Energy Colorado territory.[7] Questions in the survey will address the following topics:
- Are customers aware of the Xcel Energy Home Lighting discount? (If yes) Is the Home Lighting Product impacting their decision?
- Where are customers getting their information regarding lighting products?
- How are customers making lighting decisions regarding which product to buy?
- Do customers make their choices in the store or prior to shopping?

The evaluation team will also analyze the InfoScout responses to assess any trends between income level, purchase locations, and type of bulb purchased (LED, halogen, CFL). This analysis would inform potential segments to focus future Home Lighting Product interventions.

The evaluation team will aim to complete 100 surveys with recent lighting purchasers, those that purchased lightbulbs within the previous 12 months. The survey will be offered to InfoScout participants on a rolling basis, beginning with most recent lighting purchasers (e.g., within the previous three months), and moving on to less recent purchasers until the survey quota is achieved.

Legislative Research

This research task is intended to inform recommendations on a prospective baseline for program bulbs. Due to uncertainty around EISA backstop implementation dates, outstanding lawsuits, changing political priorities, and the rapidly evolving lighting market, lighting programs across the country struggle with appropriate wattage to use for the comparable (inefficient) baseline, for current programs and future savings claims. This issue is compounded when calculating lifetime savings as future legislative directives can alter savings years after installation. While no one can claim certainty around the future of the lighting market, the evaluation team follows this market, legislation, and legal developments closely and will provide a synopsis of recent changes, and potential impacts to the Xcel Energy Home Lighting program. This briefing will be based on research, professional expertise, and industry insights to include the wide spread of opinions on this topic. Additionally, the team will include our best estimate of where the lighting market is headed, and appropriate baseline wattage to use in 2020 and beyond.

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[6] Note the evaluation team is confirming timing and availability of this service as of the writing of this memo. See infoscout.co for details on InfoScout.
[7] The evaluation team plans to weight the results by income or education to that of the Xcel Energy Colorado territory. The team will obtain territory population statistics from Xcel Energy data, if possible, or census data.

Appendix B: DATA COLLECTION DOCUMENTS

B.1   Home Lighting Staff Interview Guide

Introduction

This guide is to be used to interview staff associated with Xcel Energy's DSM programs as part of the EMI Consulting 2018 evaluation of the Xcel Energy DSM programs. The interviews will be semi-structured, with these questions serving as a basic guide for experienced EMI Consulting staff during one-on-one phone interviews.[8] As a guide for semi-structured interviews, these questions will not necessarily be asked verbatim, but will serve as a roadmap during the conversation.

Staff Interview Research Questions or Objectives

- Assess the extent to which the program design supports program objectives and customer service/satisfaction objectives.
- Assess the degree to which program resources are sufficient to conduct program activities with fidelity to the implementation plan
- Collect staff feedback on implementation successes and challenges
- Identify themes and issues to incorporate into the evaluation plan

Interview

Section A: Introduction

[If staff was not included in kick-off meetings:] First we would like to give you some background about who we are and why we want to talk with you today. EMI Consulting is an independent consulting firm that works with electric and gas utilities to review and improve program operations and delivery. EMI Consulting is sub-contracting with other leading national firms to perform this evaluation- including Evergreen Economics, Rick Ridge and Associates, and Apex Analytics. Xcel Energy contracted with us to perform an evaluation of their portfolio of energy efficiency programs and we're currently in the process of conducting interviews with product managers and key staff involved in designing and delivering the portfolio to improve our understanding of Xcel Energy's DSM programs and its' influence on customers. We also want to

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[8] Some interviews may be conducted jointly. This would most likely occure if someone's role recently changed or if more than one person performs the role.

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understand what will be useful for you as Xcel Energy program staff because of our research. We want to incorporate your priorities into our study so that the results are as useful as possible.

[ALL] Thank you for taking the time to speak with me today. My objective for this meeting today is to gain a deeper understanding of this program, what Xcel hopes to achieve through implementing this program how it operates, and a bit about your experiences with the the Home Lighting program. We are interested in asking you some questions about the Home Lighting program so we can benefit from your knowledge and experience to improve our understanding of the program. I have a set of questions that should take approximately 45 - 60 minutes, depending upon your experiences and involvement with the program. All the information provided is anonymous, we will be weaving it together with information gleaned from other interviews.

Before I begin, is it alright if I record the conversation for note taking purposes? [RECORD IF ALLOWED]

A1.   [If needed] First, can you take a moment and explain your role and scope of responsibilities with respect to the Home Lighting program?

Probes:
- Approximately how long have you held this position?
- What previous positions did you hold?
- Whom do you report to in the overall org structure?
- Do you have any direct reports?

Section B: Program Goals

I'd like to be sure I understand the goals of this program, both overall and specific.

[TAILOR BASED ON WHAT IS ALREADY KNOWN]

B1. During the kickoff meeting, Xcel staff provided the following goals of the Home Lighting program:
- **Societal Net Benefits – spending ratepayer funds in the most effective manner**
- **Energy savings that reflect the unique generation profile of Xcel**
- **Educating customers on energy efficient lighting technologies**
- **Customer satisfaction and awareness**
- **Meet energy savings or other relevant regulatory goals**
- **Serve as a touch point for customers – most accessible program is lighting**

Do you have any additional goals to add to this list? (anything we missed?)

B1a.   Can you describe any savings goals? Do you have specific goals for individual components of the program (measure type/retail channels)? These can be internal goals, as well.

B1b. Any other, non-energy goals?

B1b1. Any more immediate goals? For example, participation goals, customer engagement goals, improving customer satisfaction? Changing customer awareness of or attitudes about energy efficiency measures?

B1b2. Any longer-term goals? For example, reducing greenhouse gas emissions? Altering market behaviors?

B2. What are "indicators of success"?

B2a. What are interim indicators that the program is or is not meetings its objectives or goals?

B3. Have any of these goals changed in the last few years?

B3a. What was the rationale for changing them?

B3b. In your opinion, how have these changes affected the program's operations or its outcomes?

B4. What influences do you think this program has had on the market?

Section C: Program Activities

I would like to make sure I have a solid understanding of how this program operates. If there is any formal documentation that you can refer me to as we walk through these next questions, I'd appreciate getting copies.

[TAILOR BASED ON WHAT IS ALREADY KNOWN]

C1. What are the different components of the program?

C1a. Whatincentives and/or tools does the program use to achieve its goals? What are the incentive levels for different bulbs?

C1b. What activities do program and implementer staff engage in to achieve program goals?
- Marketing?
- Financial assistance?
- Education?
  - o Retailer staff training?
  - o Program representative support at stores?
- Retailer/Trade Partner support?
- Drop ship/direct install?

- Online sales? (are these included in the res lighting program or associated with a different program?)

C1c. What tools are used to reach out to customers and/or market partners?

C1d. What are the participation steps from a retailer perspective?

C2. Are these program activities modeled on another program or set of programs?

C3. How have incentives changed in the last few years? What was the rationale for changing them?

C4. Have any of these activities changed in the last few years?

C4a. What was the rationale for changing them?

C4b. In your opinion, how have these changes affected the program's operations or its outcomes?

C4c. Have you measured how these changes impacted savings or participation?

C5. Do you have any per customer quantity or transaction limits for this program? How are these enforced?

C6. Do program staff perform any onsite visits to participant stores? [IF SO: How often is each store visited? What are the goals of these visits? E.g. - marketing material availability, employee training, customer support, etc]

Section D: Resources

D1. What resources do you rely on to implement the program? How many staff are in each role? How are the resources distributed/shared between different states.

D1a. Program, implementer, sales staff?

D1b. Management and program direction?

D1c. IT tools and data tracking tools?

D1d. Other resources?

D2. Are these resources sufficient to implement the program as designed?

D2a. [IF NO] How could the program design/implementation change to be more efficient? What additional resources would help you implement the program as designed?

D3. Have any of these program resources changed in the last few years?

D3a.   What was the rationale for changing them?

D3b.   In your opinion, how have these changes affected the program's operations or its outcomes?

Section E: Program Tracking and Reporting

Since this program does not use Salesforce as the primary program tracking tool, I'd like to understand how program activities are tracked to understand what data might be available to us in our evaluation.

[TAILOR BASED ON WHAT IS ALREADY KNOWN]

E1.   What kind of documentation is available for the program? Implementation plans? Program manuals? Process maps?

E2.   What kinds of data are collected for the Home Lighting program? Are any demographic characteristics or end user surveys conducted during implementation?

E3.   Are there any data that you would like to collect for the Home Lighting program, but haven't been able to?

E4.   Are there any data/documentation currently not tracked that might be helpful for the evaluation?

E5.   As part of our evaluation, we will likely want to speak to "near-participants," retailers/manufacturers that showed some interested in program participation, but didn't participate for whatever reason. Would these market actors all be tracked?

Section F: Strengths and Challenges

Next, I'd like to get your feedback on how the program is running.
[TAILOR BASED ON WHAT IS ALREADY KNOWN]

F1.   In your opinion, what are the strengths of the Home Lighting program as it is currently being run?

F1a.   What would you say is working well in terms of program design or implementation?

F2.   What are the most significant challenges for this program at this point?

F3.   What feedback, if any, do you receive from customers and/or market partners on the program? (PROBE FOR CUSTOMER ENGAGEMENT/ CUSTOMER SATISFACTION)

F4. What do you believe are the biggest barriers to getting customers and/or market partners to participate in this program?

F5. Are there any specific opportunities for improvement in the design or implementation of the program? Please describe.

F6. What would you like to see changed in how the program is designed or run, if anything?

> **F6a.** Do you think there are any roadblocks preventing these changes from happening?

Section G: Closing

G1. Xcel staff expressed a number of evaluation priorities during kickoff meeting, which we need to whiddle down. What do you think are the highest and lowest priority reseach objectives for this program? Do you have anything you would like to add to these priorities, remove from this set of priorities, or change about these priorities?

- **Which segments have the most savings potential; How to target these segments.**
- **Prospective NTG: If/how the NTG changes for different segments, channels, or bulb types.**
- **Decision making process: How are customers making lighting decisions? What information would be useful? Where are customers getting their information?**
- **Awareness: Is Xcel effectively driving awareness of the lighting program? Are people aware of the discount? Methods to increase customer connection between Xcel and the discounts.**
- **Streamlined logic model**
- **Benchmarking of program designs, what are other utilities doing for their programs going forward?**
- **Prospective baseline**
- **Cross-Sector Sales**
- **In-home lighting saturation study – In conjunction with the 2018 Xcel Home Use Study.**

G2. [FOR KIM] I'd like to learn a bit about your experience with previous evaluations of the Home Lighting program. What were the successes and challenges? What worked well (or didn't?)

G3. [FOR KIM] Have you had experience with any of the following common upstream NTG methods?
- Sales Data Modeling
- Consumer Self Report
- Supplier Surveys
- Price Elasticity Model
- Revealed preference

- Market Model

What were your experiences? Were there research methods that worked well (or didn't)?

G4. Do you have particular questions that you would like to see answered by the evaluation? Why are these questions important?

G3. Do you have any other comments, concerns or suggestions about the program that we didn't discuss that you would like to make sure I know about?

Thank you very much for taking the time in assisting us with this evaluation. If I come up with any additional questions that come from this interview, do you mind if I send you an email or give you a quick call? I will also follow up with you shortly to identify peer utilities and performance indicators to kick-of the benchmarking task.

B.2   Lighting Supplier/Corporate Partner Interview Guide

Introduction

To support the process and impact evaluation of the 2017 Xcel Energy efficiency programs, the EMI Consulting evaluation team will conduct telephone surveys with corporate partners, including participating lighting manufacturers and partner retailers. The survey will assess partner experiences and satisfaction with the program, discuss the future of lighting products, and it will provide data to help determine free ridership and spillover.
Targeted respondents are participant manufacturers and corporate retailer partners that participated in the program in 2017. The evaluation team will attempt to contact a mix of large and small lighting suppliers in the final survey population.

The remainder of the introduction provides the research questions that the corporate partner interviews are designed to address, a description of the sample variables to support programming the survey, and fielding instructions for the survey house.

Evaluation Objectives

The objectives for the Home Lighting Product evaluation are to:
- Collect benchmarking data of program designs: What lighting measures are other utilities incentivizing going forward?
- Analyze expected legislative changes: What is the expected baseline for savings in 2020 and beyond?
- Develop an NTG ratio documenting the program's influence on customer's decisions.
- Estimate any market effects associated with the delivery of the Home Lighting Product
- Estimate how the NTG changes for different segments, channels, or bulb types.
- Benchmark Xcel Energy's NTG with those of similar utilities.

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Specific research questions which this participant survey is designed to address are the following:

- Where do partners see opportunities for new technologies? Where do partners expect growth in the lighting market?
- What legislative changes do partners expect?
- What is the partner estimate of retrospective NTG ratio?
- What do partners expect for NTG ratios moving forward?
- What do partners expect for NTG ratios for segments/channels/bulb types?

The following table presents the link between each evaluation objective, research question, and survey question.

Evaluation Objectives	Research Question	Survey Question Number(s)
Assess market opportunities	Where do partners see opportunities for new technologies? Where do manufacturers see opportunities for growth in retail channels?	2,3, 4
Analyze expected legislative changes	What legislative changes are partners anticipating? How are partners planning for these changes? Are they already making stocking changes in preparation?	B51)-B57)
Develop an NTG ratio documenting the program's influence on customer's decisions.	What is the partner estimate of retrospective NTG ratio? What do partners expect for LED NTG ratios moving forward?	B3)-B49)
Estimate how the NTG changes for different segments, channels, or bulb types.	To what extent do NTG ratios differ between channels and bulb types? What do partners expect for NTG ratios for segments/channels/bulb types?	B3)-B49)
Assess manufacturer needs and educational efforts	Do participant manufacturers need any additional support or resources from Xcel Energy? What educational efforts are they employing to educate customers and retailers on LEDs? What are most effective?	B60)-B69)

Interview Variables

We will use the following variables in fielding the interview:

Variable Name	Description
PARTNER	Name of manufacturer or retailer
PROGRAM QTY	Quantity of bulbs manufactured/sold
CONTACT	Name of contact at supplier
RESEARCH FIRM	Name of firm conducting survey
TOTAL 2017 INCENTIVES	Amount of Xcel Energy incentives paid to PARTNER
RETAILERS	Retailers distributed to
CHANNELS	Retail channels distributed to

Interview Sections

- **Introduction**
- **Program Benefits**
- **Free-Ridership**
- **Market Share**
- **Future of Lighting**
- **Program Satisfaction**
- **Closing**

Interview

Introduction

Intro: **[TO RESPONDENT]** Hello, my name is **[INSERT FIRST NAME]** and I am calling from [**RESEARCH FIRM**] on behalf of Xcel Energy. May I please speak with **[INSERT CONTACT]**

[IF CONTACT IS AVAILABLE, CONTINUE; IF UNAVAILABE TRY TO RESCHEDULE, IF CONTACT CONTINUES TO BE UNAVAILBLE REACH OUT TO PROGRAM STAFF FOR SECONDARY CONTACT.
We are currently evaluating the Xcel Energy Lighting Product program and I have a few questions I'd like to ask you about your experience with the program. Your individual responses will remain confidential and this interview should take about 30 minutes. Your feedback will help us determine the effectiveness of the program and assist with future planning for the program and ongoing rebate opportunities to allow manufacturers to continue to incentivize and produce energy efficient lighting products.
Do you have a few minutes to talk?
1. Yes
2. No **[ARRANGE CALLBACK]**

[RESPONSES TO CONCERNS – MAY BE USED IF NECESSARY]

(**TIMING:** This interview should take 30 minutes to 1 hour of your time. Your insight on this program is very important as we continue to evaluate and refine this program. Is this a good time for us to speak with you? **[IF NOT, SET UP CALL BACK APPOINTMENT]**)

(WHO ARE YOU WITH: I'm with [**RESEARCH FIRM**], independent research firm that has been hired by Xcel Energy to evaluate their Upstream Lighting program.)

