2015 Comprehensive Evaluation: Lighting Efficiency

Recommendations and Responses

February 2016

Executive Summary

The Lighting Efficiency product offers rebates to customers who purchase and install qualifying energy efficient lighting in existing or new construction buildings. Prescriptive rebates are offered to encourage customers to purchase energy efficient lighting by lowering the up-front premium costs associated with this equipment. Custom Efficiency Lighting rebates are also available for energy-saving lighting solutions not included in the prescriptive rebate menu.

The full report, completed by Cadmus, is attached to this summary.

Recommendation	Response
Training and Marketing Increase end-use customer program awareness and improve clarity on trade partner eligibility requirements.	
1. **Improve customers' understanding of eligible equipment** by simplifying equipment eligibility criteria or by providing more training material to help participants easily navigate the eligibility requirements. Consider creating flyers by business type that showcase successful installations and operations of the latest energy-savings technologies.	The Company in 2016 will be eliminating wattage requirements on equipment being removed for all prescriptive LED rebates, effectively eliminating the "3 to 6 times" rule. The Company will also implement a new "+/-10% allowance" for the replacement equipment wattages to allow for the increasing efficacy and variances amongst technologies based on manufacturer. This will reduce customer barriers to participation and reduce the complexity of the current program requirements. In addition, the Company will create LED technology snapshots for customers to better understand the pros and cons of the various technology options such as a full fixture replacement, retrofit kit, and lamp replacement options. These will be made available on our Company website in PDF format. These will also be made available in print to be handed out at trainings and events.
2. **Consider promotions** to raise awareness for short webinar trainings to keep trade allies informed of the latest program developments.	The Company will increase promotion of webinar trainings to keep the trade informed of the latest program developments.

3. For the program's future success, Xcel Energy may **establish an online calculator for estimating savings** to enable trade partners and customers to more accurately estimate energy savings and custom rebate amounts in real time prior to submitting their application.	The Company will evaluate the opportunity to create an online savings calculator for custom lighting projects. As part of the evaluation, the online calculator tool will need to be consistant with the broader custom project analysis tool. Product management will consider the cost in determining the feasibility of implementation.
4. Focus development and distribution of training materials to end-use customers' facility management staff (rather than accounting staff).	The Company will tailor new case studies for a facility management audience by adding in more detailed technical information about the new measures that were installed and old measures that were replaced.
5. **Consider conducting trainings in various locations** within Xcel Energy's service location and promote online webinars to increase awareness of existing training opportunities. Trainings may also help to set expectations for application processing time, particularly in regions where trade partners may have different expectations based on proximity to other utility service areas.	The Company will host additional trade partner training sessions for those who are unable to attend the trainings in the metro Denver area. Training sessions will be offered in both in-person and webinar format.
6. **Continue to develop and distribute case studies** presenting simple paybacks on LED technology investments.	The Company will continue to develop and distribute case studies showcasing projects using LED technology and presenting simple paybacks along with the energy savings achieved. Five existing case studies can be found on the Company's website, here: http://www.xcelenergy.com/Energy_Solutions/Business_Solutions/Rebates_&_Energy_Savings/Lighting_Efficiency.
7. **Incorporate a simple payback calculator in the application process** that trade partners can use for marketing the program.	The Company will add a simple payback calculator to the Lighting Efficiency website in 2016, found here: http://www.xcelenergy.com/Energy_Solutions/Business_Solutions/Rebates_&_Energy_Savings/Lighting_Efficiency.
8. **Consider simplifying prescriptive rebate application requirements** to reduce the volume of applications carried over to the custom application option.	In 2016, the Company will simplify the prescriptive rebate application requirements by elimating wattage requirements on equipment being removed, effectively eliminating the "3 to 6 times" rule. The Company will also implement a new "+/-10% allowance" for the replacement equipment wattages to allow for the increasing efficacy and variances amougst technologies based on manufacturer.

9. **Continue investing in trade partner outreach and training** to enable them to accurately assess equipment eligibility in order to qualify more projects under prescriptive rebate application.	The Company will continue to hold a trade partner training series in 2016. The first session of 2016 was held January 27.
Application Process Increase visibility into application status and outcomes.	
10. **Consider adopting an online application process that allows real-time tracking of an application's status**, along with other useful resources and calculators. Trade partners suggested that they prefer the online rebate application form to be in an Excel spreadsheet format.	The Company plans to implement a digital DSM rebate application tool for customers in 2016. Initially, trade partners may not be able to process rebates on behalf of the customers through the tool, but the Company will continue to evaluate the potential for that functionality.
11. **Consider establishing the preapproval process to review prescriptive applications for completeness of application and confirming equipment eligibility. Consider establishing a preapproval process for prescriptive applications.** Three comparison utilities (a Midwestern utility, Con Edison, and PPL Electric) require prescriptive measures to be preapproved prior to installation. In the preapproval process implemented by these utilities, applicants share the responsibility of ensuring that the application is filled out correctly in order to reserve funds for their upcoming lighting upgrade. The preapproval process will also help Xcel Energy eliminate the number of customers who submit applications for measures that do not qualify and help identify candidates for custom measures early in the process. Customers could reevaluate their selection of non-qualifying measures and change the application as needed.	The Company will evaluate offering a prescriptive preapproval process by interviewing the three mentioned utilities to understand the costs, tools, and process of implementation. Program management will assess the results of the preapproval processes of the three mentioned utilities, specifically the number of projects that did not qualify before and after the preapproval process was implemented.

The preapproval process could also help clarify the number of projects in the pipeline throughout the program year.	
12. **Ensure Xcel Energy account managers consistently communicate the program by training them and ensuring they are aware of eligibility updates and changes.** Anticipate possible confusion areas, and emphasize requirements through training and communications.	The Company will continue to train Account Managers on the product's rebates and changes. The first internal training of 2016 was held February 1.
13. **Consider relaxing the eligibility criteria for LED fixtures.** Xcel Energy has the most rigid wattage reduction requirements of all of the benchmarked utilities. Currently, the program requires that LED down lighting luminaires, LEDs replacing interior incandescent or halogen lamps, and exterior LEDs replacing HIDs to use 3 to 6 times less energy than the existing conventional counterpart—in addition to being listed on the DLC or ENERGY STAR QPL. All of the other utilities Cadmus reviewed require downlight LEDs, replacement LEDs, and screw-in LEDs to both be DLC or ENERGY STAR-qualified, and have a net reduction in wattage. For Xcel Energy, the 3 to 6 times rule (which was set to ensure measure cost effectiveness and product efficacy) appears to be limiting the number of DLC or ENERGY STAR fixtures that could be eligible for rebates and also introduces the need for the program account manager or engineering staff to manually verify and calculate if fixtures comply. This may be adding significant time and effort to Xcel Energy's application review process.	In 2016, the Company will simplify prescriptive rebate requirements by elimating wattage requirements on removed equipment, effectively eliminating the "3 to 6 times" rule. The Company will also implement a new "+/-10% allowance" for the replacement equipment wattages to allow for the increasing efficacy and variances amougst technologies based on manufacturer.

14. **Consider developing an online tool that helps customers and vendors understand eligibility criteria based on existing fixtures needing replacement/retrofit.** ConEd lists the technical data required based on measure type to help customers/vendors understand the eligibility requirements associated with each measure. Keeping in mind the current eligibility criteria, Xcel Energy could consider developing a tool that allows the designer/vendor/customer to select existing equipment details from a drop-down list and understand eligibility criteria for each equipment type based on its wattage, technology type and ballast type, etc. This tool could help reduce the possibility of accidental oversight or misinterpretation of eligibility requirements. The tool can also generate a report that helps the reviewer understand why particular equipment was selected while retrofitting.	The Company currently displays qualifying equipment on its website, here: http://www.xcelenergy.com/Energy_Solutions/Business_Solutions/Rebates_&_Energy_Savings/Lighting_Efficiency; and identifies fixture combinations, here: http://www.xcelenergy.com/staticfiles/xe/Marketing/Files/CO-Bus-Deemed%20Fixture-Table-Combinations.pdf. The Company will continue to evaluate other opportunities for effectively conveying eligiblilty criteria online.
15. **Consider ways to reduce application processing times.** An online application process will likely help expedite the application processing time and may provide additional functionality such as application tracking and resource capabilities for future applicants.	The Company plans to implement a digital DSM rebate application tool for customers in 2016, an anticipated benefit of which will be reduced application processing times.
Trade Allies Information in the trade partner database needs updating.	
16. **Consider updating the trade partner list** with updated contact names and details to ensure easy access to the trade partner organization and the ability to identify prospective partners not currently participating.	The Company will continue to periodically update the trade partner list with contact names and details. Maintaining an up-to-date trade partner list is part of the Company's product management practices.

17. Trade partners also suggested that Xcel Energy maintains an updated list of participating **trade partners by region on its website** so that retail and end-use customers can readily identify trade partners in their vicinity to partner with.	The Company will consider organizing the participating trade partner list by region.
Net-to-Gross Update the net-to-gross (NTG) ratio.	
18. **Cadmus recommends that Xcel Energy consider using the calculated NTG of 99% for this program going forward.** The low calculated freeridership, coupled with high trade partner engagement and low market effects supports a high NTG for the program.	The Company will adopt the recommended NTG of 99% for this program going forward.

Evaluation of Xcel Energy's Lighting Efficiency Program

December 29, 2015

Xcel Energy
1800 Larimer Street
Denver, CO 80202

The Cadmus Group, Inc.
An Employee-Owned Company • www.cadmusgroup.com

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CADMUS

Prepared by:
Jane Colby
Cheryl Winch
Rasika Savkar
Ashley Fredi
Danielle Kolp

Cadmus

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CADMUS

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Executive Summary

As part of a portfolio program evaluation, Cadmus evaluated Xcel Energy's Colorado business Lighting Efficiency program. This evaluation's findings—presented in this report—will inform program and implementation staff as they fine-tune the business Lighting Efficiency program.

Program Description

A demand-side management (DSM) program, Xcel Energy's business Lighting Efficiency program in Colorado is designed to achieve cost-effective energy savings for commercial customers. Through the program, customers receive rebates for installing qualifying, energy-efficient, lighting equipment in new construction and existing facilities. Implemented in-house by Xcel Energy, the program has operated for nearly 10 years.