(SALES CONCERN: I am not selling anything; we would simply like to learn about your experience with the Xcel Energy Upstream Lighting program. Your individual responses and your company-specific information will remain confidential.

(WHY ARE YOU CONDUCTING THIS STUDY: Studies like this help Xcel Energy better understand customers' need and interest in energy programs and services. Sharing your opinions and experiences will help us as we consider modifications and improvements to the program going forward.)

[IF INITIAL CONTACT WAS NOT REACHED, ASK 0
RETAILER: Are you familiar with the Colorado Xcel Energy Home Lighting Product program where Xcel Energy provided incentives to discount LED bulbs sold through **[PARTNER]** in 2017?

 Are you familiar with the Colorado Xcel Energy Home Lighting Product program where Xcel Energy provided incentives to discount LED bulbs sold through retailers such as [RETAILER] in 2017?

1. Yes
2. No **[**TERMINATE. FOLLOW UP WITH XCEL ENERGY FOR SECONDARY CONTACT]

Program Benefits

As background, in 2017, Xcel Energy provided $[TOTAL 2017 INCENTIVES] to your company to buy down the cost of LEDs in their Colorado territory.

1   In general, what benefits to your corporation, if any, do you see from participating in the Xcel Energy Home Lighting Product program?. [DO NOT READ; SELECT ALL THAT APPLY; RECORD OPEN ENDS]

Drives more customers to the store
Encourages customers to purchase additional products
Increases consumer awareness of energy efficient products
Increases store employee awareness of energy efficient products
We stock more energy efficient products
Increases sales
Other [Specify]
I don't see any benefit to participation
98.   **[DO NOT READ]** DON'T KNOW
[DO NOT READ] REFUSED

2   Xcel Energy is always looking for ways to encourage adoption of new energy efficient lighting technologies. Do you have any suggestions for new lighting technologies that the program should promote, or technology that's not included in the program already? [IF NEEDED: XCEL ENERGY CURRENTLY FOCUSES ON LED BULBS]

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

3   Xcel Energy wants to ensure that all customers have access to energy efficient lighting technologies, especially hard to reach populations such as low income customers or non-native English speakers. What is the best way for Xcel Energy to help hard to reach populations purchase efficient lighting technologies?

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

4   Are there any hard to reach retailers, retail channels, or customer segments that you sell to that could benefit from Xcel Energy lighting incentives?

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

Program Attribution

Please note in the next section that when I refer to LEDs I mean LEDs used to replace regular screw-based light bulbs and not LED tubes, nightlights, flashlights, or other specialty lighting applications, and by specialty lamps we are referring to globes and candelabras. Now I'm going to ask you some questions on the possible effects of the Xcel Energy lighting program on your sales of standard LED lighting products.

B1)   Which of the following types of light bulbs did your company [RETAILER: stock] [MANUFACTURER: manufacture] in 2017? **[READ LIST; MAY HAVE MULTIPLE RESPONSES]**

CFL: Standard
CFL: Reflector
CFL: Specialty
LED: Standard
LED: Reflector
LED: Specialty
Halogen/Incandescent: Standard
Halogen/Incandescent: Reflector
Halogen/Incandescent: Specialty

   NONE [Our store does not manufacture/stock lightbulbs outside of the bulb incentivized through the Xcel Energy lighting program]
98. **[DO NOT READ]** DON'T KNOW
99. **[DO NOT READ]** REFUSED

B2)   In 2017, our records indicate that you sold program bulbs through the following retail channels in Colorado **[INSERT CHANNELS; MAY HAVE MULTIPLE RESPONSES]**

Club   (e.g., Costco or Sams Club)
Home Improvement   (e.g., Home Depot or Lowes)

Mass Merchandisers   (e.g., Walmart or Target)
Discount/Dollar Stores   (e.g., Dollar Tree or Goodwill)
Small Hardware   (e.g., Ace True Value)
Specialty Stores   (e.g., office supply stores, lighting specialty store, batteries plus)
Grocery   (e.g., King Soopers or Safeway)
Drug Stores   (e.g., CVS or Walgreens)

B3)   Do you sell light bulbs to any other retail channels in Colorado? Which ones? [Please include all technologies you manufacture, including LEDs, CFLs, and Halogens/incandescents]

   1. **[RECORD]**
  98. DON'T KNOW
  99. REFUSED

[IF SELLS THROUGH MORE THAN THREE CHANNELS, ASK B3A]
b3A) What channels are the majority of your LEDs bulbs sold through?

B4)   Our records indicate that during 2017, Colorado Xcel Energy Home Lighting Product program processed incentives for **[PROGRAM QTY] LEDs** [RETAILER: sold] [[MANUFACTURER: manufactured] through your company**.** Roughly what percent of the total LEDs that your company [RETAILER: sold] [[MANUFACTURER: manufactured] in 2017 Colorado were discounted by Xcel Energy?

[CLARIFICATION IF NEEDED: WE ARE LOOKING FOR THE % OF ALL LEDS YOU SELL IN COLORADO THAT WERE INCENTED THROUGH THE Xcel Energy LIGHITNG PROGRAM, FOR EXAMPLE, IF YOU <u>ONLY</u> SOLD LEDS IN COLORADO THROUGH THE Xcel Energy LIGHTING PROGRAM IN 2017, YOUR ANSWER WOULD BE 100%. IF HALF OF THE LEDS YOU SOLD IN COLORADO ARE INCENTED THROUGH THE PROGRAM, YOUR ANSWER WOULD BE 50%]
IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]

   i) % sold
  98.   **[DO NOT READ]** DON'T KNOW   [**SKIP TO 0**]
  99.   **[DO NOT READ]** REFUSED   [**SKIP TO S1**]

[TOTAL_LED = PROGRAM QTY/C4]
B5)   If the Colorado Xcel Energy Home Lighting Product program incentives of approximately $1.55 per LED bulb were not available in 2017, do you think your company would have sold about the same, lower, or higher than [TOTAL_LED] LEDs in Colorado? **[IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]**

1. Same
2. Lower
3. Higher
98.   DON'T KNOW [**SKIP TO NEXT SECTION**]
99.   REFUSED   [**SKIP TO NEXT SECTION**]

B6) Why do you think sales of LEDs would have been [same/lower/higher] in Colorado? [check to make sure that the explanation matches the response to B5)

   1. **[RECORD]**

98. DON'T KNOW
99. REFUSED

B7)   [ASK IF B5)= 2 OR 3] By what percent would your sales of LEDs in Colorado have been [LOWER/HIGHER] without the Colorado Xcel Energy Home Lighting Product program? [IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]

   1. **[RECORD]**
   98. DON'T KNOW   [**SKIP TO NEXT SECTION**]
   99. REFUSED   [**SKIP TO NEXT SECTION**]

B8)   **[ASK IF B5)= LOWER]** I want to make sure I understand you correctly when you say your company's sales of LEDs in Colorado would be *[%FROM QUESTION B7)]* lower without the Colorado Xcel Energy Home Lighting Product program discounts. So you're saying that if you sold 100 LEDs in a given month with the program discounts, you would have sold *[100 - (%B7) * 100)]* *that* month in Colorado without the program discounts. Does that sound about right? **[IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]**

   1. Yes
   2. No [CLARIFY RESPONSE]
   98. **[DO NOT READ]** DON'T KNOW
   99. **[DO NOT READ]** REFUSED

B9)   **[ASK IF** ERROR! REFERENCE SOURCE NOT FOUND.= **SAME]** I want to make sure I understand you correctly when you say your company's sales of LEDs would be *the same* without the program discounts. So you're saying that if you sold 100 LEDs in a given month with the Colorado Xcel Energy Home Lighting Product program discounts, you would have still sold 100 LEDs *that* month in Colorado without the program discounts. Does that sound about right? **[IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]**

   1. Yes
   2. No [CLARIFY RESPONSE]
   98. **[DO NOT READ]** DON'T KNOW
   99. **[DO NOT READ]** REFUSED

B10)   **[ASK IF B5)= HIGHER]** I want to make sure I understand you correctly when you say your company's sales of LEDs would be *[%FROM QUESTION* **Error! Reference source not found.***]* higher without the program discounts. So you're saying that if you sold 100 LEDs in a given month with the Colorado Xcel Energy Home Lighting Product program discounts, you would have sold *[100 + (%FROM QUESTION B7) * 100)]* *that*

month in Colorado without the program discounts. Does that sound about right?
[IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]

1. Yes
2. No [CLARIFY RESPONSE]
98. **[DO NOT READ]** DON'T KNOW
99. **[DO NOT READ]** REFUSED

Market Share Predictions

Next, since the lighting market continues to change rapidly and face an uncertain future for many reasons, including uncertainty over the adoption of the Energy Independence and Security Act (EISA) in 2020, we'd like to ask you to provide lighting market share predictions.

I'd like you to predict the future market shares in Colorado for A-Line Medium Screw Base Lamps for 2018, 2020, and 2022 under the assumption that the Xcel Energy lighting program would continue LED incentives for these bulbs.

[ASK B11)-B13) IF RESPONDENT SELLS STANDARD HALOGENS/INCANDESCENTS OR STANDARD CFLS (FROM B1)) IN ADDITION TO LEDS.]

A-Line Market Shares, Efficiency Program Continues

Table 7 A-line Market Share Predictions, Assuming Efficiency Program Continues

	2018	2020	2022
1. CFL: Standard	_%	_%	_%
2. LED: Standard	_%	_%	_%
3. Halogen/Incandescent: Standard	__%	__%	__%
4. Other	_%	_%	_%
MUST SUM TO 100%	100%	100%	100%

B11) What are your Colorado [PARTNER] market share predictions for A-line medium base lamps for 2018, by lamp technology (CFL, LED, halogen/incandescent, other) assuming that the Xcel Energy lighting program continues to offer LED incentives? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps, and can combine the estimate for halogens and incandescent lamps. [STATED DIFFERENTLY: WHAT PERCENT OF THE A-LINE BULBS [PARTNER] SELLS IN COLORADO IN 2018 IS [TECHNOLOGY]?] [RECORD PREDICTIONS IN Table 7]

B12) What are your market share predictions for A-line medium base lamps in 2020, by lamp technology (CFL, LED, halogen/incandescent, other (if applicable)? [REPEAT SCENARIO IF NEEDED] [RECORD PREDICTIONS IN Table 7]

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B13) What are your market share predictions for A-line medium base lamps in 2022 by lamp technology (CFL, LED, halogen/incandescent, other (if applicable)? [REPEAT SCENARIO IF NEEDED] [RECORD PREDICTIONS IN Table 7]

[ASK B14)- B16) IF RESPONDENT ONLY SELLS STANDARD LEDS (NOT STANDARD HALOGENS/INCANDESCENTS OR STANDARD CFLS (FROM B1))]

Table 8 A-line Quantity Predictions, Assuming Efficiency Program Continues

	2018	2020	2022
1. LED: Standard			

B14) Earlier, you estimated that you sold [TOTAL LEDS] in Colorado in 2017 (including standard, reflector, and specialty bulbs). Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many A-line LEDs do you expect to sell in Colorado in 2018? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 8]

B15) Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many A-line LEDs do you expect to sell in Colorado in 2020? [RECORD PREDICTIONS IN Table 8]

B16) Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many A-line LEDs do you expect to sell in Colorado in 2022? [RECORD PREDICTIONS IN Table 8]

[ASK B17) IF PARTNER SELLS THROUGH MORE THAN ONE CHANNEL]

B17) How do you expect the [PARTNER] market share of A-line LEDs to vary by retail channel in 2022, assuming the Xcel Energy LED incentives continue? [According to our records, [PARTNER] sells LEDs through [CHANNELS] in Colorado.] [STATED DIFFERENTLY: WHAT PERCENT OF THE A-LINE BULBS SOLD IN COLORADO THROUGH [CHANNEL] IN 2022 WILL BE LEDS?] [ASK ONLY FOR CHANNELS INDICATED]

Table 9 A-line LED Market Share Predictions, by Channel, Assuming Program Continues

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	2022
1. Club [Sams Club, Costco]	__%
2. Home Improvement [Lowes, Home Depot]	__%
3. Mass Merchandisers [Target, Walmart]	__%
4. Discount/Dollar	__%
5. Small Hardware [ACE/True Value, Independent Hardware]	__%
6. Specialty Stores [Batteries Plus]	__%
7. Grocery [King Soopers, Safeway]	__%

B18)   What is your thinking behind your predictions for these:
Standard spiral CFLs?
A-line LEDs?
A-line Halogen/Incandescents?

B19)   [IF NOT ALREADY MENTIONED] What role does the EISA 2020 Backstop play in your predictions?

A-Line Market Shares, No Efficiency Program

[READ] Next, as a follow up to my previous question, I'd like you to predict the future market shares for A-Line Medium Screw Base Lamps for 2020, and 2022 under the assumption that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022.

[ASK B20)- B21)IF RESPONDENT SELLS STANDARD HALOGENS/INCANDESCENTS OR STANDARD CFLS (FROM B1)) IN ADDITION TO LEDS.] .

Table 10 A-line Market Share Predictions, Assuming No Program

	2020	2022
1. CFL: Standard	__%	__%
2. LED: Standard	__%	__%
3. Halogen/Incandescent: Standard	__%	__%
4. Other	__%	__%
MUST SUM TO 100%	100%	100%

B20)   What are your Colorado market share predictions for A-line medium screw base lamps for 2020, by lamp technology (CFL, LED, incandescent/halogen, other) assuming that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 10]

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B21)   What are your market share predictions for A-line medium base lamps in 2022, by lamp technology, assuming the Xcel Energy program LED incentives were not offered in 2020 or 2022?

[ASK B22)- B23)IF RESPONDENT ONLY SELLS STANDARD LEDS (NOT STANDARD HALOGENS/INCANDESCENTS OR STANDARD CFLS (FROM B1))]

Table 11 A-line Quantity Predictions, Assuming No Program

	2020	2022
1. LED: Standard		

B22)   Earlier, you estimated that you sold [TOTAL LEDS] in Colorado in 2017 (including standard, reflector, and specialty bulbs). Assuming that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022, how many A-line LEDs do you expect to sell in Colorado in 2020? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 11]

B23)   Assuming that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022, how many A-line LEDs do you expect to sell in Colorado in 2022? [RECORD PREDICTIONS IN Table 11]

[ASK B24) IF PARTNER SELLS THROUGH MORE THAN ONE CHANNEL]

B24)   How do you expect the [PARTNER] market share of A-line LEDs to vary by retail channel in 2022, assuming the Xcel Energy LED incentives were not offered in 2020 or 2022? [According to our records, [PARTNER] sells LEDs through [CHANNELS].] [WHAT PERCENT OF THE A-LINE BULBS SOLD IN COLORADO THROUGH THE [CHANNEL] CHANNEL IN 2022 WILL BE LEDS, IF XCEL ENERGY INCENTIVES WERE NOT OFFERED?] [ASK ONLY FOR CHANNELS INDICATED. RECORD RESPONSE IN Table 12]

Table 12 A-line LED Market Share Predictions, by Channel, Assuming NO Program

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	2022
1. Club [Sams Club, Costco]	__%
2. Home Improvement [Lowes, Home Depot]	__%
3. Mass Merchandisers [Target, Walmart]	__%
4. Discount/Dollar	__%
5. Small Hardware [ACE/True Value, Independent Hardware]	__%
6. Specialty Stores [Batteries Plus]	__%
7. Grocery [King Soopers, Safeway]	__%

Reflector Market Shares, Efficiency Program Continues

[READ] Next I'll ask you predict the future market shares for medium screw base *reflector* lamps for 2018, 2020, and 2022 under the assumption that the Xcel Energy lighting program will continue to offer LED incentives through 2022.

[ASK B25)- B27) IF RESPONDENT SELLS REFLECTOR HALOGENS/INCANDESCENTS OR REFLECTOR CFLS (FROM B1)) IN ADDITION TO REFLECTOR LEDS.]

Table 13 Reflector Market Share Predictions, Assuming Efficiency Program Continues

	2018	2020	2022
1. CFL: Reflector	__%	__%	__%
2. LED: Reflector	__%	__%	__%
3. Halogen/Incandescent: Reflector	__%	__%	__%
4. Other	__%	__%	__%
MUST SUM TO 100%	100%	100%	100%

B25) What are your Colorado market share predictions for medium screw base reflector lamps in 2018, by technology (CFL, halogen, LED), assuming that the Colorado lighting program continues to offer LED incentives through 2018? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 13]

B26) What are your market share predictions for reflector lamps in 2020, by lamp technology, assuming the program continues?

B27) What are your market share predictions for reflector lamps in 2022, by lamp technology, assuming the program continues?

[ASK B28)-B30)IF RESPONDENT ONLY SELLS REFLECTOR LEDS (NOT REFLECTOR HALOGENS/INCANDESCENTS OR REFLECTOR CFLS (FROM B1))]

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Table 14 Reflector Quantity Predictions, Assuming Efficiency Program Continues

	2018	2020	2022
1. LED: Reflector			

B28) Earlier, you estimated that you sold [TOTAL LEDS] in Colorado in 2017 (including standard, reflector, and specialty bulbs). Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many reflector LEDs do you expect to sell in Colorado in 2018? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 14]

B29) Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many reflector LEDs do you expect to sell in Colorado in 2020? [RECORD PREDICTIONS IN Table 14]

B30) Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many reflector LEDs do you expect to sell in Colorado in 2022? [RECORD PREDICTIONS IN Table 14]

[ASK B31)IF PARTNER SELLS THROUGH MORE THAN ONE CHANNEL]

B31) How do you expect the [PARTNER] market share of reflector LEDs to vary by retail channel in 2022, assuming the Xcel Energy LED incentives continue? [According to our records, [PARTNER] sells LEDs through [CHANNELS] in Colorado.] [STATED DIFFERENTLY: WHAT PERCENT OF THE REFLECTOR BULBS SOLD IN COLORADO THROUGH [CHANNEL] IN 2022 WILL BE LEDS?] [ASK ONLY FOR CHANNELS INDICATED]

Table 15 Reflector LED Market Share Predictions, by Channel, Assuming Program Continues

	2022
1. Club [Sams Club, Costco]	__%
2. Home Improvement [Lowes, Home Depot]	__%
3. Mass Merchandisers [Target, Walmart]	__%
4. Discount/Dollar	__%
5. Small Hardware [ACE/True Value, Independent Hardware]	__%
6. Specialty Stores [Batteries Plus]	__%
7. Grocery [King Soopers, Safeway]	__%

B32) What role does the EISA 2020 Backstop play in your predictions? What role does the expanded definition of general service lamps play in your predictions? [IF UNFAMILIAR WITH EISA, READ DESCRIPTION]

Reflector Market Shares, No Efficiency Program

[READ] Next I'll ask you predict the future market shares for Medium Screw Base Reflector Lamps for 2020, and 2022 under the assumption that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022.
[ASK B33)- B34)IF RESPONDENT SELLS REFLECTOR HALOGENS/INCANDESCENTS OR REFLECTOR CFLS (FROM B1)) IN ADDITION TO LEDS.] .

Table 16 Reflector Market Share Predictions, No Efficiency Program

	2020	2022
1. CFL: Reflector	__%	__%
2. LED: Reflector	__%	__%
3. Halogen/Incandescent: Reflector	__%	__%
4. Other	__%	__%
MUST SUM TO 100%	100%	100%

B33) What are your Colorado market share predictions for medium screw base reflector lamps in 2020, by technology (CFL, LED, incandescent/halogen), assuming that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022 Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 16]

B34) What are your market share predictions for reflector lamps in 2022, by lamp technology, assuming the program LED incentives were not offered in 2020 or 2022?

[ASKB35)- B36) IF RESPONDENT ONLY SELLS REFLECTOR LEDS (NOT REFLECTOR HALOGENS/INCANDESCENTS OR REFLECTOR CFLS (FROM B1))]

Table 17 Reflector Quantity Predictions, Assuming No Program

	2020	2022
1. LED: Reflector		

B35) Earlier, you estimated that you sold [TOTAL LEDS] in Colorado in 2017 (including standard, reflector, and specialty bulbs). Assuming that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022, how many reflector LEDs do you expect to sell in Colorado in 2020? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 17]

B36) Assuming that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022, how many reflector LEDs do you expect to sell in Colorado in 2022? [RECORD PREDICTIONS IN Table 17]

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[ASK B37) IF PARTNER SELLS THROUGH MORE THAN ONE CHANNEL]

B37) How do you expect the [PARTNER] market share of reflector LEDs to vary by retail channel in 2022, assuming the Xcel Energy LED incentives were not offered in 2020 or 2022? [According to our records, [PARTNER] sells LEDs through [CHANNELS].] [WHAT PERCENT OF THE REFLECTOR BULBS SOLD IN COLORADO THROUGH THE [CHANNEL] CHANNEL IN 2022 WILL BE LEDS, IF XCEL ENERGY DID NOT OFFER THEIR INCENTIVES?] [ASK ONLY FOR CHANNELS INDICATED. RECORD RESPONSE IN Table 18]

Table 18 Reflector LED Market Share Predictions, by Channel, Assuming NO Program

	2022
1. Club [Sams Club, Costco]	__%
2. Home Improvement [Lowes, Home Depot]	__%
3. Mass Merchandisers [Target, Walmart]	__%
4. Discount/Dollar	__%
5. Small Hardware [ACE/True Value, Independent Hardware]	__%
6. Specialty Stores [Batteries Plus]	__%
7. Grocery [King Soopers, Safeway]	__%

Specialty Lamp Market Shares, Efficiency Program Continues

Finally, I'll ask you predict the future market shares for specialty Lamps for 2018, 2020, and 2022 under the assumption that the Xcel Energy lighting program will offer LED incentives through 2022. In this category, we're interested in globes and candelabras – anything not in the A-line or reflector category. We are going to think about them as a group, rather than individual bulb shapes or functions.

[ASK B38)-B40) F RESPONDENT SELLS SPECIALTY HALOGENS/INCANDESCENTS OR SPECIALTY CFLS (FROM B1)) IN ADDITION TO LEDS.]

Table 19 Specialty Market Share Predictions, Assuming Efficiency Program Continues

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	2018	2020	2022
1. CFL: Specialty	__%	__%	__%
2. LED: Specialty	__%	__%	__%
3. Halogen/Incandescent: Specialty	__%	__%	__%
4. Other	__%	__%	__%
MUST SUM TO 100%	100%	100%	100%

B38) What are your Colorado market share predictions for specialty lamps in 2018, by technology (CFL, halogen, LED), assuming that the Xcel Energy lighting program offers LED incentives through 2022? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 19]

B39) What are your market share predictions for specialty lamps in 2020, by lamp technology, assuming the program offers incentives on these?

B40) What are your market share predictions for specialty lamps in 2022, by lamp technology, assuming the program offers incentives on these?

[ASK B41)-B43)IF RESPONDENT ONLY SELLS SPECIALTY LEDS (NOT SPECIALTY HALOGENS/INCANDESCENTS OR SPECIALTY CFLS (FROM B1))]

Table 20 Specialty Quantity Predictions, Assuming Efficiency Program Continues

	2018	2020	2022
1. LED: Specialty			

B41) Earlier, you estimated that you sold [TOTAL LEDS] in Colorado in 2017 (including standard, reflector, and specialty bulbs). Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many specialty LEDs do you expect to sell in Colorado in 2018? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 20]

B42) Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many specialty LEDs do you expect to sell in Colorado in 2020? [RECORD PREDICTIONS IN Table 20]

B43) Assuming that the Xcel Energy lighting program continues to offer LED incentives, how many specialty LEDs do you expect to sell in Colorado in 2022? [RECORD PREDICTIONS IN Table 20]

[ASK B44)IF PARTNER SELLS THROUGH MORE THAN ONE CHANNEL]

B44) How do you expect the [PARTNER] market share of specialty LEDs to vary by retail channel in 2022, assuming the Xcel Energy LED incentives continue? [According to our records, [PARTNER] sells LEDs through [CHANNELS] in Colorado.] [STATED DIFFERENTLY: WHAT PERCENT OF THE SPECIALTY BULBS SOLD IN COLORADO THROUGH [CHANNEL] IN 2022 WILL BE LEDS?] [ASK ONLY FOR CHANNELS INDICATED]

Table 21 Specialty LED Market Share Predictions, by Channel, Assuming Program Continues

	2022
1. Club [Sams Club, Costco]	__%
2. Home Improvement [Lowes, Home Depot]	__%
3. Mass Merchandisers [Target, Walmart]	__%
4. Discount/Dollar	__%
5. Small Hardware [ACE/True Value, Independent Hardware]	__%
6. Specialty Stores [Batteries Plus]	__%
7. Grocery [King Soopers, Safeway]	__%

B45) [IF NOT ALREADY MENTIONED] What role does the EISA 2020 Backstop play in your predictions? What role does the expanded definition of general service lamps play in your predictions?

Specialty Market Shares, No Efficiency Program

[READ] Next I'll ask you predict the future market shares for specialty lamps for 2020, and 2022 under the assumption that the Xcel Energy lighting programLED incentives were not offered in 2020 or 2022.

[ASK B46)-B47) IF RESPONDENT SELLS SPECIALTY HALOGENS/INCANDESCENTS OR SPECIALTY CFLS (FROM B1)) IN ADDITION TO LEDS.] .

Table 22 Specialty Market Share Predictions, No Efficiency Program

	2020	2022
1. CFL: Specialty	__%	__%
2. LED: Specialty	__%	__%
3. Halogen/Incandescent: Specialty	__%	__%
4. Other	__%	__%
MUST SUM TO 100%	100%	100%

B46) What are your Colorado market share predictions for specialty lamps in 2020, by technology (CFL, halogen, LED), assuming that the Xcel Energy lighting programLED incentives were not offered in 2020 or 2022? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 22]

B47) What are your market share predictions for specialty lamps in 2022, by lamp technology, assuming the program LED incentives were not offered in 2020 or 2022?

[ASK IFB48)-B49) RESPONDENT ONLY SELLS SPECIALTY LEDS (NOT SPECIALTY HALOGENS/INCANDESCENTS OR SPECIALTY CFLS (FROM B1))]

Table 23 Specialty Quantity Predictions, Assuming No Program

	2020	2022
1. LED: Specialty		

B48) Earlier, you estimated that you sold [TOTAL LEDS] in Colorado in 2017 (including standard, reflector, and specialty bulbs). Assuming that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022, how many specialty LEDs do you expect to sell in Colorado in 2020? Your predictions should include both ENERGY STAR and non-ENERGY STAR lamps. [RECORD PREDICTIONS IN Table 23]

B49) Assuming that the Xcel Energy lighting program LED incentives were not offered in 2020 or 2022, how many specialty LEDs would you expect to sell in Colorado in 2022? [RECORD PREDICTIONS IN Table 23]

[ASK B50) IF PARTNER SELLS THROUGH MORE THAN ONE CHANNEL]

B50) How do you expect the [PARTNER] market share of specialty LEDs to vary by retail channel in 2022, assuming the Xcel EnergyLED incentives were not offered in 2020 or 2022? [According to our records, [PARTNER] sells LEDs through [CHANNELS].] [WHAT PERCENT OF THE SPECIALTY BULBS SOLD IN COLORADO THROUGH THE [CHANNEL] CHANNEL IN 2022 WILL BE LEDS, IF XCEL ENERGY INCENTIVES WERE NOT OFFERED?] [ASK ONLY FOR CHANNELS INDICATED. RECORD RESPONSE IN Table 24]

Table 24 Specialty LED Market Share Predictions, by Channel, Assuming NO Program

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	2022
1. Club [Sams Club, Costco]	__%
2. Home Improvement [Lowes, Home Depot]	__%
3. Mass Merchandisers [Target, Walmart]	__%
4. Discount/Dollar	__%
5. Small Hardware [ACE/True Value, Independent Hardware]	__%
6. Specialty Stores [Batteries Plus]	__%
7. Grocery [King Soopers, Safeway]	__%

Future of Lighting

DOE Rulemaking on EISA Phase 2 Implementation: In two rules dated December 29, 2016 and published January 18, 2017, the DOE expanded the definition of *general service lamp* to include many specialty bulbs that had previously been exempt from EISA, such as reflectors. As it now stands, on January 1, 2020, all general service lamps, according to the expanded definition, should meet a 45 lumens/watt standard. The DOE did indicate some flexibility in meeting this deadline, particularly for reflector lamps. However, a budget rider remains in effect that bars Congress from allocating funds towards EISA enforcement.