Xcel Energy's Lighting Efficiency program targets commercial customers with peak demand of 400 kW or greater by offering prescriptive and custom rebates to help lower upfront costs for installations of qualifying, high-efficiency equipment in new and existing buildings. The program also offers funding for lighting redesign studies, conducted to determine proper lighting levels for a space. Table 1 lists the prescriptive rebates available.

With preapproval, custom rebates become available for energy-saving lighting projects not covered by the program's prescriptive component. Lighting projects become eligible to receive rebates covering up to 60% of a project's total equipment and labor costs.

Evaluation Objectives

In collaboration with Xcel Energy, Cadmus identified the following process and impact evaluation objectives:

- **Stakeholder Interviews and Logic Model.** Understand program operations and delivery protocols; identify any areas of concern that could affect data collection or analysis.
- **Participating and Nonparticipating Customer Site Visits.** Understand customers' program experiences, measure their satisfaction levels, and collect data to calculate program freeridership, spillover, and market effects.
- **Participating and Nonparticipating Trade Partner Surveys.** Collect information on trade partners' program experiences, their satisfaction levels and perceptions of the program, challenges associated with participation, and suggested areas for improvements. Collect data to inform program spillover estimates.
- **Benchmarking.** Provide a context for assessing key program elements (e.g., program structures, the measure mix, eligibility requirements, incentive levels, and net-to-gross (NTG) values).
- **Program Freeridership and Spillover.** Calculate a net-to-gross (NTG) ratio, including freeridership, spillover, and market effects.

Method

In evaluating the program, Cadmus relied on primary and secondary data. In summer 2015, the program evaluation began with a kick-off working session. Following the session, Cadmus began collecting program data from Xcel Energy staff, using the following research activities:

- Interviews with five Xcel Energy staff members.
- Interviews with 20 participant and three nonparticipant trade partners.
- Surveys of 71 participant and nonparticipant businesses.
- Benchmarking the program with seven other commercial lighting efficiency programs, served by implementers of business lighting programs across the United States.
- NTG analysis of savings.

Summary of Key Findings

Xcel Energy's Lighting Efficiency program is a well-coordinated prescriptive and custom rebate offering that is nearly achieving its kWh savings targets. In 2014, the program achieved 95% of its energy-savings target and 102% of its participation target. Below are a few key findings from this evaluation study:

Improvements in prescriptive rebate offerings present programmatic challenges. The Lighting Efficiency program manager and the team lead engineer identified the time required to approve new prescriptive measures as one of the biggest challenges facing the Lighting Efficiency program.

Participants learn about the program largely through connections with lighting professionals (50%), such as contractors, electricians, and lighting distributors. Just under one-half (46%) of participants had participated previously in another Xcel Energy program. Motors & Drives, Cooling Efficiency, and Lighting – Small Business were common programs exhibiting participation overlap with Lighting Efficiency.

Participant trade partners report satisfaction with the overall program. The Lighting Efficiency program remains fairly well-known in the commercial marketplace; just over one-half (55%) of nonparticipants had heard of Xcel Energy's program and were familiar with rebates or incentives offered through the program. Bill inserts (30%) and lighting professionals (24%) served as common perceived sources of program awareness for nonparticipants. Although the program does not currently use bill inserts for marketing the program, customers' perceptions may relate to an earlier experience when they first became aware of the program or a more general energy efficiency message that was not specific to the Lighting Efficiency program.

Participating trade partners report that Xcel Energy's program presents one of the most comprehensive measure mixes of the utilities that they do business with. **Nearly all participants (96%) expressed satisfaction with the Lighting Efficiency program overall.** Participants also expressed high satisfaction levels with information provided about requirements (84%) and the application process (83%). All participants would somewhat (23%) to very likely (77%) recommend the program to others.

More participants (81%–94%) than nonparticipants (39%–77%) agreed with the four customer engagement statements about Xcel Energy:

1. As a company they can trust
2. Providing valuable programs
3. Providing tools/services for lowering costs
4. Helping make customers more energy conscious

These findings are consistent with Xcel Energy customer engagement research that has shown higher engagement and satisfaction levels with Xcel Energy from participating customers.

Twelve of the 20 surveyed participating trade partners indicated they find Xcel Energy's program offerings to be one of the most comprehensive programs. Where trade partners indicated that they prefer programs offered by other utilities, they indicated it was a result of simplified application requirements and faster application processing times.

Rigid eligibility requirements present the biggest challenge preventing increased prescriptive rebate participation. Program staff noted the vast number of qualifying options can complicate the program for customers, and the rigid eligibility requirements potentially can limit fully realizing the program's potential. Trade partners echoed this concern when citing reasons for encountering resistance to program participation.

Upfront costs, capital, and identifying cost-effective measures stood as the key challenges cited by participants and nonparticipants in regard to making energy-efficient improvements in their facilities. Respondents most often suggested offering rebates as a way for Xcel Energy to help them overcome such challenges. Nonparticipating trade partners noted the difficulty in convincing customers to spend more upfront for lighting efficiency measures, even though these options present longer-term savings potential and relatively shorter payback periods. Contractors agree incentives are necessary to overcome higher upfront costs of energy-efficient technologies.

Although not highly prevalent as a concern among participants, **a few nonparticipants cited the application process as a participation barrier**. The 2009 Prescriptive Commercial Lighting program evaluation recommended addressing the complexity of the application process, and this appears to have improved, given participants' relative lack of concerns about this issue. Continue to streamline application processes and encourage support from trade partners to assist with the more challenging aspects of the application process.

The applications' lack of visibility regarding estimates of rebate amounts through the custom rebate approach alienates some trade partners from the program. Trade partners stated (and program staff agreed) that a lack of visibility concerning measures that may qualify for rebates upon application submissions introduces uncertainty in the process and reduces customer base confidence in trade partners' ability to secure rebate amounts close to their estimates. Continue marketing the program through lighting professionals to provide program information to smaller and newly established

businesses. Continue conducting outreach with participants in other demand-side management programs to more deeply engage customers already making efficiency upgrades.

Approval of prescriptive measures in the measure mix presents a long-term challenge to the program's success. The Lighting Efficiency program manager and the team lead engineer identified the time required to attain approval for new prescriptive measures as one of the greatest challenges faced by the Lighting Efficiency program.

Participants were more familiar (50%–90%) with five efficient lighting technologies (e.g., CFLs, LEDs, T8s, T5s, controls) than nonparticipants (34%–66%), but over one-half of each respondent type indicated their familiarity with these technologies increased within the past five years. Participants were more likely than nonparticipants to acknowledge Xcel Energy's role in helping increase their familiarity with the technologies. Both participants (90%) and nonparticipants (66%) were most familiar with LED lighting technologies and least familiar with T5s (50% and 34%, respectively).

Conclusion and Recommendations

The following conclusions and recommendations were derived from the various research activities:

Nearly all participants (96%) expressed satisfaction with the overall Lighting Efficiency program. Participants also expressed high satisfaction levels with information provided about requirements (84%) and the application process (83%). All participants were somewhat (23%) to very likely (77%) to recommend the program to others.

Although its stakeholders perceive the program as successful, program areas may benefit from further refinement.

Program Administration

As evidenced by the difficulty evaluators had in identifying nonparticipant trade partners, the program achieved wide trade partner participation throughout its service territory. While this demonstrates the program's reach is pervasive, trade partner tracking and information sources could be updated to better serve program promotional efforts among lighting trades.

Training and Marketing

Not all customers know of the program. Based on feedback received from its marketing team, program staff learned many end-use customers either remain unaware of the program or know little about program offerings. Trade partners shared the same concerns, further suggesting that targeting facility management staff during development and distribution of training materials. Some trade partners in remote locations expressed concern about the lack of proximity to training locations.

Not all trade partners/customers understand the eligibility requirements. While larger, high-activity (program) trade partners found eligibility requirements straightforward, some of the smaller high-activity and low-activity trade partners found the equipment eligibility requirements confusing. Some trade partners expressed concern over their inability to predict savings accurately for custom projects

and cited that this was primarily due to inconsistent feedback from Xcel Energy's account managers about qualifying equipment.

Participants and nonparticipants confirmed the **importance of trade partners** in affecting their awareness of the program, their understanding the variety of efficient lighting options available, and they decisions on equipment to install. Trade partners largely offer energy-efficient options to customers (75% and 55% for participants and nonparticipants, respectively) and to promote program measures.

- **Recommendation:** Improve customers' understanding of eligible equipment by simplifying equipment eligibility criteria or by providing more training material to help participants easily navigate the eligibility requirements. Consider creating flyers by business type that showcase successful installations and operations of the latest energy-savings technologies.
- **Recommendation:** Consider promotions to raise awareness for short webinar trainings to keep trade allies informed of the latest program developments.
- **Recommendation:** For the program's future success, Xcel Energy may establish an online calculator for estimating savings to enable trade partners and customers to more accurately estimate energy savings and custom rebate amounts in real time prior to submitting their application.
- **Recommendation:** Focus development and distribution of training materials to end-use customers' facility management staff (rather than accounting staff).
- **Recommendation:** Consider conducting trainings in various locations within Xcel Energy's service location and promote online webinars to increase awareness of existing training opportunities. Trainings may also help to set expectations for application processing time, particularly in regions where trade partners may have different expectations based on proximity to other utility service areas.

High first costs present the biggest barrier for customers considering efficient lighting options. This primarily results from higher initial costs for LEDs than for linear fluorescents and other technologies. Most customers use linear fluorescent and compact fluorescent technologies, but are slowly adopting LED technologies in lighting design as the prices for these products become more comparable to their fluorescent counterparts. Trade partners also stated that they prefer using LEDs over fluorescents given their longer life span which reduces the cost of replacement in the long run, however also mentioned that proposing LEDs on their projects still meets resistance given the higher first cost of installing LEDs.

- **Recommendation:** Continue to develop and distribute case studies presenting simple paybacks on LED technology investments.
- **Recommendation:** Incorporate a simple payback calculator in the application process that trade partners can use for marketing the program.

High volumes of custom rebate applications burden the rebate application process. Given the eligibility requirements' complex nature and customers' inability to navigate these complexities, most prescriptive rebate applications are processed as custom rebate application option, increasing rebate processing burdens.

- **Recommendation:** Consider simplifying prescriptive rebate application requirements to reduce the volume of applications carried over to the custom application option.

- **Recommendation:** Continue investing in trade partner outreach and training to enable them to accurately assess equipment eligibility in order to qualify more projects under prescriptive rebate application.

Application Process

The inability to view an application's status and outcome presents a participation barrier. Multiple contractors and distributors said they would prefer an online application system that would allow them to submit applications and supporting documentation electronically and could track their application's status. Trade partners reported their customers expressed frustration about their inability to track their application's status. Some of the benchmarked utilities already have an established online application process which is easy to use.

- **Recommendation:** Consider adopting an online application process that allows real-time tracking of an application's status, along with other useful resources and calculators. Trade partners suggested that they prefer the online rebate application form to be in an Excel spreadsheet format.

- **Recommendation:** Consider establishing the preapproval process to review prescriptive applications for completeness of application and confirming equipment eligibility. Consider establishing a preapproval process for prescriptive applications. Three comparison utilities (a Midwestern utility, Con Edison, and PPL Electric) require prescriptive measures to be preapproved prior to installation. In the preapproval process implemented by these utilities, applicants share the responsibility of ensuring that the application is filled out correctly in order to reserve funds for their upcoming lighting upgrade. The preapproval process will also help Xcel Energy eliminate the number of customers who submit applications for measures that do not qualify and help identify candidates for custom measures early in the process. Customers could reevaluate their selection of non-qualifying measures and change the application as needed. The preapproval process could also help clarify the number of projects in the pipeline throughout the program year.

Account managers inconsistently predict equipment eligibility. Multiple participating trade partners expressed concerns about receiving conflicting outcomes regarding the eligibility of certain equipment, largely depending on the account manager processing the application.

- **Recommendation:** Ensure Xcel Energy account managers consistently communicate the program by training them and ensuring they are aware of eligibility updates and changes.

Anticipate possible confusion areas, and emphasize requirements through training and communications.

- **Recommendation:** Consider relaxing the eligibility criteria for LED fixtures. Xcel Energy has the most rigid wattage reduction requirements of all of the benchmarked utilities. Currently, the program requires that LED down lighting luminaires, LEDs replacing interior incandescent or halogen lamps, and exterior LEDs replacing HIDs to use 3 to 6 times less energy than the existing conventional counterpart—in addition to being listed on the DLC or ENERGY STAR QPL.

  All of the other utilities Cadmus reviewed require downlight LEDs, replacement LEDs, and screw-in LEDs to both be DLC or ENERGY STAR-qualified, and have a net reduction in wattage. For Xcel Energy, the 3 to 6 times rule (which was set to ensure measure cost effectiveness and product efficacy) appears to be limiting the number of DLC or ENERGY STAR fixtures that could be eligible for rebates and also introduces the need for the program account manager or engineering staff to manually verify and calculate if fixtures comply. This may be adding significant time and effort to Xcel Energy's application review process.
- **Recommendation: Consider developing an online tool that helps customers and vendors understand eligibility criteria based on existing fixtures needing replacement/retrofit.** ConEd lists the technical data required based on measure type to help customers/vendors understand the eligibility requirements associated with each measure. Keeping in mind the current eligibility criteria, Xcel Energy could consider developing a tool that allows the designer/vendor/customer to select existing equipment details from a drop-down list and understand eligibility criteria for each equipment type based on its wattage, technology type and ballast type, etc. This tool could help reduce the possibility of accidental oversight or misinterpretation of eligibility requirements. The tool can also generate a report that helps the reviewer understand why particular equipment was selected while retrofitting.

Rebate application processing times present a perceived participation barrier. Trade partners cited longer processing time as one reason for their preferring other utilities' programs over Xcel Energy's. Generally, nonparticipants purchased energy-efficient lighting without participating in the program cited the application process and processing times as their primary reasons for nonparticipation. Although longer processing times are required for larger programs, most trade partners suggested they would like the application processing time to be no longer than 2 weeks.

- **Recommendation:** Consider ways to reduce application processing times. An online application process will likely help expedite the application processing time and may provide additional functionality such as application tracking and resource capabilities for future applicants.

Trade Allies

As evident by the difficulty in identifying nonparticipant trade partners, the program achieved wide trade ally participation throughout its service territory. Participants and nonparticipants confirmed the importance of trade partners in their awareness of the program, understanding the variety of efficient

lighting options available, and decisions on equipment to install. Trade allies largely offer energy-efficient options (75% and 55% for participants and nonparticipants, respectively) to customers and in promoting program measures. While this demonstrates the program's reach is pervasive, information in the trade partner database appeared outdated.

- **Recommendation:** Consider updating the trade partner list with updated contact names and details to ensure easy access to the trade partner organization and the ability to identify prospective partners not currently participating.

- **Recommendation:** Trade partners also suggested that Xcel Energy maintains an updated list of participating trade partners by region on its website so that retail and end-use customers can readily identify trade partners in their vicinity to partner with.

Net-to-Gross

Cadmus recommends that Xcel Energy consider using the calculated NTG of 99% for this program going forward. The low calculated freeridership, coupled with high trade partner engagement and low market effects supports a high NTG for the program.

Report Overview

This report's following chapters document the results, methods, and objectives of each research task, as appropriate:

- **Staff Interviews** present overviews of program management and operations, per program staff. This section also presents the program's logic model.
- **Participant/Nonparticipant Survey** presents the program's impact on participating and nonparticipating customers.
- **Trade Ally Interviews** present findings from the trade partner survey, assessing trade partners' experiences with the program.
- **NTG** presents the program's freeridership and spillover effects.
- **Benchmarking** presents findings from a study comparing elements of Xcel Energy's Colorado Lighting Efficiency program with commercial lighting programs across the country.

Program Staff Interviews

The purpose of this section of the report is to summarize the findings from Cadmus' interviews with Xcel Energy staff. To inform the 2014 Colorado Lighting Efficiency program evaluation, Cadmus interviewed these Xcel Energy staff members:

- Program Manager (June 4 and June 9, 2015)
- Trade Channel Manager (June 18, 2015)
- Team Lead, Energy Efficiency Engineering (June 30, 2015)
- Account Managers (2) (June 17, 2015)

Program Description

Xcel Energy's Lighting Efficiency program targets commercial customers with a peak demand of 400 kW or greater by offering prescriptive and custom rebates to help lower the upfront cost for the installation of qualifying high-efficiency equipment in new and existing buildings.[1] Funding is also available for lighting redesign studies, which are conducted to determine the proper lighting levels for the space. Table 1 lists the prescriptive rebates available.

With preapproval, custom rebates are available for energy-saving lighting projects not covered by the prescriptive component of the program. Lighting projects are eligible to receive rebates of up to 60% of the total equipment and labor cost of the project.

[1] Non-managed customers with a peak demand of 400 kW or less are served by the Lighting–Small Business program.

Table 1. 2014 Prescriptive Program Measures

Measure	Specifications	Rebate Amount
High-Efficiency Electronic Ballasts		
Fluorescent T8 fixtures with high-efficiency electronic ballasts	T12 to T8, 4 foot or less, 1- to 2-lamp T12 to T8, 4 foot or less, 3- to 4-lamp	$1.50/HE ballast
Lighting Optimization		
Lamp removal in T8 systems; must include high-efficiency electronic ballasts	T8 to T8	$12/fixture
	T12 to T8 1- to 2-lamp installation	$10/fixture
	T12 to T8 3-lamp installation	$12/fixture
Low-Wattage Fluorescent T8 lamps		
4-foot; 28W	Replaces 32W T8 lamp	$1/lamp
4-foot; 25W	Replaces 32W T8 lamp	$2/lamp
High-Bay Fluorescent Fixtures with High-Efficiency Electronic Ballasts		
2-lamp T5HO, 3-lamp T5HO, 4-lamp T8	Replace HID* 175W-250W lamp systems	$85
3-lamp T8VHO, 4- to 6-lamp T5HO, 6- to 8-lamp T8	Replace HID* 310W-400W lamp systems	$125
6-lamp T8VHO, 8-lamp T5HO, 12- to 16-lamp T8	Replace HID* 750W lamp systems	$175
8-lamp T8VHO, 10-lamp T5HO, 18- to 20-lamp T8	Replace HID* 1000W lamp systems	$175
Parking Garage Fluorescent Fixtures with High-Efficiency Electronic Ballasts		
4 foot, 2- and 3-lamp	Replace HID* systems (150W or 175W) with T5HO or T8	$85/fixture
Parking Garage Low-Wattage Fluorescent T8 Lamps		
4-foot, 28W	Replaces 32W T8 lamp	$1/lamp
4-foot, 25W	Replaces 32W T8 lamp	$2/lamp
Hardwired or Modular Compact Fluorescent Fixtures (does not include screw-base CFLs)**		
18 W or less	Replace incandescent systems with hardwired or modular CFL systems that use 3-5 times less energy. (Does not include screw-base CFLs).	$25
Greater than 18W to 32W		$30
Greater than 32W		$35
High-Pressure Sodium Fixtures @**		
151W to 250W	Replace incandescent, halogen, or mercury vapor with high-pressure sodium	$30
Greater than 250W		$45