B51)   There is currently much debate on whether DOE will uphold the EISA backstop provision in 2020 that will require bulbs to produce at least 45 lumens per watt. Are you aware of this debate? [IF NO – then SKIP TO B55)] –

What is your stance on this backstop? Do you think it will come into effect in 2020?

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

B52)   (If not addressed in B51) What is your expectation surrounding the expanded EISA general service lamp definition, which would include specialty and reflector bulbs in the backstop requirement? Do you think this will come into effect?

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

B53)   In what ways, if any, is your company preparing for the EISA backstop?

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

B54) What impact do you expect the EISA backstop will have on the market (for consumers and programs like XCEL ENERGY)?

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

B55) We are also interested in your outlook in general – outside of the backstop. What do you see as the primary changes or developments you expect to see in the lighting market over the next couple years, and what are the primary drivers behind these changes? [PROBE: What are retailers identifying as market trends over the next couple years?]

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

B56) Do you expect the cost of A-line LEDs to continue to go down, increase, or remain about the same for the next three years?

1. LED prices will decrease
2. LED prices will increase
3. LED prices will remain about the same_____
98.DON'T KNOW
99. REFUSED

B57) What about specialty bulbs? Do you expect the cost of specialty LEDs to continue to go down, increase, or remain about the same for the next three years?

1. LED prices will decrease
2. LED prices will increase
3. LED prices will remain about the same_____

B58) As you may know we are also pulling together retail lighting sales for screw-based lamps by state, and our finding that in 2017 approximately 27% of all lamps sold in non-program states are LEDs, compared to 42% LED market share in states with utility sponsored programs. Do you think the efforts of the utilities in program states have impacted the sales of LEDs in non-program states?

    1. Yes
    2. No
    98.DON'T KNOW
    99. REFUSED

(If B58=Yes then ask)

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B59)　What do you think the LED market share would have been in the non-program states if the utilities had not supported LEDs in the program states?

＿＿＿ Enter % (if greater than Q1a ask: Why do you think market share in non-program states would be higher if utility sponsored programs had not existed)

98.DON'T KNOW
99. REFUSED

Section F: Program Satisfaction

B60)   We understand there have been a number of changes to the lighting market over the
last decade. Are their areas you feel customers are ill-informed when it comes to
home lighting?

1. Yes [RECORD]
2. No
98.   DON'T KNOW
99. REFUSED

B61)   What educational efforts are you employing to educate customers on the benefits of
LEDs, if any?

1. [RECORD]
2. None
98.   DON'T KNOW
99. REFUSED

B62)   What educational efforts are you employing to educate customers on who to
choose the right LED for their home or office, if any?

1. [RECORD]
2. None
98.   DON'T KNOW
99. REFUSED

B63)   What methods to you find most effective for educating customers?

1. [RECORD]
98.   DON'T KNOW
99. REFUSED

B64)   What educational efforts are you employing to educate retailers and retail staff
on LEDs?

1. [RECORD]
2. None
98.   DON'T KNOW
99. REFUSED

B65)   How do you differentiate *your* LEDs from those made by other manufacturers?

1. [RECORD]
98.   DON'T KNOW

99. REFUSED

B66)   Are there any changes you would recommend to improve the current Colorado Xcel
Energy Home Lighting program?

1. Yes [RECORD]
2. No
98. DON'T KNOW
99. REFUSED

B67)   On a scale of 0 to 10, where 0 is "not at all satisfied" and 10 is "extremely satisfied,"
how would you rate your overall satisfaction with the Colorado Xcel Energy Home
Lighting Product program?

1. [RECORD 0-10]_____
98.DON'T KNOW
99. REFUSED

Why did you give the program that rating?

B68)   On a scale of 0 to 10, where 0 is "not at all satisfied" and 10 is "extremely satisfied,"
how would you rate your overall satisfaction in working with Xcel Energy
representatives?

1. [RECORD 0-10]_____
98.DON'T KNOW
99. REFUSED

Why do you say that?

B69)   Is there any additional support or resources you would like Xcel Energy to offer
manufacturers as part of this program?

1. [RECORD]_____
98.DON'T KNOW
99. REFUSED

Conclusion
Do you have any final questions, comments, or feedback on the Colorado Xcel Energy Home Lighting
Product program**?**

1. Yes **[RECORD]**
2. No
98. DON'T KNOW
99. REFUSED

B.3   Peer Utility Program Benchmarking Guide

Introduction

To support the process and impact evaluation of the 2017 Xcel Energy energy efficiency programs, the EMI Consulting evaluation team will benchmark the Xcel Energy programs against peer utilities. The objective of the benchmarking is to identify opportunities to improve the Xcel Energy programs based on a comparison of peer utility programs' design, delivery, and processes. In addition, benchmarking allows the evaluation team to understand the performance of the program in context with the performance of other utilities. To conduct the benchmarking, the evaluation team will conduct secondary research on the peer utilities identified and perform in-depth interviews with program managers at the peer utilities.

This document presents the in-depth interview guide for peer utility Home Lighting Product. Table 25 identifies the interview questions related to each key performance indicator. Table 26 identified the interview questions related to each contextual theme.

This interview is being conducted with a set of approximately 6 of Xcel Energy's peer utilities. Target respondents are managers of home lighting energy efficiency programs.

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Table 25: Mapping of interview questions to indicators

Key Performance Indicator	Data Needed	Interview Question
Program Structure	• Upstream / Downstream / Midstream Direct Install • Types of products offered • Target markets	A1, A2
Savings calculations	• Baseline bulb types/ wattage	A2c
Forward Looking Programs	• Plans for program structure, products going forward • Expectations regarding EISA backstop and expanded GSL definition	B1-B4
Net-to-gross ratios (NTGRs)	• NTG values estimated at program level or measure level	A3

Table 26: Mapping of interview questions to contextual themes

Contextual themes	Data Needed	Interview Question
Net-to-gross (NTG) savings approach	• NTG ratio applied currently and prospectively	A3
Program description	• Overall program objectives, implementation strategies, customer types targeted for participation • Product baselines assumed for savings calculations • List of measures offered	A1, A2
Forward looking program design	• Expectations regarding EISA backstop adoption • Expectations regarding DOE expanded bulb definition • Planned changes to lighting program	B1-B4

Recruiting Instructions

The research team plans to send advance emails to any program managers with available emails. The email will contain an explanation of the research, as well as both an Xcel Energy and EMI Consulting contact person the utility can reach out to if they have additional questions or would like to schedule an interview at their convenience.

Potential respondents will be recruited by consultants on the research team who will be conducting interviews and have been trained on the purpose and goals of the Home Lighting product qualitative research. The research team will be as flexible as possible in scheduling these interviews, including scheduling early morning or evening interviews when possible to accommodate busy utility schedules. The research team will leave a voicemail or receptionist message on the first attempt whenever possible, and then use discretion to determine any additional messages left on subsequent attempts. The research team will strive to attempt to contact each peer utility a minimum of 4 times before giving up on that particular contact, but depending on each unique situation, the research team may need to attempt some contacts more times to ultimately reach the correct person.

Interview

Introduction/Recruitment

INTRO 1   Hello, this is INTERVIEWER NAME, calling from Apex Analytics on behalf of Xcel Energy. Is CONTACT NAME available?

INTRO 2   We are working with Xcel Energy on a benchmarking and best practices study for their Home Lighting energy efficiency programs. As part of this study, we are reaching out to leaders of lighting programs to learn about innovative programs and best practices in the field.

We would like to include UTILITY in this study, as your lighting program has been identified as an [innovative/peer] program. We would like to spend some time talking with you about your lighting program's design and implementation, as well as your plans for future lighting programs.

[IF NEEDED:] We will not be requesting any customer or participant data.

INTRO 3   Can we include your utility in the study?

a.   Yes [**RECORD CONTACT INFORMATION; SETUP INTERVIEW TIME; EMAIL INTERVIEW TOPICS**]
b.   No [**DISCUSS CONCERNS; ANSWER QUESTIONS**]

Section A: KPIs/Program Design

A1.   First, we'd like to talk through the basic design and organization of your program. [**ASK/CONFIRM BASED ON HOLES IN BACKGROUND RESEARCH ON PROGRAM**]

Can you describe your lighting program at a high level?

a.   Is your program run by utility staff or a third-party implementer?

b.   How are your lighting incentives offered? (Upstream? Midstream? Downstream? Direct install? Giveaways)

c.   Do you know what % of your current bulbs sales are A line vs. specialty? Do you expect that ration to stay the same over the next 3-5 years?

d.   What was your 2017 savings goal for this program?

e.   What percent of lightbulbs is assumed to go to non-residential applications?

A2.   Next, I'd like to talk about your program's incentives for 2018.

a.   What types of measures do you offer? [**PROBE:** LEDs – standard/specialty; smart lighting, TLEDs]

a.   Do you require lighting products to be energy star certified?

b.   What baseline did you use for the 2018 program year? (halogen? CFL? Blended?)

   a. Does the baseline vary by program method? (Direct install vs upstream)

   b. Does the baseline vary by lighting type? (standard vs specialty)

   c. What baseline do you plan to use if the Backstop is triggered?

c.   Do you have any target customer segments or retailer focus for this program?

d. How do you determine your incentive level per bulb and is there a cap? What I'm trying to find out if they have a cap they use like rebates can't be more than 60% of incremental cost or XX% of retail price.

A3.   What net-to-gross ratio is your program currently claiming for 2018?

a. Does this ratio vary by implementation type or product or segment (i.e. low income)? If so, what are the different NTGRs?

b. What program year(s) is that net-to gross ratio applied?

c. Do you have a different, prospectively applied net-to-gross ratio?

Section B: Forward Looking Program Design

Next, I'd like to talk about the future of your lighting program, particularly with respect to the changing lighting standard potentially occurring in 2020.

B1.   As you are likely aware, DOE recently completed a rulemaking that expanded the definition of general service lamps to include most light bulbs (regardless of shape, brightness, and function) and kept the *backstop* in place that would bar the manufacturing and import of non-compliant bulbs starting in January 2020.

a. On a scale of 0 to 10, where 0 is not at all likely and 10 is extremely likely, how likely is it that the expanded general service lamp definition will be adopted in January 2020?

b. Why do you think so?

c. Are you adjusting your program practices based on this expanded definition of general service bulbs? Why or why not?
   i. If yes, what changes are you making?

B2.   According to the original EISA legislation, on January 1, 2020, all general service lamps (based on the original criteria) must meet a 45 lumens/watt standard. Lamps that don't meet that standard can no longer be manufactured or imported into the United States.

    a.   On a scale of 0 to 10, where 0 is not at all likely and 10 is extremely likely, how likely is it that the 2020 backstop will be fully adopted in January 2020?

        i.   Why do you think so?

    b.   On a scale of 0 to 10, where 0 is not at all likely and 10 is extremely likely, how likely is it that the 2020 backstop will be completely repealed?

        i.   Why do you think so?

    c.   On the same scale from 0 to 10, how likely is it that the backstop will be adopted with modifications?

        i.   Why do you think so?

        ii.   What modifications to you anticipate?

    d.   On the same scale from 0 to 10, how likely is it that the backstop barring import and sales of noncompliant lamps will be *enforced* starting January 2020?

        i.   Why do you think so?

    e.   Are you adjusting your program practices based on the EISA backstop? Why or why not?

        i.   If yes, what changes are you planning? When are you planning to implement these?

B3.   Do you think halogen or incandescent lamps will generally remain on most store shelves after 2020?

    a.   Why do you think so? [PROBE FOR: legally or illegally remain on store shelves; enforcement or lack thereof or exemption work around (specify type) allowing lamps to stay on retail shelves]

    b.   Are you assuming a sell through period into your future lighting programs?

        a.   How long is your assumed sell through period?

B4.   Are you planning to make changes to your lighting programs in 2020 and beyond? What changes are you planning? [ADJUST QUESTIONS BASED ON ANSWERS ABOVE]

    a.   Any changes to types of products offered? (standard/specialty/LEDs/others)

    b.   Changes to goals?

    c.   Changes to baseline/savings?

    d.   Changes to incentives?

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e.   When will these program changes come into effect? (Is there a gradual phase in for these updates?)

f.   Changes to target segments or retailers?

g.   Changes to implementation method? (upstream to DI, for example)

B5.   How do you stay abreast of legislative changes to lighting standards? What sources of information do you rely on?

Section D: Marketing

D1.   What marketing do you use to promote energy efficient lighting to the consumer, if any?

D2.   (IF NOT MENTIONED) What marketing do you use at retail stores, if any?

D3.   Do you feel that your customers know what to look for when buying an LED (i.e. are able to determine what lumens and color temperature are the best for them)? If not, are you addressing those educational needs? How are you addressing them?

D4.   What tactics do you use to increase achievement in a short time?   For example, do you have any short term promotional activities that you use like "buy one get one" or something else? Do you have any creative promotions that have worked well for your program?

Section E: Closing

E1.   Great! Thank you so much for your time. Those are all the questions we have for you today. Before we finish, do you have any questions for me, or anything else you would like to add?

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Appendix C: STAFF INTERVIEW FINDINGS

This memo provides summative notes from discussions with CO Home Lighting program staff as part of the 2018 evaluation cycle. To support the process and impact evaluation of the 2017 Xcel Energy efficiency programs, members of the EMI Consulting evaluation team from Apex Analytics, LLC interviewed key staffing managing and implementing the Home Lighting program. These interviews include the following staff:

- Product Managers
- Implementers
- Lighting Team Engineer
- Lighting Team Lead

This memo contains our summary of the key takeaways, a description of the product, an inventory of the product's strengths and barriers, and feedback on evaluation priorities.

C.1 Key Takeaways

The following bullets present key takeaways from staff experiences with the Home Lighting program. These key takeaways provide a summary of the program context and feedback received during both the kick-off meeting and the subsequent staff interviews.

- Program has effective and mature partnerships between Xcel and the program implementer, as well as with retailers and manufacturers.
- The program has met or exceeded goals over the past several years. It is a flexible offering, making substantial changes due to market shifts and price changes.
- There is uncertainty for the program, given lighting standards and market transformation of LED technology.