Measure	Specifications		Rebate Amount
Ceramic Metal Halide Fixtures @**			
150W or less	Replace incandescent, halogen, high-pressure sodium, metal halide, or mercury vapor with ceramic metal halide systems	175W or less	$50
Greater than 150W to 250W		200W to 400W	$80
Greater than 250W		400W to 1000W	$100
20W to 25W Integrated Ceramic Metal Halide lamps	Replace 75W to 150W incandescent or halogens with integrated ceramic metal halide lamps		$25
Pulse-Start Metal Halide Fixtures @**			
175W or less	Replace incandescent, halogen, mercury vapor, high-pressure sodium, or metal halide systems with pulse-start metal halide systems		$60
Greater than 175W to 319W			$90
Greater than 319W to 749W			$100
Greater than 749W			$120
Automatic Controls			
Wall Mount Occupancy Sensors 50W-300W connected load	Must be permanently installed		$15
Wall Mount Occupancy Sensors greater than 300W connected load			$25
Ceiling Mount Occupancy Sensors 50W-300W connected load			$30
Ceiling Mount Occupancy Sensors greater than 300W connected load			$40
Photocell			$25
Bi-level Stairwell Fixture with Integrated Sensor	Replace a 2-lamp fixture with a 2-3 lamp T8 fixture or a 20W-30W LED fixture with an integrated occupancy sensor or step-dimming ballast		$25
LED and LEC Exit Signs			
LED and LEC Exit Signs	Replace incandescent exit signs		$25
ENERGY STAR-Qualified LED Lamps #**			
5W or less	Replace incandescent or halogen lamps with an ENERGY STAR-qualified LED that uses 3-6 times less energy		$7/lamp
Greater than 5W to 10W			$12/lamp
Greater than 10W to 20W			$15/lamp

Measure	Specifications	Rebate Amount
ENERGY STAR-Qualified Commercial LED Downlight Luminaires (Not all ENERGY STAR LED fixtures qualify for rebates)**		
25W or less	Replace incandescent systems with an ENERGY STAR-qualified commercial LED downlight luminaire that uses 3-6 times less energy	$35/fixture
Greater than 25W to 50W		$50/fixture
ENERGY STAR-Qualified LED Retrofit Fixture (screw in) Downlights#		
25W or less	Replace incandescent systems with an ENERGY STAR-qualified commercial LED downlight luminaire that uses 3-6 times less energy	$15
Refrigerated LED Case Lighting 5- and 6-Foot Doors (DLC QPL Required)**		
5- and 6-foot doors	Replace fluorescent T12 or T8 systems with LED Case Lighting	$100/door
LED Wall Pack Fixtures Exterior and Parking Garage Installations (DLC QPL Required)**		
25W or less	Replace HID* systems with LED systems that use 3-6 times less energy. Replacement LED wall pack fixtures must be used for building exteriors or inside parking garages and must be attached to a wall (parking garage ceiling fixtures are not eligible for this rebates, but may qualify for a Custom Efficiency rebate).	$35/fixture
Greater than 25W to 60W		$75/fixture
Greater than 60W		$100/fixture
Exterior LED Canopy and Soffit Fixtures (Fixtures must be rated for exterior use) (DLC QPL Required)**		
25W to 60W	Replace HID* systems with LED rated for exterior use systems that use 3-6 times less energy	$135/fixture
Greater than 60W		$175/fixture
LED Troffer Fixtures (DLC QPL Required)		
LED Troffer Fixture, 1x4, 2x2, 2x4 Existing buildings, interior only	Replace fluorescent T12, T8, existing fixtures	$50/fixture
Retrofit Kit for LED Troffer Fixtures, 1x4, 2x2, 2x4 Existing buildings, interior only		$30/fixture
LED Parking Garage Fixtures (DLC QPL Required)		
25W to 60W	Replace 100W-175W fixtures; parking garages must be illuminated 24x7	$135/fixture
61W to 83W	Replace 200W-250W fixtures; parking garages must be illuminated 24x7	$175/fixture

*High-intensity discharge systems include mercury vapor, high-pressure sodium, metal halide and pulse-start metal halide.

**These rebates are available specifically for standard retrofit projects in which the lumen output of the proposed system is similar to the existing system and the energy savings is within a reasonably expected range. Retrofits with unusually large or small energy savings and/or lumen reductions must apply through the Custom Efficiency program and obtain preapproval prior to purchase.

Rebate offering discontinued for downstream participants since Jan 15, 2015.

@ Removed from program starting Sept 1- part of 2015/2016 DSM Plan

Equipment eligibility requirements for the prescriptive component of the program are explained on the application and vary depending on the type of equipment being installed. For example, all measures must replace existing equipment on a one-to-one basis or use three to six times less energy (known as the "3-6 times rule") than what is being replaced. LED equipment must be listed on a qualified product list (QPL) from ENERGY STAR® or DesignLights Consortium (DLC) to be eligible for a rebate. Equipment eligibility will be discussed in more detail below.

Program History

The Lighting Efficiency program launched in 2006; at that time, the program served all business customers, regardless of size. To help meet the needs of what a previous evaluation study found to be an underserved market,[2] Xcel Energy launched a Lighting – Small Business program[3] in 2009 to serve commercial customers with a peak demand of 400 kW or less. Lighting Efficiency and Lighting – Small Business program staff collaborate on developing new product offerings and on cultivating and maintaining relationships with the trade, as many trade partners work with both programs. The Lighting – Small Business program is not in the scope of this evaluation and will be evaluated separately in 2016.

In early 2015, Xcel Energy launched a mid-stream LED instant rebate component to the Lighting Efficiency program to attain a deeper reach in market sales. In the mid-stream instant rebate, distributors issue an instant rebate to their customers and are reimbursed by Xcel Energy. Currently, lamps and downlight can retrofits are eligible, and Xcel Energy is very interested to see if this model can achieve additional savings over the current downstream model. Depending on the success of the mid-stream instant rebates for lamps and downlight can retrofits, Xcel Energy will decide whether to expand this component in the future. This component of the program is not included in the scope of this evaluation given that it has not yet seen a full performance year at the time of this evaluation.

Program Targets and Objectives

The primary goal of the Lighting Efficiency program is to encourage customers to save energy through the installation of high-efficiency lighting equipment. Colorado regulatory statutes dictate a portfolio-wide energy savings goal and Xcel Energy bases the Lighting Efficiency program's energy savings target on this requirement and the results of a market potential study.

The program very nearly achieved its aggressive electric energy-savings target in 2014, coming in at 95%. Table 2 shows the program's 2014 targets and achievements. The Lighting Efficiency program is the second-largest contributor, after Home Lighting & Recycling, to energy savings in Xcel Energy's portfolio.

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[2] Wirtshafter Associates, Inc. Evaluation of Xcel Energy's Business Lighting Efficiency Program. July 5, 2009.

[3] In 2015, the Company changed the program name from "Small Business Lighting" to "Lighting – Small Business."

To help ensure the program meets its annual energy-savings target, Xcel Energy runs time-limited bonuses to encourage customers to complete projects during the calendar year. This promotion offers customers a 20% bonus on the total rebate amount, with a cap at 75% of the total project cost.

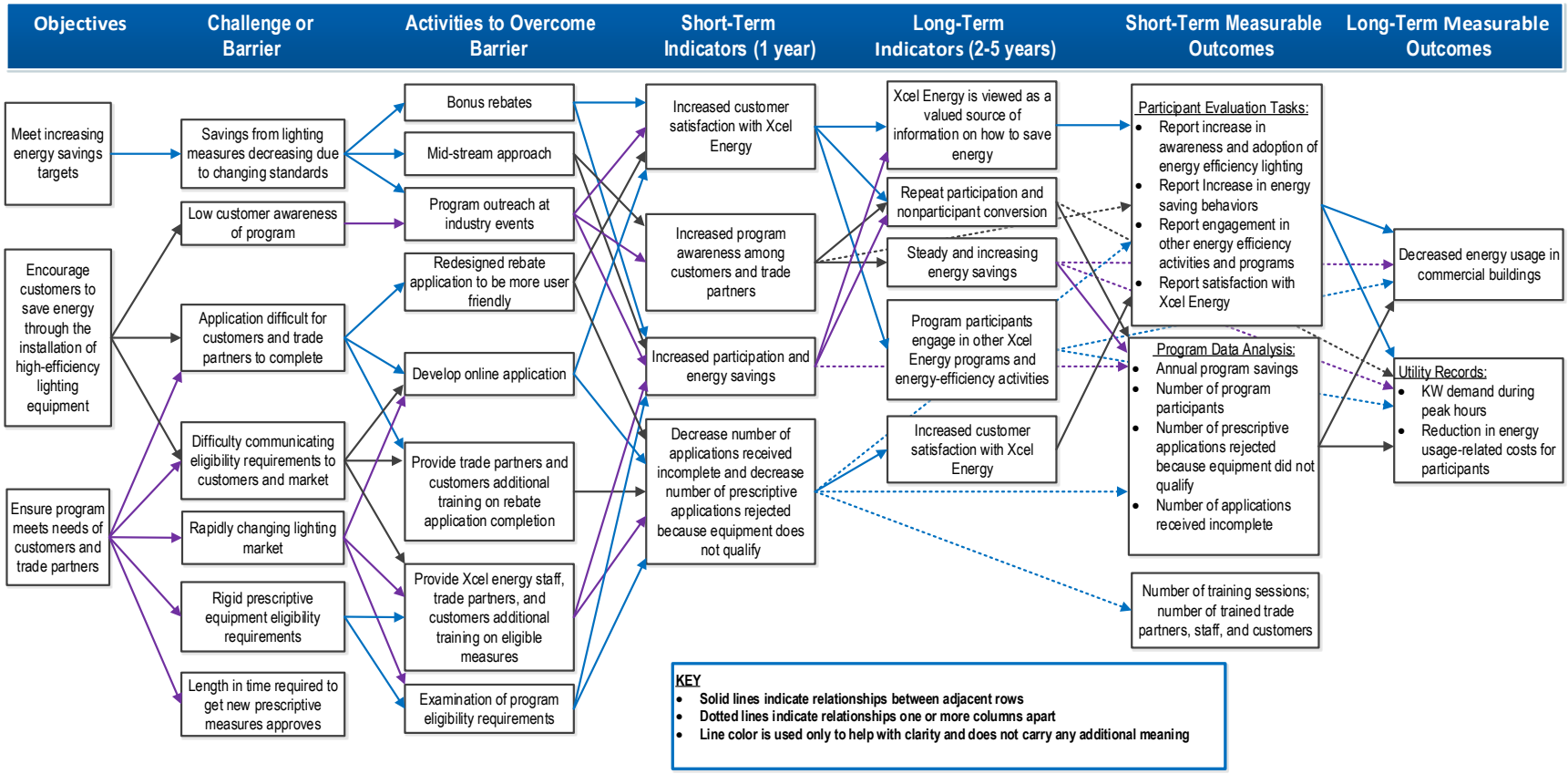
Table 2. 2014 Lighting Efficiency Targets and Achievements

2014	Electric Savings (Net Gen. kWh)	Electric Participants
Target	75,288,784	1,584
Achievement	71,534,278	1,608*
Percentage of Target	95%	102%

*Unique participants

The program logic model, depicting program objectives, barriers, and resulting market effects, is shown in Figure 1.

Figure 1. Lighting Efficiency Program Logic Model



Xcel Energy's Program Management and Program Partners

Xcel Energy manages and implements the Lighting Efficiency program in-house, although the LED instant rebate component is implemented by a third-party.

The Xcel Energy program manager is responsible for the day-to-day operation of the Lighting Efficiency program and for managing the budget and monitoring energy-savings impacts. The program manager is also involved in product development, training trade partners, conducting quality assurance/quality control (QA/QC) of prescriptive applications, approving custom projects from a program requirements standpoint, developing and implementing program policies, and making changes to improve the program in the future.

Xcel Energy's Account Managers

Account managers play a major role in the Lighting Efficiency program because customers with a peak demand of 400 kW or greater, the program's target market, are assigned a dedicated account manager. Some national chains in Xcel Energy's territory with a peak demand under 400 kW are also assigned an account manager.

Account managers are a customer's "single point of reference" with Xcel Energy. They work with all departments at Xcel Energy to ensure these large customers have the support they need. In supporting the Lighting Efficiency program, account managers are responsible for promoting the program, educating customers about the program and any changes or bonuses being offered, assisting with applications, and answering any questions customers have.

The program management team provides account managers with e-mail templates and marketing collateral to engage customers and encourage program participation, and account managers try to discuss all of Xcel Energy's programs anytime they are talking to customers. By establishing and maintaining relationships with their customers, account managers are successfully encouraging customers to participate in the program with multiple projects. The program manager said account managers do a great job in promoting the Lighting Efficiency program and have met their targets for contribution to DSM efforts every year to date.

The program management team also trains account managers on program changes and updates and, periodically, on different technologies they will encounter in the Lighting Efficiency program. Account managers said, in general, the training supports their ability to educate their customers about the program. However, they noted that additional technical, product-specific training would help them better support their customers. They also said they wanted more clarity about who to contact with questions and who has the authority to make certain decisions.

Account managers help customers fill out applications and stated it is extremely difficult to get customers to complete them themselves. They said the applications they receive are rarely complete. In many cases, customers send their invoices for the lighting project to their account manager and the

account manager assists in completing the application. For larger projects, account managers sometimes conduct an on-site verification.

Account managers said they would appreciate a faster turnaround time on items such as exception requests. The program manager noted that, although Xcel Energy has adequate sales staff to engage customers, the program could benefit from additional support staff to conduct initial reviews of applications and exception requests. This supports the need for additional staff in this area, something that Xcel Energy is considering.

Xcel Energy's Business Solutions Center

The Business Solutions Center (BSC) serves all customers that are not assigned an account manager. BSC representatives support small businesses with billing and answer any other questions they have. A smaller group of energy-efficiency specialists within the BSC are dedicated to assisting customers with participating in energy-efficiency programs. Program staff said there are challenges with the BSC's support of the Lighting Efficiency program, such as not and not adhering to program management and engineering decisions or program requirements.

Xcel Energy's Product Development Team

With regards to the Lighting Efficiency program, the Xcel Energy product development team, with assistance from the Engineering Team, is responsible for developing new prescriptive measure offerings. As new lighting technologies emerge and exhibit a strong trend in the Custom Efficiency program, Xcel Energy staff is evaluating the possibility of rebating these measures prescriptively. Engineers and product development staff compile and analyze data from the Custom Efficiency program, as well as information from manufacturers and other utilities, as an input for determining the measure's cost-effectiveness for the typical participant. By studying the measure's historical performance in the Custom Efficiency program, Xcel Energy staff can estimate annual achievement and then compare cost-effectiveness to existing prescriptive measures. The team lead engineer, engineering manager, and program director review the proposed measure and technical assumptions and decide if the measure warrants posting a 60-Day Notice to add a new prescriptive measure offering. Product Development staff are responsible for developing the Notice content, including write-ups and technical assumptions, though staff from other departments contribute heavily.

Depending on the type of measure being considered, measures move through one of two paths. Measures that meet certain criteria around feasibility and market readiness move through the product development express (PDx) path. The product development team is primarily responsible for facilitating the movement of the measures through the internal development process, while program management and engineering teams, as well as third-party engineering firms, compile the Notice content. On average, it takes two to three months to develop the materials for a 60-Day Notice, and another one to two months for the measure to be approved. Xcel Energy developed the PDx path in early 2014 as a means of keeping up with the rapidly changing energy-efficiency market. However, the amount of time it takes for measure to be developed and approved is still a challenge.

Measures that do not meet the criteria for the PDx path enter the full product development (PD) path, during which extensive market research is conducted. The product development team is highly involved in the development of Notice and/or filing documents for measures that move through the full product development path. In contrast to the PDx path, it can take up to a year and a half to two years for measures to move through the full product development path and be approved by regulators (if part of a DSM Plan filing).

Xcel Energy's Engineering Team

In addition to the role they play in developing new prescriptive measure offerings, the Xcel Energy engineering team is highly involved in the operation of the Lighting Efficiency program. Engineers analyze all custom projects and also help develop and review the deemed savings estimates and technical assumptions used to calculate project savings and cost-effectiveness.

Engineering staff cited time constraints related to the additional work load associated with the development of prescriptive measures. The product development team also identified resource constraints with the engineering team, noting that they are tasked with many responsibilities and development of new measures is not necessarily one of them. This sentiment was echoed by the program manager, who noted that the product development team does not have time to focus on developing prescriptive measures and the responsibility often falls to the engineering team, which has competing priorities. To alleviate these technical resource constraints, Xcel Energy brings in external engineering consulting firms to develop technical assumptions and other filing details for measures in the PDx path. This helps to move measures through the process more efficiently. Product development staff noted that the PDx path has been streamlined and is working especially well now that external resources are available to assist with the development of technical details.

Xcel Energy Trade Channel Manager

The trade channel manager communicates with the trade partners to ensure they understand the program and to obtain their feedback to support the program. Xcel Energy relies on trade partners for information about new product pricing, current equipment and its compatibility with program rebates, and any issues they see in the field with installations.

The trade channel manager reaches out primarily to manufacturers, distributors, full-service lighting firms, and the top 20 installing contractors, with the assumption that manufacturers and distributors will disseminate the program's messages to the smaller installing contractors. Historically, the top 20 installing contractors have produced the majority of customer participation for that group. In 2014, over 400 trade partners actively participated in the Lighting Efficiency program. Xcel Energy recruits new trade partners as needed.

Trade Partners

The Lighting Efficiency program relies on different types of trade partners, including manufacturers, distributors, full-service lighting firms, and installers to deliver the program. Trade partners influence

what equipment is installed and, along with account managers, promote the program. The program offers trade partners the option to receive the rebate on behalf of their customers.

Trade partners are not required to receive any certifications or complete any training to participate in the program unless they conduct lighting redesign studies. Upon registration, the trade partner is added to the Salesforce database and then receives program communications. The Lighting Efficiency program keeps trade partners informed about the program and promotions primarily though newsletters and e-mail. Xcel Energy also hosts a DSM roundtable to distribute information and gather feedback from trade partners.

Xcel Energy also established a Lighting Advisory Board that communicates directly with manufacturers, distributors, and installers. The board meets with trade partners three times a year and trade partners in attendance provide information for product development, give feedback on potential program improvements, and convey questions or concerns from customers. The program manager said that Xcel Energy has a strong relationship with its trade partners and that many program decisions are based on information gathered during these meetings.

Trade partners receive printed materials, such as program overviews and case studies, to help market the program. Xcel Energy also designed a preapproved logo that trade partners can apply to their own marketing materials to promote rebates available through the Lighting Efficiency program. Trade partners also promote the program when they are talking directly to their customers and as part of the proposal process.

Trade partners can be directly involved in completing and submitting the customer's application and documentation. While the program manager and trade channel manager said trade partners are often responsible for the paperwork, account managers reported that they assist in completing many of the custom applications for customers.

The Lighting Efficiency program does not provide cash incentives to trade partners but recognizes their success in other ways, such as taking them to events and awarding the top-performing trade partners each year with a plaque and window clings with information about why they are being recognized. Trade partners that win in multiple years receive a metallic pin to add to their plaque. When possible, Xcel Energy delivers the awards in person and the trade channel manager said trade partners really appreciate the awards.

The program manager said the program has been particularly successful in developing long-lasting trade relationships. The trade channel manager receives few complaints from trade partners regarding ease of participation and said the Lighting Efficiency program has become a big part of these trade partners' business model and is very important in helping them close deals.

Training

Xcel Energy offers optional training to trade partners that focuses primarily on providing information about the Lightning Efficiency program, qualifications for rebates, and how to incorporate the program into the sales process.

Starting in 2015, Xcel Energy, in collaboration with all of the lighting manufacturers, launched a series of workshops to train trade partners on program requirements and provide an opportunity to discuss specific applications and trends in the marketplace. The workshops are designed to explain the details and specifications of every prescriptive lighting measure available; as new prescriptive measures are approved, trade partners can see and learn about the product directly from the manufacturers. The first workshop, held in June, focused on helping trade partners understand the DLC category pairings and how they match rebates available through the Lighting Efficiency program. An upcoming workshop will focus on the program's custom component.

Xcel Energy also builds upon the relationships it has with lighting trade groups—especially the Illuminating Engineering Society (IES), which is considered the most active trade group for lighting—to conduct program marketing and education. The IES hosts continuing education training and, at a May 2015 session, Xcel Energy presented information about the Lighting Efficiency program.

Program Delivery

Once a customer becomes aware of the Lighting Efficiency program from an account manager, trade partner, or through direct mail or other form of marketing, customers may work with a trade partner, account manager, and/or internal facilities personnel to determine lighting needs specific to the use of the space and to understand what qualifies for the program.