C.2 Product Description

The following bullets present the evaluation team's understanding of the product based on staff interview results and review of available program documentation.

- The Program has Savings Goals: kWh and kW goals (which are typically overachieved)
- This year (2018) the focus has moved to societal net benefits and cost-effectiveness goals.
- Agreement with goals defined in kickoff meeting
- Additional Program Goals: to serve as a resource for other residential programs by knowing the lighting industry and understanding the future of it
- Program Resources: for this program, most resources are external (WECC specifically). Internal resources relied upon are marketing departments, product managers, and engineering staff.
- WECC implements all home lighting programs for Xcel and has been working with Xcel for over 4 years. WECC and Xcel have a strong working relationship and Xcel relies on WECC staff knowledge and industry relationships to achieve program success.

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- Program uses a rebate automatically applied at register, which is easiest for the retailer, seamless for the customer). The program limits the bulbs to 12 items or bulbs per transaction.
- Program is implemented through differed retail channels such as clubs, home improvement centers, specialty retailers, mass retailers (Walmart). Program includes a field team that meets with retailers to explain the program to the retailer's lead person in the lighting aisle. Program staff visit retailers at least 2x/year, with some (more challenging stores) more than 5 times per year.
- Program promotes Energy Star Bulbs, focus on pushing the envelope of lighting efficiency and technologies. Program places importance on educating retailers and customers. Program works to ensure that customers know that Xcel is sponsoring the program.
- Program has changed quickly to adjust to changes in the market, including shift from CFLs to LEDs, as well as price and technology changes for LEDs. Program is currently researching which bulbs bring in the highest savings.
- Program collects data such as units and total incentives paid by retailer by bulb type, as well as bulb attributes including Wattage and Wattage equivalent.
- Xcel has its own marketing team that designs billboards, TV ads, POP materials, beam stickers, educational materials, aisle signs. This group also does advertising campaigns, delivery guides, TV specific lighting commercial, radio, newspaper. WECC is partner in this process, but Xcel leads. Xcel has an effective program website, which has a store finder that lists out the bulbs available through the program.
- Within Xcel, team is cross-functional with multiple disciplines, including program staff, marketing and engineering, under a single manager. Reported to be effective.
- The only team that has the mixed group. Only team where multilple disciplines under one manager. PMs, mark, marketing assistant Neal, engineer

C.3 Strengths and Barriers

During interviews, staff identified the following strengths and barriers to implementing this product in 2017 and at the time of the interview. Strengths include factors that product staff identified as supporting the success of the product; barriers include factors that product staff identified as preventing the product from reaching its goals.

C.3.1 Strengths

- Multiple interviewees noted the strong relationships between Xcel and the implementer. Work in close partnership to plan the program, achieve goals and adjust to market needs. High levels of communication were reported to be effective. Program forecasting has been accurate and has met or exceeded goals consistently. Reporting is on-time and accurate
- Program has strong and consistent relationships with retailers and manufacturers. Program is good at overcoming barriers for retailers to participate.
- Program has been flexible with market changes and to the needs of the portfolio. When the portfolio has a need for savings, the lighting program can quickly offer a promotional event and achieve more savings.
- The program has moved the market over time, by encouraging higher efficiency and higher quality lighting.

- Interdisciplinary lighting team is effective at working together, engaging everyone and handling the pressure of constantly changing market and program.

C.3.2   Barriers

- It can be difficult to work with different retailers, all who have different rules and needs. It is becoming more difficult to have utility-sponsored materials and signs, due to "clean aisle" policies. This can make customers aware of Xcel sponsorship difficult. It can also be difficult to attract new retailers.
- There is uncertainty for the future of the program given changes in standards and the LED market. Market for LEDs is changing so quickly and customers' approach to LEDs is different than CFLs. There is a pull in the market for LEDs that the program must keep up with. With the longer life product, programs are at risk; lighting aisles are shrinking. Team must consider what is next.

C.4   Feedback on Evaluation Priorities

During interviews, staff identified research topics they would like the evaluation to address. The following bullets compile these topics along with additional topics that the evaluation team identified based on staff interview findings. The evaluation team will consider these research topics when prioritizing portfolio-wide evaluation needs and as able, incorporate them into the final evaluation plan for the 2017 Home Lighting program. The EMI Consulting team will deliver this plan in March. In general, there was agreement with the evaluation priorities listed during the interviews, with the following adjustments or highlights:

- Team is interested in knowing from customers the following: free ridership, how they heard about LEDs, why the customer is purchasing an LED, leakage, HOU, saturation, types of bulbs in homes. Yet, awareness is not a high priority
- From retailers/manufacturers, program would like to know how they perceive Xcel and WECC.
- Program would like to know which segments have the most savings potential, with a close look at low-income segments and what other bulbs have been successful in other utility programs.
- In the past, intercept surveys were time consuming, logistically difficult and risked relationships with retailers
- Team is interested in how to maximize consumer connection between Xcel and their upstream lighting rebates.
- There is some interest in understanding what other implementers are doing going forward.

Appendix D: LIGHTING SUPPLIER INTERVIEW FINDINGS

To support the process and impact evaluation of the 2017 Xcel Energy efficiency programs, the EMI Consulting evaluation team conducted telephone interviews with seven participating lighting manufacturers and one partner retailer, exploring their experiences managing and implementing the Colorado Xcel Home Lighting Product Program. The interview objectives were:

- Explore opportunities for new technologies, where partners expect the lighting market to grow, and what changes they expect in legislation
- Identify what partners estimate for retrospective NTG ratio and what they expect for NTG ratios moving forward
- Quantify what partners expect for NTG ratios for segments/channels/bulb types

The interview objectives that address NTG are captured in the main report (Section 2.1). A summary of findings is presented below, and further details are provided in the main report.

This memo contains our summary of the key takeaways, a description of the product, an inventory of the product's strengths and barriers, and feedback on evaluation priorities.

D.1 Key Takeaways

The following bullets present key takeaways from lighting suppliers with the Home Lighting program. These key takeaways provide a summary of the program context and feedback received during staff interviews:

- Respondents identified connectivity, lighting controls, and fixtures as the primary areas in which they expect the lighting market to grow over the next few years.
- Respondent perspectives on the likelihood of EISA backstop being enacted vary. Half (50%) of the respondents are uncertain, 25% believe it has already happened, and 25% believe it is not going to be enacted.
- All respondents that believe EISA backstop has already been triggered or that anticipate it being enacted have begun to prepare in the following ways: transitioning to connected bulbs, transitioning manufacturing from halogens to LEDs, and making plans to meet the backstop requirements.
- Two-thirds of respondents believed the GSL expansion will not be enacted in its present form.

D.2 Strengths and Barriers

During interviews, staff identified the following strengths and barriers to implementing this product in 2017 and at the time of the interview. Strengths include factors that product staff identified as supporting the success of the product; barriers include factors that product staff identified as preventing the product from reaching its goals.

D.2.1   Strengths (and Benefits)

- The program significantly increases the amount of LED bulbs sold in Colorado and increases consumer awareness of energy efficient products.

- Incentives from the program allow access to LED bulbs for populations who might otherwise only be able to or only be interested in cheaper bulbs.
- The program increases the amount of people who have been exposed to and now utilize LED bulbs, providing a bigger pool of people to proselytize in their communities.
- Strong working relationships with Xcel and/or WEC, as well as a realistic and straightforward program design, make the Home Lighting Product Program one of the best each of the respondents gets to work with each year.
- The program allows manufacturers and retailers to build relationships with each other, as well as the utilities, while building brand exposure and helping to reduce energy consumption.
- Through the incentives, high-quality bulbs are able to be sold at a more accessible price for consumers, preventing an influx of poorly made bulbs more naturally at that price point.

D.2.2 Barriers (and Recommendations)

- Reductions in incentive levels, as well as the removal of some previously included bulbs, make it difficult for manufacturers and retailers to plan from year to year.
- In-demand items are currently absent from the portfolio.
- Customer ignorance and apathy regarding lightbulbs makes education important, yet difficult.
- Suggestions for new lighting technologies that the program could promote were in areas of connectivity (smart lighting) and lighting fixtures.

D.3 Market Trends

D.3.1 Current Market State

This section summarizes key findings on where manufacturers sell their products and the types of products they sell. All manufacturers interviewed manufacture only LEDs, and they all manufacture standard LEDs, LED reflectors, and specialty LEDs. The one retailer interviewed stocks the three types of light bulbs in question (CFL, LED, and halogen/incandescent) in all of the styles in question (standard, reflector and specialty).

Most manufacturers interviewed sell program light bulbs primarily at home improvement stores (e.g., Home Depot or Lowe's) and/or mass merchandiser stores (e.g., Wal-Mart or Target). There were three manufacturers interviewed that sell program bulbs through only one retailer (either home improvement stores or mass merchandiser stores). Two manufacturers also sell program bulbs at smaller hardware stores and discount/dollar stores. One manufacturer sells program bulbs at all of the retailer channels already mentioned, and additionally at grocery and drug stores.

D.3.2 Future of Lighting

Respondents identified connectivity, lighting controls, and fixtures as the primary areas in which they expect the lighting market to grow over the next few years. Two-thirds of respondents expect prices of A-lines to remain the same; the other third expects prices to continue to decrease. All respondents expect specialty bulb prices to decrease.

When it comes to the future of lighting legislation, respondent perspectives on the likelihood of EISA backstop being enacted vary. Half (50%) of the respondents are uncertain, 25% believe it has already happened, and 25% believe it is not going to be enacted. All respondents that believe EISA backstop has already been triggered or that anticipate it being enacted. Despite the uncertainty surrounding EISA, manufacturers are planning for it to come into effect. For example, one stated they have "revised (their) product mix" and another two are "proceeding with manufacturing, shelf placements, product labeling as if it will happen." Two-thirds of respondents believed the GSL expansion will not be enacted in its present form.

D.4   Marketing

D.4.1   Educational Efforts

Manufacturers agree that the typical customer focuses on the wattage of a light bulb, whereas the manufactures prefer the customer to focus on lumen output. Since LEDs already have such low wattage (compared to halogen and incandescent technologies), in order to differentiate between LED products, there needs to be a shift to focus on other light bulb attributes. Another misconception around LEDs is that customers believed LEDs to be similar to the early-on CFLs that were introduced to the market and widely rejected. In general, manufacturers agree that lighting is confusing to the customer, which makes the decision process overwhelming. There is a need to correctly inform the customers of the differing attributes that make up a light bulb (temperature, lumen output etc.) so that the customer can end up with a product that better matches their need and better matches the lighting products that are being replaced.

Despite the misconceptions around LEDs, manufacturers are ultimately interested in getting LEDs into customers' homes. Therefore, any education effort aimed at customers tends to focus on the benefits of LEDs versus the different attributes that make up an LED. One manufacturer believes that by just getting one LED into someone's home is the most effective way to demonstrate the benefits of LEDs (through first-hand experience). A couple of manufacturers shared that they either conduct demonstrations or install interactive displays at retail stores, where the customer can see each type of light bulb (CFL, LED and halogen/incandescent) in operation side-by-side, and have found them effective in getting customers to purchase LEDs during that visit.

Manufacturers also conduct one-on-one education trainings with store owners or managers. These trainings are more in-depth and carry the objective of training the owner/manager well enough so that they can conduct training with their own staff. The goal of these trainings is to have a knowledgeable staff on the wide-range of benefits of LEDs accessible to customers when shopping in the stores Manufacturers have found that stores with high staff turnover face challenges in reaching this goal. Whereas stores with a more consistent staffing have higher success in educating staff (and therefore customers) on the benefits of LEDs.

D.4.2   Customer Expansion Efforts

Respondents provided ways Xcel Energy could help hard to reach populations purchase efficient lighting technologies. Responses provided differed on this topic, so the following list captures the main themes provided across the pool of respondents:
- Broadcast online educational videos that relay the benefits of efficient lighting against standard lighting
- Provide the same products online as provided in stores

- Target non-big-box stores to reach low-income and first-generation populations. These two populations tend to shop more locally (at grocery, dollar and discount stores), as transportation to larger shopping areas can be an issue.
- Conduct outreach events in local venues
- Xcel Energy should continue to target new retailers and new customer segments.

D.5   Program Satisfaction

Overall, respondents reported high satisfaction with the program. All respondents gave a satisfaction rating of 8 or higher on a 0 to 10-point scaled. They believe the program is run well, and relationships and communication with the program managers are above satisfactory. One respondent shared that they "are always paid on time." The only explanation provided as to why the satisfaction rating was not any higher was due to the incentives levels and available program funding reducing.

Overall, respondents rated their satisfaction with Xcel Energy representatives slightly higher than their satisfaction with the program. Respondents feel WECC is very responsive, very realistic, very competent with processing incentives and payments, and "progressive with what they push."

D.6   Net-to-Gross Findings

The lighting supplier NTG responses were intended to supplement the Sales Data Model as a secondary data point for estimating the retrospective NTGR, in addition to investigating future LED sales trends and NTGR. The interviews assessed the retrospective and prospective NTGR by asking about market share by lamp technology with and without the program (e.g., if the program were to end, what would the trajectory of LED market share look like"). An important advantage of these interviews is they explored, where possible, differences in LED past and future market share, as well as reasons behind those differences. The qualitative insight from the interviews are intended to provide important context behind the more quantitative Sales Data and Market Models in the main report. Table 27 indicates the percent of 2017 program bulbs represented for the respondents in each NTGR.

Table 27. Percent of 2017 Bulbs Represented in Each Prospective NTGR, by Bulb Type

Bulb Type	2017	2020	2022
A-Line	34%	46%	46%
Reflectors		7%	

The decreasing NTGR shown in the table below is indicative of a market transformation toward LEDs and expected efficiency standards for lighting (Table **Error! No text of specified style in document.**-28). For example, some manufacturers believe that the EISA backstop will be enacted and LEDs will be "the only thing anybody is selling." Another manufacturer stated they are planning to manufacturer 100% LEDs for all bulb types starting in 2019 based on the EISA backstop. However, the fact that there is some increase in market share resulting from program intervention indicates that at least some of the manufacturers are not planning on EISA being enacted until after 2022, or are unsure if it will be enacted at all.

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Table Error! No text of specified style in document.-28. Manufacturer Prospective NTGR, by Bulb Type

Bulb Type	2017	2020	2022
A-Line	74%	61%	61%
Reflectors		53%	

Appendix E: BENCHMARKING RESEARCH FINDINGS

E.1 Approach

To support the process and impact evaluation of the 2018 Xcel Energy Home Lighting Product, the EMI Consulting evaluation team benchmarked the Xcel Energy programs against four peer utilities. The objective of benchmarking was to identify opportunities to improve the Xcel Energy programs based on a comparison of peer utility programs' design, delivery, and processes. In addition, benchmarking allowed the evaluation team to hear directly from peer utilities regarding their predictions for EISA 2020 legislation, and how they plan to adapt their residential lighting program offerings in response to anticipated forthcoming regulations. To conduct this benchmarking exercise, the evaluation team spoke at length with residential program managers at four peer utilities Xcel Energy identified based on their comparable program structure.