Prescriptive Process: Projects that qualify for the prescriptive component require that customers (or a representative on their behalf) complete and submit an application to Xcel Energy detailing the equipment to be installed and/or equipment to be removed. Customers are also required to submit specification sheets and invoices listing model numbers, quantities, and equipment and labor costs to demonstrate that the proposed equipment meets the program's eligibility criteria. Xcel Energy representatives check all prescriptive applications for accuracy, completeness, and required supporting documentation. The application package is then submitted through Salesforce to rebate processors. Information on the application is cross-referenced with information on the invoice and in Salesforce to ensure adherence to program eligibility requirements. Once these quality assurance checks have been completed, Xcel Energy issues a rebate check to the customer or to the trade partner.

Custom Process: The custom application process is different; participation requires preapproval. Customers work with their account manager or trade partner to complete and submit an application and an Excel-based Custom Efficiency Workbook that calculates savings and rebate amounts based on the equipment to be installed and/or equipment to be replaced. A marketing assistant reviews the custom workbook for completeness. An associate engineer then analyzes the project by inputting the custom workbook information into Xcel Energy's cost-effectiveness model, which populates a standard

lighting template. The engineer relies on a checklist to confirm that all information is complete and the analysis model is correct.

Large projects go through multiple reviews before they are given final approval. Depending on its size, the project could be reviewed by an energy-efficiency engineer, the team lead engineer, and, the engineering manager. A random number generator determines if the project will be audited by a third-party firm. Typically, audits are more likely conducted for larger projects. When project is approved, a copy of the final analysis is sent to program management, which then sends the customer a letter that states the project has been preapproved. Customers then have two years to implement the project.

The time required to complete the preapproval process for custom projects varies depending on the size and complexity of the project, but the engineering team typically does not have a large backlog of custom projects to approve. The average custom project takes the engineering team a day to review. If a project involves, for example, a large number of fixture change-outs, the process can be more complex because the engineering team must ensure they are making the correct comparisons.

A common issue the engineers run into is customers using an outdated technology, such as T-12s. In these cases, the engineers may need to make some adjustments because they will not be comparing the proposed equipment to exactly what is currently installed. To estimate energy savings, the engineers must first determine what reasonable comparison equipment would be. If the engineers have questions about the proposed equipment, they contact the vendor to make sure they understand what is being proposed.

Sometimes the engineering team receives application packets that do not include all of the information they need to complete their review, or packets where the application form and the custom workbook do not agree. In these instances, the engineering team works with the customer, vendor, and account manager to determine the cause of the discrepancy and to remedy it.

The team lead engineer said the custom workbook is working especially well for the Lighting Efficiency program and allows the team to process projects quickly. The trade channel manager echoed this, stating the process for reviewing and approving custom applications has improved greatly and the engineers can quickly turn around project approvals.

Promotion and Marketing

Xcel Energy promotes the Lighting Efficiency program through direct mail and e-mail communications and advertising in market publications, websites, and at Denver Broncos football games. Using standard industrial classification (SIC) codes, Xcel Energy targets business types and promotes the most applicable measures. Xcel Energy has developed several case studies specific to the Lighting Efficiency program and learned through surveys that customers find the examples of projects and actual energy savings helpful. Xcel Energy also markets the program through general energy efficiency awareness campaigns and at customer events such as the Energy Efficiency Expo it hosts every other year. Over 600 people, mostly customers, attended this year's expo.

As discussed above, account managers and trade partners play a large role in promoting the program to their customers. The program management team provides account managers and trade partners with promotional materials, such as case studies and program overviews. The annual training meetings also serve a marketing role by engaging trade partners in the technology and supplying them with information to promote the program.

Despite these marketing efforts, however, account managers are surprised at how many customers do not know about the rebates Xcel Energy offers. They said most customers know that Xcel Energy offers programs but these customers are not familiar with any specifics. When asked what resources or materials would help them promote the program, account managers suggested product training directed to customers and getting vendors and customers together.

Role and Impact of Other Programs

The program manager said distinguishing between small and large businesses is a challenge, and causes confusion both internally and with CLEAResult, the third-party firm that implements the Lighting – Small Business (SBL) program. By definition, if a customer's peak demand is under 400 kW and they are not managed by an account manager, they fall under the SBL program. However, small businesses who do not receive SBL program services provided by CLEAResult, such as a free lighting assessment, can go through the Lighting Efficiency program. Xcel Energy wants to ensure that customers who participate in the SBL program do so because they need the additional services available through the program, such as the free lighting assessment.

The program manager also noted that Xcel Energy does not have enough data to determine the optimal cutoff point delineating small and large businesses, but Xcel Energy is currently working on refining this definition to decrease confusion and ensure customers receive the support and program offerings that are most appropriate and cost effective to deliver. As discussed previously, staff members from both programs collaborate on developing new products, developing and maintaining relationships with the trade, and marketing the programs.

Xcel Energy also offers a business New Construction program that includes an energy design assistance path. Many larger new construction projects go through the business New Construction program and savings from lighting measures installed as part of these projects are applied to this program rather than the Lighting Efficiency program.

Market Barriers and Program Challenges

The Lighting Efficiency program manager and the team lead engineer identified the length of time it takes to get new prescriptive measures approved as one of the biggest challenges the Lighting Efficiency program faces. The lighting market, and LED technologies in particular, is moving incredibly fast, which makes it difficult to keep qualifying prescriptive measures and rebates aligned with new products in the market. Before launching a new prescriptive measure, Xcel Energy must post a 60-Day Notice or file it within a DSM Plan proceeding for approval. The large number of custom projects in the pipeline

indicates that the prescriptive component of the program, which the program manager identified as the easiest way to obtain customers, is not keeping up with the pace and needs of the market.

Program staff said the high rigor around measure eligibility for the prescriptive component of the Lighting Efficiency program could be a barrier to participation and make achieving program goals difficult. The program requires customers to report the equipment they are removing along with what they are putting in, and, in some cases, measures must replace existing equipment on a one-to-one basis or use the "3-6 times rule." If the new equipment falls outside of those parameters, it does not qualify for the prescriptive program. Program staff noted that the vast number of options that exist can complicate the program for customers and the rigid eligibility requirements can potentially limit what the program is able to achieve.

These requirements help ensure that the program rebates measures that save energy at a rate that can support technical assumptions for program cost-effectiveness. The challenge for customers, however, is in determining what qualifies. Based on interview findings, these requirements are not clear to the trade and customers, and not all eligibility requirements are captured on the application form. Additionally, as product efficiencies continue to rise, the rigid wattage range requirements can limit the equipment that qualifies for the program. The constantly changing lighting market adds to the difficulty of effectively communicating the complexities of equipment eligibility. The program manager said that simplifying equipment eligibility requirements or more effectively communicating these requirements to trade partners and customers is essential for the program's continued success.

The complexities around equipment eligibility and the difficulty of communicating eligibility requirements to the market sometimes results in customers applying for a prescriptive rebate after installing equipment that does not in fact qualify. Since the equipment has already been installed, they are disqualified from the custom component of the program. In some cases, customers can seek an exception to have preapproval waived; however, exceptions are typically granted only if there is documentation of Xcel Energy indicating that the measures qualify, a processing delay caused a missed deadline, or the wattage requirements are right on the limit. This is not an ideal situation from a customer service standpoint.

Account managers said the program's complexity results in customers having difficulty filling out the application. Xcel Energy designed a new application for the 2015 program year in which eligibility requirement descriptions are built into the rebate worksheet portion of the application instead of being listed on a separate page at the end. Despite this change, however, account managers said customers still do not complete the applications properly and often do not provide sufficient information on the removed equipment, which means staff must contact the customer to get this information. The program manager also noted that the redesigned application is still not user friendly and suggested photographs of the products could be helpful to include with the application. Account managers said the information customers are required to submit with the applications can be burdensome.

The program manager noted that marijuana growing operations, which use a significant amount of energy for lighting, are a new and underserved market in Colorado that could benefit from additional training and support. City of Denver officials estimate that annual power demand is increasing at a rate of over 1% in the city,[4] with almost half of the growth in power demand coming from marijuana growers.

Because the cannabis industry is so controversial, however, it can be difficult for Xcel Energy as a multistate corporation under federal regulations to target this market. Xcel Energy is working on reaching out to its large-scale marijuana growing customers through approved marketing in an effort to introduce them to the energy-saving lighting opportunities Xcel Energy can offer.

Data Tracking and Reporting

Xcel Energy uses the Salesforce database to track all customer and program participation data across its suite of DSM programs. Program staff use Salesforce's pipeline reporting features to help manage the forecast for the Lighting Efficiency program. A dashboard allows staff to see, on a daily basis, what projects are in the pipeline, how products are trending, and where savings are coming from. Salesforce houses all product details and calculators used to determine a project's energy savings, rebate amount, and cost-effectiveness.

In addition, Xcel Energy uses Salesforce to manage operational workflows for the program. As projects move through stages, staff members are assigned to each particular task. Salesforce shows where a project is in the process, who currently has responsibility for it, and how long the staff members has been working on a particular task. Xcel Energy uses Salesforce data to measure performance against expectations by comparing the time spent on tasks, or the number of tasks that were returned with errors, to pre-established metrics.

When asked where they see the program going in the future, the team lead engineer suggested having more program components automated and online would be ideal. Especially helpful would be a tool that allows customers and trade partners to input equipment information and see if a particular project falls within the prescriptive parameters of the program so they are not required to interpret all of the eligibility requirements. The program manager said enabling trade partners to more accurately estimate energy savings and rebate amounts in real time is important for the future success of the program. Further, account managers stated that a directory of common fixtures would be useful and save considerable time so they are not required to search through the DLC QPL for every product.

Program Changes

Xcel Energy is currently developing an online application, exploring ways equipment eligibility requirements can be refined to better serve the needs of customers, and engaging in ongoing efforts to

[4] As reported by Robert Walton in Utility Dive article: <http://www.utilitydive.com/news/marijuana-grow-houses-boost-denver-power-demand-complicating-efficiency-pl/401751/>

keep up with ever-changing lighting technologies. No other major program changes are currently planned for the prescriptive and custom program components.

Participating and Nonparticipating Customer Surveys

To further support the Lighting Efficiency program evaluation, Cadmus surveyed participating and non-participating commercial customers. The surveys took place in September 2015.

Objectives

The survey effort sought to provide Xcel Energy with feedback from 2014 program participants and to aid in understanding the program's impacts on participants and nonparticipants. With input from Xcel Energy, Cadmus designed a survey protocol to address the following research topics:

- Program awareness and motivation
- Trade partner experience
- Program satisfaction
- Energy efficiency barriers and market conditions
- Program impacts: freeridership, spillover

The net-to-gross (NTG) section of this report provides separate analysis of freeridership and spillover.

Methodology

Xcel Energy provided a list of all accounts receiving a rebate under the Lighting Efficiency program in 2014 (participants), as well as a list of accounts that did not participate in the program (nonparticipants). Cadmus developed telephone survey instruments to address the above study objectives with the following customers:

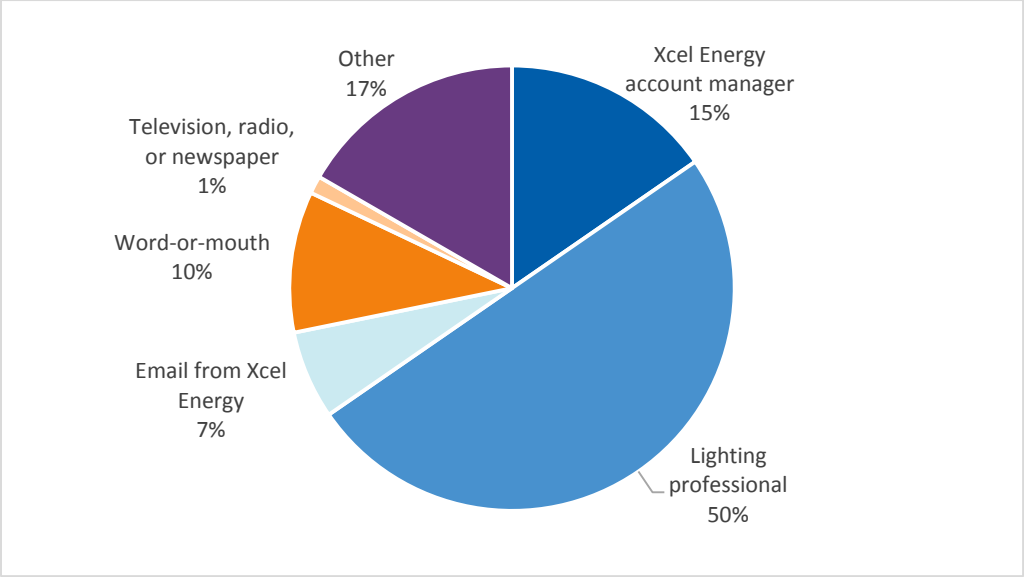
- 1,037 Lighting Efficiency participants (2014); 70 survey completions
- Sample of 3,000 nonparticipating customers selected at random; 71 survey completions

Lighting Efficiency Participant Survey Findings

Program Awareness

Contractors appear to generate a significant amount of program awareness. As shown in Figure 2, half (50%) of respondents heard about the Lighting Efficiency Program through a lighting professional or contractor. Fifteen percent of respondents first heard about the program through an Xcel Energy account manager. Participants also rated lighting distributors (44%) and contractors/electricians (33%) as the most common sources for lighting equipment and advice.

Figure 2. How Participants Heard about the Program



Source: Participant survey, C1. How did you hear about the Efficient Lighting program? (n=68)

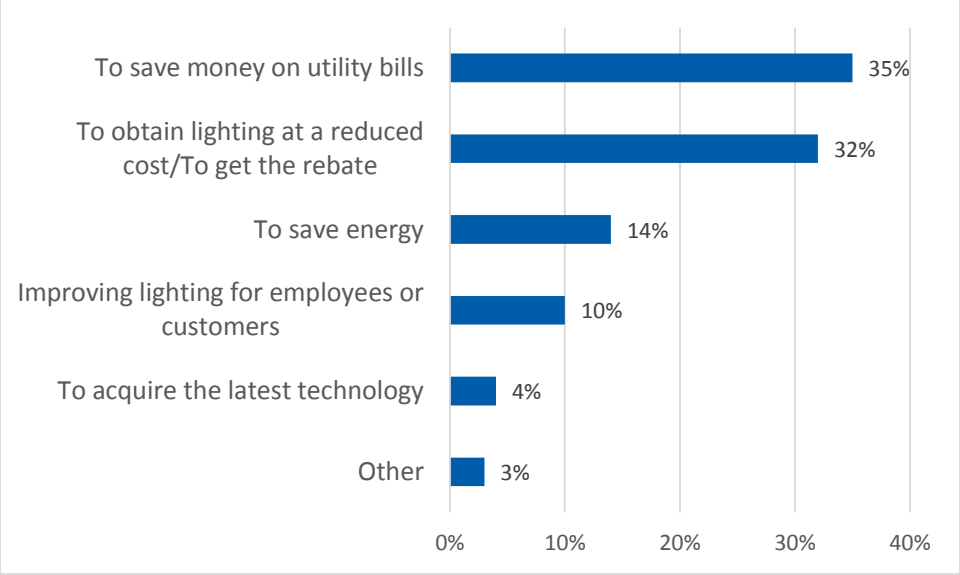
Communication Preferences

Lighting Efficiency respondents most often cited e-mail as the best way to receive information about the program (47%), with bill inserts the second-most common suggestion (17%), and all other suggestions endorsed by less than 10% of respondents.

Decision-Making Factors

As shown in Figure 3Figure 3, participants reported that their top motivations for participating in the Lighting Efficiency program were saving money on utility bills (35%) and receiving a rebate/reduced cost for a lighting project (32%). Respondents also cited saving energy (14%) and improving lighting for customers and/or employees (10%).

Figure 3. Motivations for Participating



Source Participant survey, C4. Which factor was most important in your decision to participate in the Lighting Efficiency program? (n=69)

Nearly one-half (46%) of participants had participated in another energy efficiency program provided by Xcel Energy, with the Motor Drive Efficiency (25%) and Cooling Efficiency (19%) programs the most common of these. Additionally, 16% participated in the Lighting - Small Business program prior to participating in the Lighting Efficiency program.

Trade Partner Experience

Most respondents (90%) said they worked with an outside company to design, procure, and/or install the efficient lighting purchased through the program. Lighting contractors or electricians most commonly served as trade partners (41%), with lighting distributors (38%) the second-most common trade partner.

A majority (84%) of respondents said they worked with trade partners and that trade partners "provided information about Xcel Energy's Lighting Efficiency program," and 75% said the trade partner they worked with, reviewed equipment or materials that offered various efficiency levels as project options. Most respondents (81%) said input from trade partners was important in their decisions to participate in the program. Most (89%) said there was nothing more the trade partner could do to improve their experience with the program, though a few respondents cited improvements such as faster installation, additional measures, and better work quality.

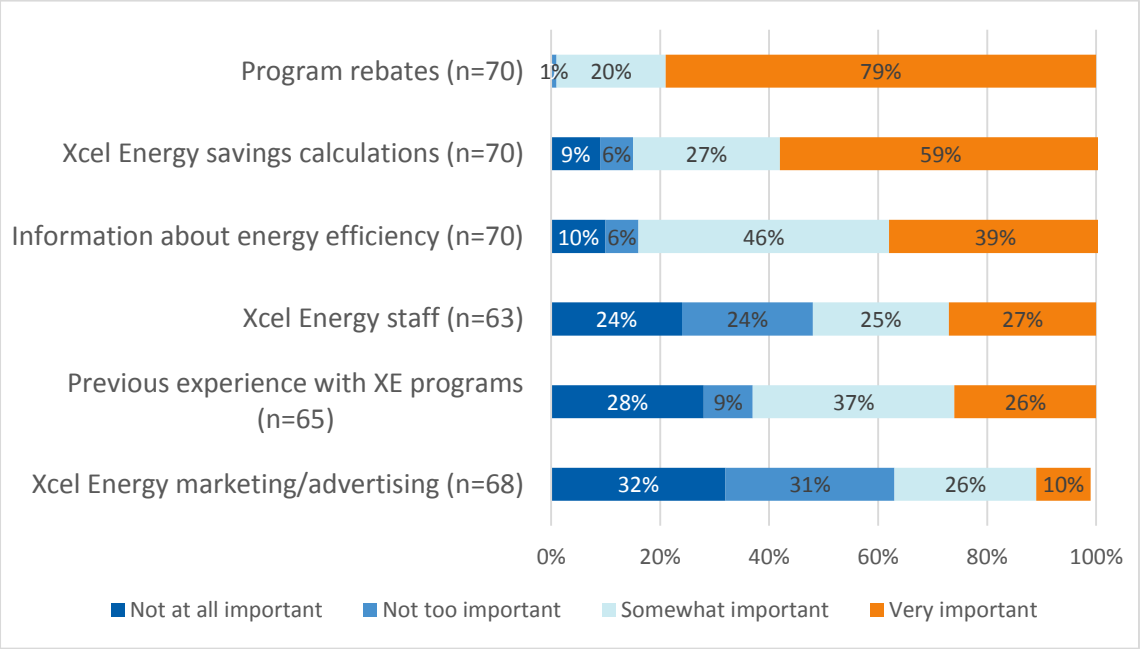
Freeridership and Spillover

Participants responded to questions about whether they would have completed the project without assistance from Xcel Energy's program. As these questions serve as components of the NTG impact analysis, the NTG section addresses the survey findings.

Program Influence

While participants considered several program components as important in deciding to undertake lighting projects, respondents most often (79%) cited program rebates as very important, as shown in Figure 4. More than half of respondents also considered savings calculations from the study very important in their decision.