In the following sections, we first provide an overview of the peer utility programs included in this research. We then compare these programs across several dimensions. We compare program design models, including measure types, incentive structure, marketing approaches, and planned program changes looking toward 2020 and beyond. Finally, we compare the program performance, using key indicators such as budget, energy savings, and net-to-gross ratios.

E.2 Comparison of Program Design Elements

In this section, we discuss each program in more detail, and compare programs in terms of program design.[9]

E.2.1 High-Level Program Descriptions

Xcel Energy uses a third party implementer to administer their residential lighting program. Three of the four residential lighting programs were run by third party implementers, with one using both internal utility staff for program management and an implementation firm for most of the field work.

All four programs use a primarily upstream program model, as Xcel Energy does, working with manufacturers, distributors, and retailers to provide mark-downs on qualifying lighting products. One of the four referred to their program as "downstream" because the discount was given to the customer at the time of purchase; however, the discount was negotiated through upstream partnerships with participating manufacturers and retailers.

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[9] These utility names have been anonymized.

E.2.2   Program Design Elements

In this section we provide a brief discussion on the types of measures currently offered by each program, their incentive structures, as well as program marketing, education, and promotional approaches.

Table 29. Description of Program Elements

Program Element	Xcel Energy	Utility #1	Utility #2	Utility #3	Utility #4
Measures Offered	A-Line, Specialty, Fixtures	A-Line, Specialty, Smart Products	A-line, Specialty, Retrofit trim kits, Fixtures with integrated lighting	A-line, Specialty, Retrofit trim kits	A-line, Specialty, TLEDs, Smart Products
2018 Baseline	Halogen	Halogen	Halogen	Standard – Halogen Specialty - Incandescent	Blended – Incandescent, Halogen, CFL[10]
Targeted Segments	All residential, including HTR	Hard-to-Reach (HTR)	All residential. Higher incentives for HTR	All residential	All retail outlets and channels, including HTR
Incentive Structure	Upstream	Upstream MOU with retailers and manufacturers	Combination Upstream-Downstream: Partnerships with manufacturers and retailers. Rebate given at time of purchase.	Upstream	Upstream and Direct Install
ENERGY STAR required?	Yes	Yes	Yes	Yes	Yes
Incentive Cap	50% of retail cost[11]	Target final retail price of $2/bulb	Target lowest retail price of $1-2/bulb, except income eligible	No cap. Try to limit to no more than half of retail price.	Must not exceed 85% of wholesale cost and should not exceed 70% of retail.[12]
Marketing to Customer	Ad campaigns, social media, bill inserts, postcard	Home Energy Reports, bill inserts, website	Bill inserts, ad campaigns, website	Social media, newsletters, website	Email, social media
Marketing at Retail	POP signage, in-store educational collateral	POP signage, utility branded products	POP signage	POP signage, demonstrations	POP signage, special events, short-term campaigns
Customer Education	Tools such as "How to buy LED" video and postcard	Focus on low-income, in-store events	Direct mail, in-store events	Updated website, in-store signage emphasizing ENERGY STAR	Educate retail staff, provide brochures to stores
Short-term promotions?	Yes	No	No	Yes	Yes

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E.2.3   Measures Offered and Targeted Segments

The four interviewed utilities, like Xcel Energy, offer a variety of products through their programs, with all offering A-line and specialty bulbs.

Only one utility specifically identified a program focus of targeting their state's hard-to-reach population, while the other three stated that they target all residential customers, retail outlets, and channels possible. Although not stated as a specific focus, two of these three offer higher incentive amounts for hard-to-reach populations.

E.2.4   Incentives

As with Xcel Energy, all four interviewed utilities use an upstream incentive model, although one said the customers receive the rebate at time of purchase – thus calling it downstream – though the rebates are determined through manufacturer partnerships.

Xcel Energy currently puts an incentive cap on their residential lighting products at 50% of retail cost. Only one interviewed utility (#4) specified requiring an incentive cap of 85% of wholesale cost. One utility explicitly stated they have no incentive cap. The other two said they don't have required caps, but they do have targets of final retail price between $1-2/bulb.

E.2.5   Marketing

Xcel Energy uses a variety of marking approaches to promote their residential lighting program, including multimedia advertising campaigns (TV, radio, print), social media, direct mail, and in-store signage and education. Similarly, all four utility program managers we spoke with used a robust combination of direct marketing to customers, as well as retail-based point-of-purchase signage and promotional events. Two utilities specified sending out bill inserts. All four (like Xcel Energy) utilized a variety of digital marketing channels, such as email, social media, and their respective websites.

All the utilities utilized in-store signage and two also held promotional and educational events in their partnering retail outlets.

Xcel Energy has used short-term promotional strategies to promote its residential lighting products, including a limited time increased incentive. Of the four utilities we interviewed, two also made use of short-term promotional activities to drive up program interest and participation within specified timeframes, while the other two did not use this tactic.

E.3   Comparison of Key Program Performance Indicators

In this section we provide a brief description of three types of program performance metrics: Savings claims, net-to-gross ratios (NTGRs), and the estimated percentage of incented residential lighting product that went to nonresidential applications.

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[10] Based on assumed market shares, not what is actually removed.
[11] Xcel Energy is working to change this to 75% of incremental cost for A-lines and 85% of incremental cost for specialty bulbs.
[12] No retail floor, but "comfort zone" of retail around $1/bulb after incentive.

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Table 30. Program Performance Indicators by Utility

Indicators	Xcel Energy	Utility #1	Utility #2	Utility #3	Utility #4
2017 Savings Goal (MWh)	90,000	10,000	217,565	32,000	2.4 Million
2018 Net-to-Gross Ratio	0.91	0.6	0.58 (bulbs) – 0.73 (fixtures)	0.85	0.7 (bulbs) – 0.89 (fixtures)
% of Lighting Product Estimated to Nonresidential	6%	<10%	5%	Did not specify	7%

E.3.1 Net-to-gross ratios

The four utilities we interviewed reported net-to-gross ratios between 0.58 and 0.89 for their residential lighting programs. Two utilities differentiated their NTGR between bulbs and fixtures, with bulbs representing a lower NTGR than fixtures in both cases. One utility operated its program in two states, and reported gross savings to one of the two states, and a NTGR of 0.85 to the other.

E.3.2 Savin gs Goals

Xcel Energy's 2017 savings goal for residential lighting was 90,000 MWh. Savings goals for each of the four utilities we spoke with varied widely, from 10,000 MWh to over two million MWh for program year 2017. In the case of Utility #2 and #4 (the larger two MWh goals) the program managers specified these as lifetime savings goals. The other two utilities did not specify whether their savings goals represented lifetime savings. In addition, Utility #4 claims upward of 90% of all the efficient lighting sold in their state, which results in a high savings target.

E.4 Utility Predictions for EISA Legislation

One of Xcel Energy's key objectives from this benchmarking research was to learn how other utility program managers view impending EISA legislation. This legislation, as originally drafted, states that on January 1, 2020, all general service lamps (based on the original criteria) must meet a 45 lumens/watt standard. According to the legislation, lamps that don't meet that standard would no longer be permitted to be manufactured or imported into the United States after Janaury 1, 2020.

There is a lot of uncertainty in the energy efficiency industry surrounding EISA, including mixed opinions about whether, and when, the legislation will be enacted as written. Therefore, we asked the four utility program managers to predict the likelihood that the EISA backstop will be triggered in 2020. Three of the four think it's very unlikely, while one believes it will be triggered on schedule – this utility plans to eliminate their residential lighting program in 2020.

We also asked utilities about DOE's recent rulemaking that expanded the General Service Lamp (GSL) definition to include most light bulbs (regardless of shape, brightness, and function). When asked to rate the likelihood that the GSL will be adopted in January, 2020, once again the same three out of four utilities thought the likelihood was low.

The one utility who thought the EISA backstop and the expanded GSL definition were likely to go through as planned received information from their implementor, who they described as a trusted source of industry information.

The other three utilities described their efforts to closely follow industry activities surrounding EISA. They described a contentious political environment, where the EPA and manufacturers were both working hard to advance their respective, competing agendas. Two utilities also mentioned the National Electrical Manufacturers Association (NEMA) as a key player, lobbying rescind the legislation.

Regardless of what happens with the final ruling, all four utilities, and Xcel Energy, agreed that there would be a sell-through period of at least one year for halogen and incandescent lamps.

E.4.1 Looking Forward: 2020 and Beyond

As noted earlier, one of the four interviewed utilities said it plans to entirely eliminate its residential lighting program.

The remaining three utilities, though skeptical that the EISA backstop will be fully adopted in January of 2020, were all planning adjustments to their residential lighting offerings in response. One utility said, "We're taking a conservative approach." Another said, "We are trying to figure out what our options are, and what we can do…"

Xcel Energy expects to make changes to its program, but is not moving ahead with specific program changes yet, until the final EISA rulemaking occurs.

E.4.2 Changes to Products

One of the changes Xcel Energy expects to make is shifting its promotional efforts to focus more on specialty bulbs, and to limit its promotion of A-line bulbs to hard-to-reach customers. This was similar to what we heard from two utilities, who said their program is assuming A-lines (which currently comprises 2/3 of their program savings) will no longer be incentivized, while another said A-lines will be confined to discount stores targeting hard-to-reach customers.

Among the three utilities planning to keep their lighting programs, all were still unsure what specific products will be included post 2020, but they said they are watching "products getting ready to hit the market in 2019 and what their price points are." These program managers are looking for products that will be exempt from EISA, and are assuming that the criteria for supported products will become more strict, such as having higher lumen per watt requirements.

Two of the four specifically mentioned connected or "smart" lighting products as gaining increased attention.

E.4.3 Changes to Baseline

As stated above, Xcel Energy expects to make changes to its program baseline, but Xcel is not sure what this change will be. Two utilities told us they plan to change their baseline to CFLs, with one specifying that this will only last until CFLs are shown to be "out of the market," at which time the baseline will shift to the least efficient LED. One utility uses a blended baseline of halogens and CFLs, with CFLs gradually decreasing until halogens are the remaining baseline bulb.

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E.4.4   Changes to Savings Goals and Incentives

Like Xcel Energy, two of the three utilities planning beyond 2020 predict savings goals will drop due to a lack of qualifying, cost-effective products. The remaining utility said they believed goals would actually increase, but per unit incentive levels would fall.

Xcel Energy does not currently expect changes to incentive amounts. All three of the program managers planning for 2020 and beyond said they were uncertain about what incentives would like until more is known about the final EISA ruling, and until market conditions in 2020 are known as well.

Appendix F: XCEL ENERGY LIGHTING SALES MODEL

As part of the Colorado Residential Lighting Program, Apex Analytics, along with Demand Side Analytics, developed a national lighting sales model to estimate program administrator attribution for LED market share.[13] The research described below focuses exclusively on estimating the net impacts of the program. This memo describes the objectives, data sources, methods, and findings for the sales data modeling effort.

F.1   Introduction

The lack of reliable and comprehensive sales data has been the "Achilles heel" of upstream-based[14] program evaluations, with lighting programs being the most commonly acknowledged program faced with this issue. Historically, evaluators have attempted to address the lighting sales data challenge with alternative methods to understand program net impacts, including using program sales data to estimate price elasticity of demand, customer intercept and telephone surveys, retailer and manufacturer interviews, Delphi panels, or some combination of all of the above approaches. Ultimately, however, the goal of upstream lighting program evaluation is to measure the increase in sales of efficient lighting (i.e., the "lift") over what would have occurred in absence of the program.

The underlying theory behind the national lighting sales data net-to-gross (NTG) model (the model) is that states that have strong upstream lighting program activity, relative to those with

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[13] Note that the model is part of a multistate effort and included the input and support of other consulting firms.
[14] Note that by "Upstream" the team is referring generically to lighting programs that pay down the cost of lighting equipment to either retailers (midstream) or manufacturers (upstream).

little to no program activity, should have higher market share (via sales) of efficient lighting. The model leverages full category lighting sales data to estimate market lift as a function of program activity, while also controlling for other factors (e.g., household and demographic characteristics) that might also impact efficient lighting sales. The result of the modelling is a comprehensive NTG estimate that captures freeridership, participant spillover, and non-participant spillover.

F.2   Study Objectives

The primary objective of the model is to quantify the relationship between program intensity (e.g., program spending per household) and LED sales (the percent of light bulb purchases that are LEDs), which is then used to estimate a statewide Colorado program NTG ratio.

In addition to estimating the NTG, the data provide helpful insights into what other factors drive purchases of LEDs, plus provide opportunities for benchmarking Colorado lighting efficiency shares and program spending against other states. These additional analyses are also presented in the memo.

F.3   Data Sources

The team leveraged a variety of data sources for the analysis, though relied primarily on sales data prepared by the Consortium for Retail Energy Efficiency Data (CREED).[15] CREED serves as a consortium of program administrators, retailers, and manufacturers working together to collect the necessary data to better plan and evaluate energy efficiency programs. LightTracker is CREED's first initiative, focused on acquiring full-category lighting data, including incandescent, halogen, CFL, and LED bulb types, for all distribution channels in the entire United States. As a consortium, CREED speaks as one voice for program administrators nationwide as they request, collect, and report on the sales data needed by the energy efficiency community.

The sales data were primarily generated from two sources: point-of-of sale (POS) state sales data (representing grocery, drug, dollar, discount, mass merchandiser, and selected club stores) and National Consumer Panel (NCP) state sales data (representing home improvement, hardware, online, and selected club stores). Raw datasets were purchased from third-party vendors, and through a CREED initiative, the team cleaned and processed the data for analysis.[16,17]

Besides the sales data made available through LightTracker, the model inputs are a combination of program data collected by the Evaluation Team and household and demographic data collected through various publicly available websites. A review of the primary model input data sources is listed here, and discussed in more detail below:

- National bulb sales
  - POS data (grocery, drug, dollar, discount, mass merchandiser, and selected club stores)
  - Panel data (home improvement, hardware, online, and selected club stores)

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[15] https://www.creedlighttracker.com

[16] The information contained herein is based in part on data reported by IRI through its Advantage service for, and as interpreted solely by Lighttracker, Inc. Any opinions expressed herein reflect the judgment of Lighttracker Inc. and are subject to change. IRI disclaims liability of any kind arising from the use of this information.

[17] Data presented include LightTracker calculations based in part on data reported by Nielsen through its Strategic Planner and Homescan Services for the lighting category for the 52-week period ending approximately on December 31, 2017, for the available state level markets and Expanded All Outlets Combined (xAOC) and Total Market Channels. Copyright © 2017, Nielsen.

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- U.S. Census Bureau Import data (CFL and LED imports)
- DSM Insights, an E Source database of utility program data
- ENERGY STAR Lighting Program data (utility lighting program budgets)
- ENERGY STAR shipment data (released by the Environmental Protection Agency)
- North American Electrical Manufacturers Association (NEMA) shipment data
- American Community Survey (ACS) data (household characteristics and demographic data)
- Retailer square footage per state (based on the two primary retailer channel data sources)

Lighting Sales

The LightTracker POS data set includes lighting sales data for grocery, drug, dollar, club, and mass market distribution channels. These data represent actual sales that are scanned at the cash register for participating retailers.

The NCP represents a panel of approximately 100,000 residential households that are provided a handheld scanner for their home and instructed to scan in every purchase they make that has a bar code. For Colorado, the NCP included approximately 1,300 households in 2017. The use of a scanner avoids potential "recall bias" that is prevalent in self-report methods that ask about lighting purchases.

Though the dataset the team received included detailed records of lighting data purchases, the data required a considerable effort to ensure data integrity and inclusion of all the necessary bulb attributes. For example, not all records had some of the more critical variables populated, including bulb type, style, wattage, or had clearly erroneous values (e.g., 60 watt LEDs).

After thorough review and quality control of the dataset, the team then re-classified, standardized, populated missing records, created additional variables, and performed general enhancements to the data.

To populate missing records, validate existing records, and include additional bulb attributes, the team created a proprietary Universal Product Code (UPC) database with approximately 36,000 bulbs from five sources:

- Manufacturer product databases provided to LightTracker;
- Product catalogs downloaded from manufacturer web sites via python-code based "web scraping"
- Product offerings downloaded from retailer web sites
- Automated lookups of online UPC databases, such as www.upcitemdb.com
- ENERGY STAR databases available online at https://www.energystar.gov/productfinder/product/certified-light-bulbs

LightTracker then merged our bulb database with the POS/Panel data, populating fields based on a hierarchy of data sources believed to be most reliable. Prioritization was typically based in the following order: manufacturer specifications, UPC lookups, original data provider (IRI and Nielsen) database values. The team also conducted manual web lookups on individual bulbs to determine final assignments.

In addition, the team investigated the bulb assignment and the quantity of bulbs per package by examining the average price per unit and identifying outliers in terms of per bulb prices. This process helped us identify misclassification of certain bulb types (e.g., bulbs that were flagged as low-cost LEDs but were really LED nightlights, so needed to be moved under "other"), as well as bulb counts that represented box shipments (e.g., a package identified as having 36 bulbs was really a six-pack of LEDs that was shipped with six packages

per box). The sales model is restricted to screw-based bulbs, so any bulbs classified as type "other" was not included in the model.

The final model included 42 states, accounting for the smaller states that lacked sufficient sample size from the panel data or had incomplete program data available. Key aspects of the lighting dataset include:

- 2017 sales volume and pricing for CFLs, LEDs, halogens, and incandescent bulbs for all channels combined, and broken out by the POS and non-POS channels
- Data reporting by state (with 48 states included in both POS and non-POS) and bulb type
- Inclusion of all bulb styles (e.g., candelabra, globe, etc.) and controls (e.g., three-way, dimmers, etc.)

As will be discussed below, the dependent variable of the model used percentage of LED sales, rather than total LED sales, to normalize for states with greater/lessor bulb sales (LED or standard) due to differences in number of households, number of sockets, existing saturation of efficient vs. inefficient lamps, and other factors that drive lighting sales.

Program Activity

To research program activity, the Evaluation Team used internal resources and conducted a literature review of publicly available reports found on the internet or provided by program administrators or their evaluators.[18] The Team contacted local utilities in each given area when reports with the relevant information were not available. Additionally, the Evaluation Team accessed DSM Insights, an E Source product that provides a detailed breakdown of program-level spending, including incentives, marketing, and delivery for over 100 program administrators around the country.[19] The program data collection activity included:

- Total number of claimed LED (and, where applicable, CFL) upstream program bulbs reported by each program
- Upstream LED incentives
- Total upstream program budget

Where available, the Evaluation Team leveraged actual program expenditures; otherwise, DSM Insights, ENERGY STAR reported expenditures, planning values, or prior program spending were used as a proxy.[20] The Team aggregated data from each utility by state and assigned a modeling flag to each state based on the source of and confidence in the data provided across all major utilities and program administrators. The aggregated assigned hierarchy flag was weighted based on the number of customers for each program administrator. As an example, any state with program activity provided by the program administrator or publicly available in a report was assigned a "1." A "1" was therefore deemed the most reliable hierarchy of data available. The higher the assigned value, the less confidence the team had in the expenditures estimate. The Evaluation Team was then able to iterate through the model using states with the most accurate data (those with the lowest customer weighted hierarchy score), then to open the model up to including additional states (with higher hierarchy scoring).

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[18] In particular, the Evaluation Team began by searching the ENERGY STAR Summary of Lighting Programs website (https://www.energystar.gov/ia/partners/downloads/2017%20ENERGY%20STAR%20Summary%20of%20Lighting%20Programs. pdf) and referenced the Database of State Incentives for Renewables & Efficiency (www.dsireusa.org).
[19] E Source. "DSM Insights." April 2018.
[20] Note that because the ENERGY STAR report only included expenditure ranges, the midpoints of the ranges were used to represent the expenditures.

To determine the residential lighting program activity in Colorado, the Evaluation Team utilized program data from Xcel Energy as well as other program administrators. This dataset lists the incentives, number and type of program-supported bulbs sold in each utility service area, and overall Program expenditures. The 2017 program values are shown in Table 31.

Table 31. 2017 Residential Upstream Lighting Program Statistics by Utility

Utility	Program Expenses	LED Quantity	LED Incentives
Xcel Energy	$5,130,076	1,787,913	$2,883,395
Other Colorado Program Administrators	$6,144,579	2,003,354	n/a[a]
Total	$11,274,655	3,791,267	n/a

[a]LED Incentives reported only for utilities that provided this granularity.

Presence and Absence of Retailers (Channel Variables)

The Evaluation Team conducted secondary internet research to determine the number and total square footage of store locations in each state for five primary energy efficient bulb retailers: Home Depot, Lowes, Wal-Mart, Costco, and Menards. These data were used as explanatory variables in the model since these retailers sell a large quantity of energy efficient bulbs, thus the percentage of efficient bulbs may differ in states with more or less of these retailers.

State-Level Household and Demographic Characteristics

The Evaluation Team gathered state-level demographic data from the ACS, including annual state-level data for the population, total number of households, household tenure (own versus rent), home age, education, and income. As explained below, the Team then combined these data with other potential explanatory variables, including political index, average cost of living, and average electric retail rates.

Modeling Methods

The primary goal of the model is to quantify the impact of state-level program activity on the sales of LEDs. Clearly, there are other factors that influence LED sales, and as noted above the team considered a number of demographic, household characteristics, and retail channel variables to capture and control for the unique characteristics of each state that potentially affect the uptake of efficient lighting products.

The general form of the model is specified below, followed by a more detailed discussion of the data sources for each variable. Note the list of variables below is the comprehensive set of variables that were considered; the final model, presented below in Table 5, lists the set of variables that were ultimately selected for inclusion in the model based on their statistical significance and ability to improve the model specification.

$$LED\ Market\ Share_i = \beta_0 + \beta_1 * \sum Program\ Intensity\ Var + \beta_2 * \sum Channel\ Var + \beta_3 * \sum Demographic\ Var + \epsilon_i$$

Where:

LED Market Share$_i$	=	Proportion of total lamp sales in state 'i' that are LED. Equal to [LED sales/total bulb sales]
β_0	=	The model intercept
β_1	=	The primary coefficients of interest. This represents the marginal effect of program intensity, or the expected increase in the market share of LEDs for each unit of additional program spending per household or year of program age
Program Intensity Variables	=	Numeric variables summarizing state-level spending and program age (additional detail is provided in Table 32)
β_2 and β_3	=	Array of regression coefficients for the channel variables and demographic variables
Channel Variables	=	Numeric variables summarizing state-level retailer characteristics (additional detail is provided in Table 32)
Demographic Variables	=	Numeric variables that summarize state-level population, housing, and economic attributes in (additional detail is provided in Table 32)
c_i	=	Error term

Table 32. Variable Descriptions

Type of Variable	Description
Program Intensity Variables	
Program Spending per Household	Total upstream program budget in state 'i' divided by the number of households in state 'i'
SQRT(Program Spending per Household)	The square root of the program spending per household
Program Age	The number of years program administrators in state 'i' have operated upstream lighting programs (CFL or LED)
Channel Variables	
Sqft NonPOS per HH$_i$	The average non-POS retail square footage per household in state 'i.' Equal to non-POS square footage divided by the number of households in state 'i'
Percent Sqft NonPOS$_i$	The percentage of total retail square footage belonging to non-POS retailers in state 'i.' Equal to non-POS square footage divided by (POS sqft + non-POS sqft)
Sqft POS per HH$_i$	The average POS retail square footage per household in state 'i.' Equal to POS square footage divided by the number of households in state 'i'
Demographic Variables	
Political Index$_i$	A state-level partisan voter index developed by Gallup[1] using presidential election voting results as a state-level partisan proxy. A higher than 1.0 value represents greater democratic influence and a value less than 1.0 indicates greater republican influence.
Average Electricity Cost$_I$	The state-level average residential retail rate of electricity sourced directly from the Energy Information Agency[2]
Cost of Living$_i$	State-level cost of living indices developed by the Missouri Economic Research and Information Center[3]

Percentage of Renters Paying Utilities$_i$	All of these state-level demographic and household variables were derived from the most current U.S. Census ACS[4]
Median Income$_i$	
Percentage Owner Occupied$_i$	
Percentage of Population with College Degree$_i$	

[1] http://news.gallup.com/poll/125066/state-states.aspx
[2] https://www.eia.gov/electricity/data/state/
[3] https://www.missourieconomy.org/indicators/cost_of_living/
[4] http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

Correlation of the Independent (Explanatory) Variables

Table 33 shows the correlation between the dependent variable (LED market share) and 11 potential channel and demographic/household variables. Eight of the variables are positively correlated with LED market share and three are negatively correlated. Correlation coefficients can range from -1 to 1 and the magnitude of the absolute value indicates the degree of correlation. This means that program spending per household is the most correlated variable with LED market share (i.e., higher LED market shares typically occurring in states with more mature programs), followed closely by program age.

Table 33. Independent Variable Correlation Matrix

Possible Explanatory Varible	LED Market Share
Program Spending per Household	0.73
Sqft NonPOS per HH	-0.16
Sqft POS per HH	-0.52
Percent Sqft NonPOS	0.43
Political Index	0.53
Median Income	0.39
Average Electricity Price	0.55
Cost of Living	0.44
Percentage of Renters Paying Utilities	-0.69
Percentage Owner Occupied	0.05
Percentage of Population with College Degree	0.46
Program Age	0.72

Table 34 provides a correlation matrix among the potential independent variables. While political index and cost of living are both positively correlated with LED market share, they are highly correlated with one another (correlation coefficient=0.78). When multiple independent variables that are correlated with one another are included in a model specification, a regression model will have difficulty precisely estimating the effect of either term. This issue is compounded by the relatively low number of observations in the data set.

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Because of the complexity of the relationships and numerous options of these channel, demographic, and household characteristic variables, the team developed and tested different model options. However, we focus on the final best fit model option in the findings section below.

Table 34: Covariance Table of Potential Independent Variables

	Program Spending per HH	Sqft NonPOS per HH	Sqft POS per HH	Percent Sqft NonPOS	Political Index	Median Income	Average Electricity Price	Cost of Living	% of Renters Paying Utilities	% Owner Occupied	% of Population with College Degree	Program Age
Program Spending per Household	1.00											
Sqft NonPOS per HH	-0.41	1.00										
Sqft POS per HH	-0.58	0.26	1.00									
Percent Sqft NonPOS	0.46	0.14	-0.89	1.00								
Political Index	0.57	-0.26	-0.77	0.69	1.00							
Median Income	0.32	0.05	-0.69	0.75	0.69	1.00						
Average Electricity Price	0.52	-0.22	-0.63	0.59	0.61	0.63	1.00					
Cost of Living	0.51	-0.32	-0.80	0.73	0.78	0.73	0.77	1.00				
Percentage of Renters Paying Utilities	-0.63	0.24	0.44	-0.34	-0.43	-0.37	-0.58	-0.48	1.00			
Percentage Owner Occupied	-0.01	0.22	0.34	-0.30	-0.26	-0.26	-0.20	-0.47	-0.15	1.00		
Percentage of Population with College Degree	0.47	-0.07	-0.67	0.68	0.70	0.91	0.64	0.67	-0.48	-0.19	1.00	
Program Age	0.58	-0.21	-0.66	0.60	0.65	0.56	0.69	0.72	-0.49	-0.31	0.56	1.00

F.4   Model Weighting

Another key consideration in the modeling is the weighting of states within the model. One option is to weight each of the 42 states equally. However, since each state is one observation in the model, the team wanted to account for larger states having larger sample sizes in the panel data and bigger impacts on the lighting market as a whole, either by using the number of households or total bulb sales as the weight. The team felt that using analytic weights[21] in the model was appropriate because the data set consists of a series of purchase transactions that have been condensed into an observed mean. Estimating the following regression model with analytic weights, where each state's average market share is based on n observations:

$$LED\ Market\ Share_i\ =\ \beta_0 + \beta_1 * Program\ Spending\ per\ HH_i$$

Would be analogous to estimating:

$$LED\ Market\ Share_i * \sqrt{n_i}\ =\ \beta_0 * \sqrt{n_i} + \beta_1 * Program\ Spending\ per\ HH_i * \sqrt{n_i}$$

The square root term means that the weights are proportional to the inverse of the variance.

Because our analysis data set consists of multiple data streams, the definition of an observation is inconsistent, so a proxy is needed for the weighting variable. The sample size in the panel data is generally proportional to state population and large states also represent a larger share of the overall U.S. lighting market than smaller states. This also means the team is generally more confident in the non-POS lamp shares for larger states compared to smaller states because the average lighting share value in large states is based on more measurements than small states which should make the market share estimate more precise. Figure 1 shows the number of households for each of the 42 states included in the model.

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[21] http://www.stata.com/help.cgi?weight

Figure 1. Number of Households by State
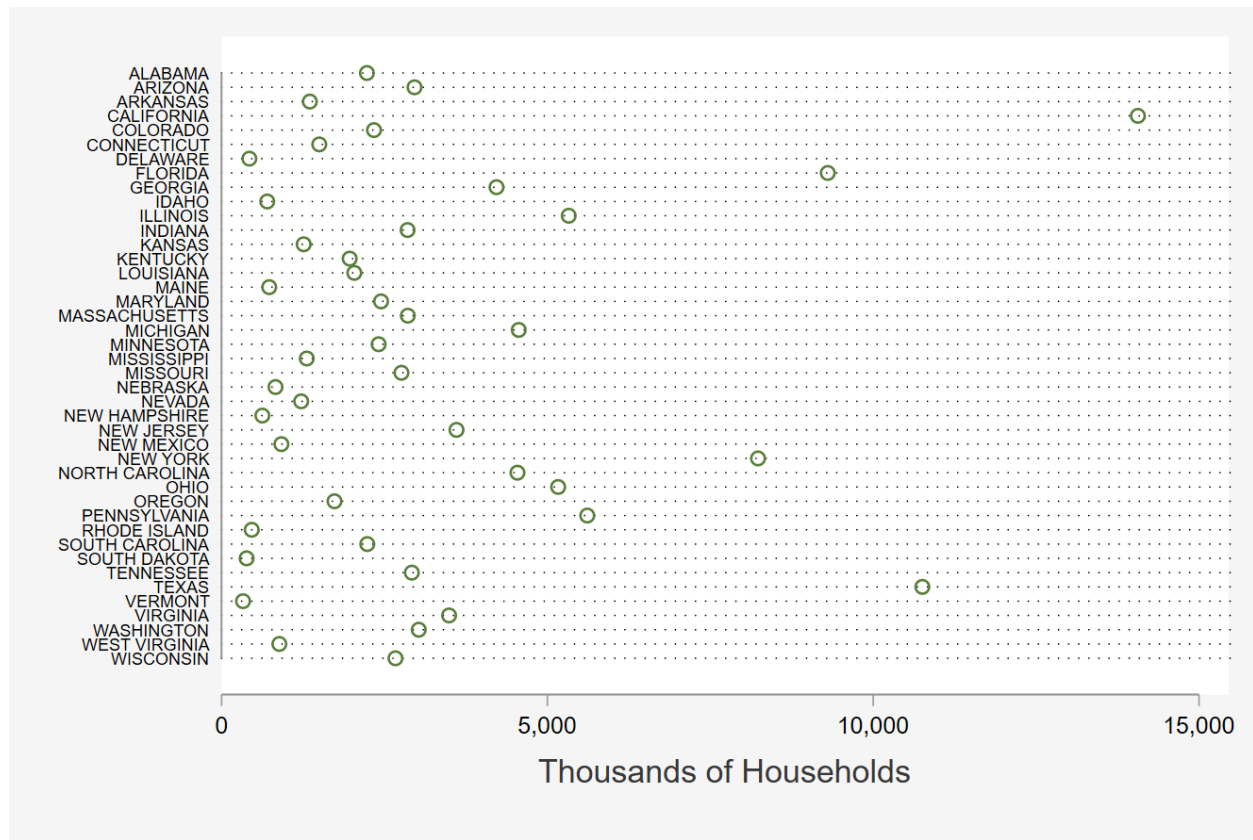
Model Functional Form

Another critical decision in the modeling process is the selection of the functional form of the model. A key input in this decision is the distribution of the dependent variable. LED market share is constrained by 0 and 1, it cannot be less than 0% and it cannot be greater than 100%. The team looked at functional forms that impose these limits to produce the top half of an "S-curve". Since the LED market share values only range from 20% to 56% and so much of that variation is explained by program intensity, the team elected to estimate the model using ordinary least squares (OLS) regression. Using OLS did not result in any unrealistic predictions (e.g. less than 0% or greater than 100%).

The team also explored transformations of independent variables, including the square root of spending as the program intensity variable. Figure 2 shows that the square root model tapers LED market share as sqrt(spending) increases. This likely reflects a "diminishing returns" in terms of market share as program spending increases, and graphically provides a good fit for the data.

Figure 2. Linear vs. Non-Linear Modeling
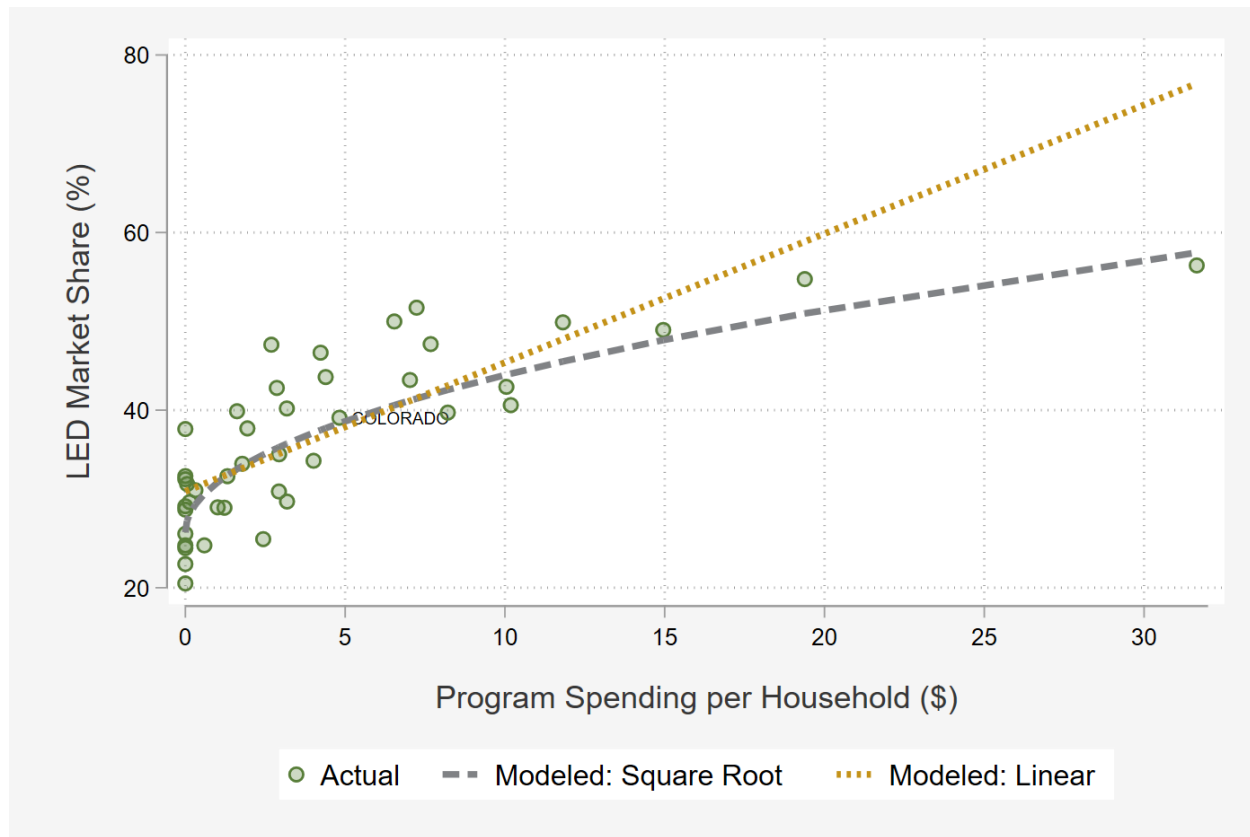
NTG Estimates

Using the results of the regression models, the sales data on LEDs, and the program-tracking databases, the team estimated NTG ratios for LEDs in 2017. These NTG ratios are derived by first using the model to predict the share of LEDs with the program (modeling actual program spending, as well as the actual program age) and without the program (the counterfactual of no program reflecting the market share as if there was no program activity in the current year). This change in share represents the "lift", or net increase in the share of LEDs resulting from program activity. To then calculate NTG, the change in share is multiplied by the total number of bulbs – for all bulb types – sold in 2017, as determined by the sales data analysis described above. This number then represents the net impact of the program (i.e., the total "lift" in the number of LEDs), and is then divided by the total number of program bulbs sold (i.e., the gross number of bulbs) to determine NTG:

$$NTGR = \frac{(\#\ bulbs\ sold\ with\ program - \#\ bulbs\ sold\ with\ no\ program)}{\#\ of\ program\ incented\ bulbs\ sold}$$

Key Findings

While the primary objective of this study is to determine the impacts of program spending on the market share of LEDs to derive the state-level NTG estimates, a secondary, but no less important, objective is to help understand national lighting sales and program activity and to assess some of the key drivers behind the

LED market share within Colorado. By having access to not only the national sales data but also the largest known compilation of state program activity (incentives, overall expenditures, bulb volumes), the team was able to analyze and compare Colorado lighting program activity with the other states. The following sections present the findings from analyzing both descriptive data statistics as well as the multivariate regression model.

Analysis of the Combined Dataset (Descriptive Statistics)

Multivariate Regression Model

The regression coefficients for the program intensity variables, and subsequent estimates of the NTG ratio, proved relatively stable across a number of model specifications. The team explored different combinations of independent variables to enter and exit the model, and in general, the models gave very similar results. Table 35 displays the relevant statistics and outcomes from the final model specification.[22] For the model details below, if an independent variable was included in the model, the regression coefficient and its associated p-value are included in the table. The p-value of the program spending term is highly significant. As shown in Table 35, the final set of explanatory variables included program spending per household, non-POS sqft per HH and program age.

Table 35. Model Summary Statistics (n=42 States)

Independent Variables	Model Coefficient	P-Value of Coefficient
Intercept	0.2045	0.000
Program Spending per Household (Sqrt)	0.0473	0.000
Non-POS sqft per HH	0.0155	0.080
Program Age	0.0023	0.072
Model Adjusted R-squared	**0.67**	

The positive coefficient for program age indicates that prior program activity does positively influence current year efficient market share. This may reflect a number of factors, including "momentum" in terms of customer awareness, education, and preference for efficient lighting, as well as retailer knowledge and promotion of efficient lighting. Program age might also be thought of as a simplistic proxy for market effects, meaning the portion of efficient lighting sales that are due to potentially permanent changes in the market as a result of ongoing program activity.

The NTG calculations are shown below in Table 36. NTG was performed using a "modeled:modeled" calculation as opposed to a "modeled:actual." This means that the counterfactual scenario (which can only be modeled) was compared to a modeled LED market share rather than the actual LED market share for Colorado in the data set.[23]

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[22] As noted above, the team selected to use an OLS model and weight by the number of homes for each state.

[23] The model predicts 39.9% LED market share for 2017 for Xcel Energy, which is very close to what the model predicts for the state of Colorado (39.7%). The national dataset reports share by state, so the ratio of modeled: actual LED market share/sales must be done at a state-level as well. The ratio of modeled: actual LED market share/sales is 99% (39.7%: 39.2%). Putting this into sales, the

In assessing NTG, the evaluation team presented one way for treating the program spending counterfactual: by setting it to zero. However, the evaluation team presents two options for treating the program age counterfactual:

1. Programs have never existed (Program Age is set to 0), or
2. The programs did not exist in the year 2017 (subtract 1 year from the Program Age).

Table 36 presents the two options to treating the counterfactual and calculates NTG ratios. The NTG including both current and past program influence (i.e., setting past programs to zero in the counterfactual scenario) is 82.5%; if examining influence of the current program and assuming that influences up to one year prior would have continued if the current program was terminated, the NTG ratio is 68.4%.

Table 36. Xcel Energy PY2017 NTG Calculations

Parameter	Calculation Term	Current and Past Influence	Current Program Spending and Age Influence
A	Total Xcel Energy Bulbs	12,351,817	12,351,817
B	Program $ per HH Actual	$4.18	$4.18
C	Program $ per HH Counterfactual	$0.00	$0.00
D	Program Age Actual	10	10
E	Program Age Counterfactual	0	9
F	LED Market Share Counterfactual	27.0%	29.0%
G	LED Market Share Modeled	38.9%	38.9%
H	LED Qty. Modeled (H=A*G)	4,810,828	4,810,828
I	LED Qty. Counterfactual (I= A*F)	3,336,674	3,587,787
J	Net LEDs Modeled (J=H-I)	1,474,154	1,223,040
K	Program LEDs	1,787,913	1,787,913
L	NTGR Modeled (L=J/K)	82.5%	68.4%

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model predicts 9,338,376 LEDs sold in Colorado, and the national dataset reports that 9,220,764 LEDs were sold in Colorado in 2017.

Home Lighting and Recycling Evaluation

2018 Program Evaluation: Recommendations and Responses

The Xcel Energy Home Lighting and Recycling product in Colorado provides resources for customers to purchase energy-efficient LED light bulbs by offering in-store retail discounts. An instant rebate is provided through Company collaboration with bulb manufacturers and retailers, enabling customers to purchase a variety of LED bulb models at a discount price.

Xcel Energy (The Company) engaged a team of researchers led by EMI Consulting to conduct a process and impact evaluation of the Home Lighting and Recycling product. The evaluation team was asked to assess the following:

- Lighting industry changes
- Underserved markets
- Program attribution (net-to-gross)

Based on the results of this research, the evaluation team developed key findings and recommendations for Xcel Energy.

Recommendation	Response
1) Continue running upstream programs until legislation or LEDs become the predominant technology. Xcel Energy can still influence consumer lighting decisions; however, the lighting market is expected to transform rapidly and this influence will likely decrease as LEDs become predominant technologies and/or the EISA backstop legislation limits the availability of less efficient bulb technologies.	The Company agrees that we should continue running the upstream Home Lighting and Recycling program.
2) Reassess prospective NTGR value when the fate of EISA backstop implementation becomes clear. Xcel Energy needs to reassess savings opportunities when DOE or litigation determines how the backstop will be enacted.	The Company agrees that it will be necessary to reassess the prospective NTGR value when EISA backstop implementation becomes clear.
3) Closely monitor legislative actions for direction on EISA. Decisions on this legislation will quickly impact the lighting market and provide direction on the future program opportunities, plus impact future NTGRs.	The Company will continue to monitor legislative actions regarding EISA.
4) Xcel Energy should plan for decreasing NTGR as options for	The Company understands that the NTGR may continue to decrease and will take the appropriate

inefficient bulbs diminish. While there may be opportunities for savings within limited channels or target populations, Xcel Energy should plan for the home lighting product to evolve with the changing market.	actions to plan for this.
5) Xcel Energy will need to design and test a variety of methods if they choose to target hard-to-reach populations. Consider focusing staff and consumer education efforts on discount and mass merchandiser stores and bringing outreach events and giveaways to low-income and immigrant geographies.	The Company will continue to explore opportunities to target hard-to-reach populations.