Figure 4. Importance of Program Components

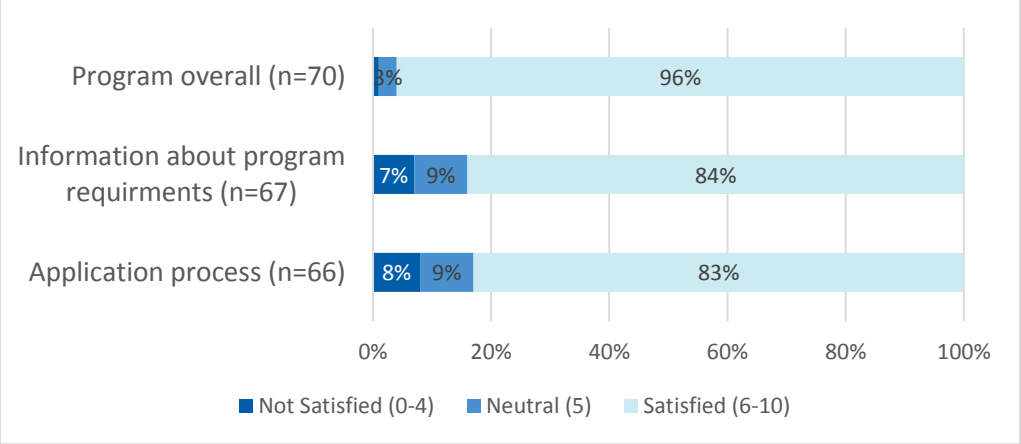


Source: E5a – E5f, Please rate each item on how important it was in your decision to do the project. (n sizes shown in chart)

Participant Satisfaction

Overall, participants expressed high satisfaction levels with the program (96%). Most respondents also expressed satisfaction with the information about program requirements (84%) and with the application process (83%); however, 16% and 17% (respectively) provided lower satisfaction ratings for these program aspects. Figure 5 shows satisfaction ratings for the three program aspects.

Figure 5. Participant Satisfaction



Source: G1, G5, G9, How satisfied are you with [program component]?

A majority (61%) of respondents indicated they or someone from their company filled out the program application. Those dissatisfied with the application process found it too time consuming or reported that instructions could be clearer.

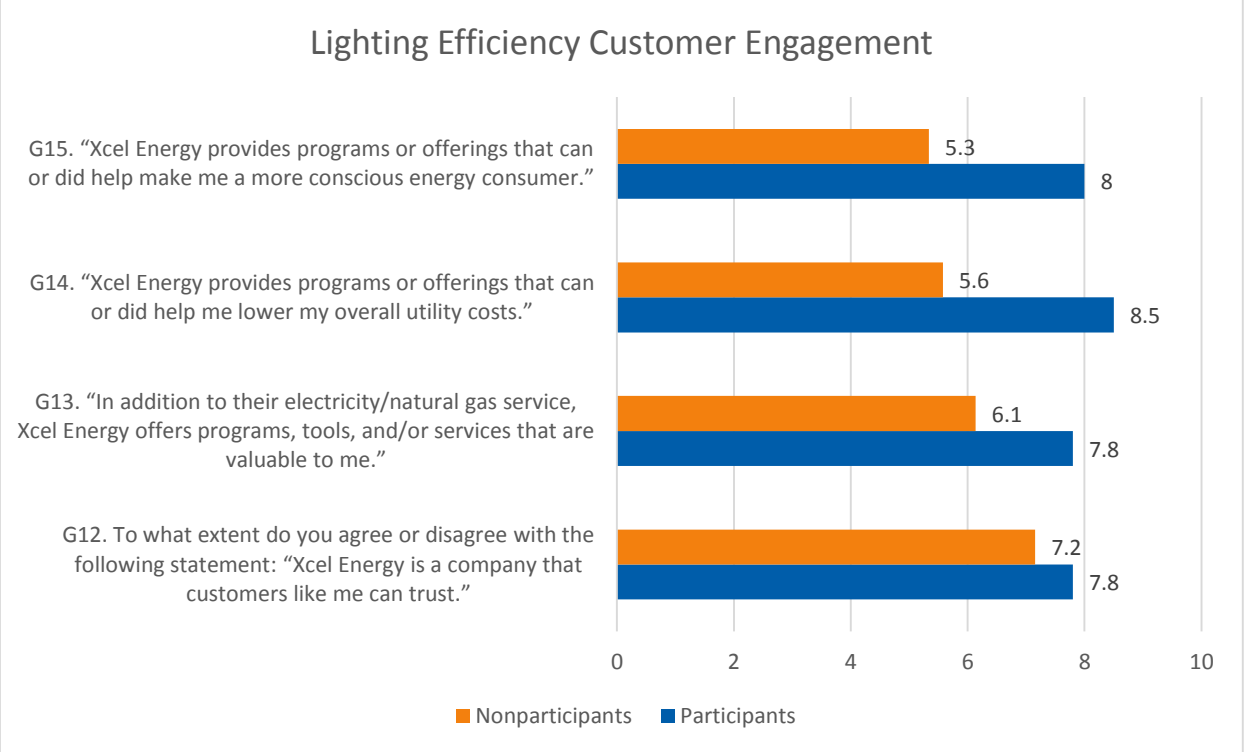
For 71% of respondents, the lighting measures completely met expectations. Those saying the measures somewhat met their expectations described a variety of issues not meeting their expectations:

- Level of energy savings (eight respondents);
- Payment delivery (two respondents);
- Installation issues (two respondents); and
- Controllers not operating as expected (two respondents).

Participants also rated the likelihood that they would recommend the program to others. All (100%) respondents provided positive responses to the question: "How likely is it you would recommend this program to a friend?" Over three-quarters of respondents (77%) said they would be very likely to recommend the program; the remainder (23%) considered a recommendation somewhat likely.

As shown in **Error! Reference source not found.**, participants also responded favorably to questions regarding their engagement with Xcel Energy. Most customers (94%) agreed that Xcel Energy provided programs that could help lower overall utility costs. Participants also showed higher mean score ratings for all of the engagement questions compared to nonparticipants.

Figure 6. Customer Engagement Ratings



Source: G12 – G15, To what extent do you agree with… (n=70)

Barriers

Respondents who acknowledged challenges in making energy-saving improvements in their facilities (81%) cited capital (34%), costs (21%), and cost-effective measures (17%) as the top three barriers. Increased rebates served as the most common solution (33%) offered for these challenges.

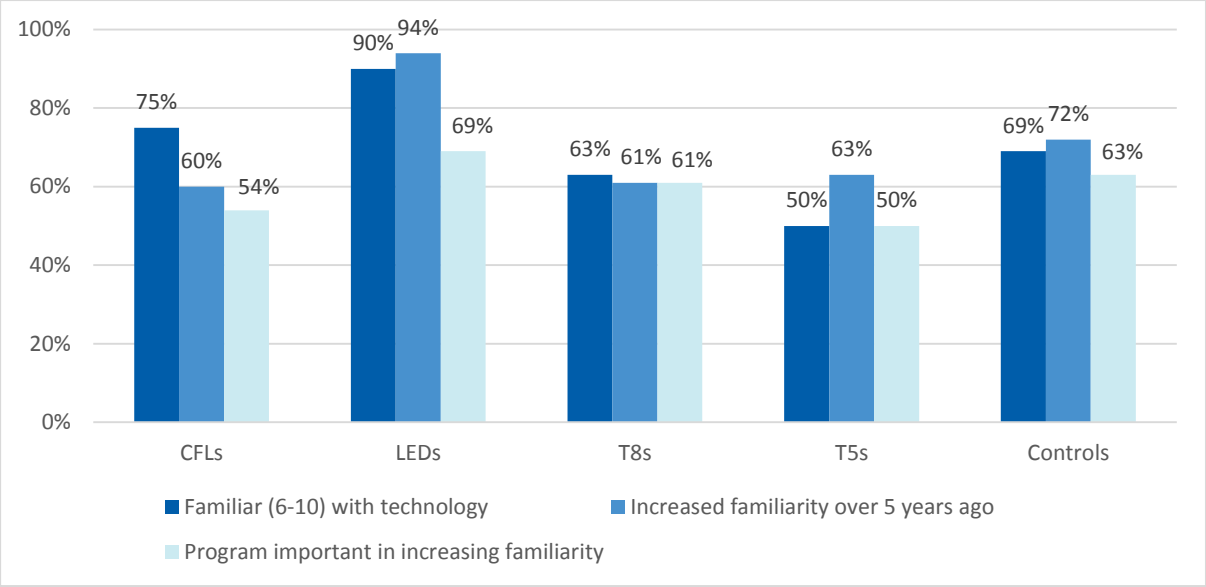
Energy Efficiency Market Conditions

Participants indicated that their familiarity with lighting technologies increased over the past five years, and a majority attributed that increase to Xcel Energy's Lighting Efficiency program.

Respondents first rated their familiarity with five types of lighting technologies. They were then asked if their familiarity increased, decreased, or stayed the same as five years ago. Those indicating their familiarity increased were then asked how important Xcel Energy's Lighting Efficiency program was in increasing their familiarity with these technologies.

Figure 7 shows response levels to the familiarity, change, and program importance questions for the five technologies.

Figure 7. Familiarity Trends for Lighting Technologies



Source: I1a-e, I2a-e, I3a-e, (n sizes vary by question)

Respondents expressed the highest familiarity level (90%) and increased familiarity (94%) with LED lighting technologies. Of the five technologies, more participants (69%) attributed the importance to Xcel Energy's program for increasing their familiarity with LEDs. Respondents were least familiar (50%) with T5 technologies.

Participant Profile

Survey respondents were well-distributed among business types, with office (26%) and retail (14%) as the most common facility uses. Over one-half (54%) described their premises as one entire building; 19% had part of a building, and another 25% had more than one building campus. Just over one-half (52%) were owner-occupied facilities, and 59% had 20 or fewer employees working on the premises where lighting projects were installed.

Nonparticipant Survey Findings

Cadmus surveyed 71 nonparticipant customers to understand levels of program awareness, experiences with lighting trade partners, engagement with Xcel Energy, barriers to energy efficiency, and familiarity with lighting technologies.

Though not participating in Xcel Energy's Lighting Efficiency program, just over one-half (55%) said they had installed efficient lighting technologies, such as LEDs or T8s, within the past five years without receiving a rebate. LEDs were the efficient lighting mostly commonly installed (62%).

Program Awareness

Over one-half (55%) of nonparticipants were aware of Xcel Energy's Lighting Efficiency program. Those respondents heard of the program through a variety of sources, with bill inserts (30%), lighting

professionals (24%), and mail (19%) the three most common sources. Most of those aware (69%) had heard about rebates/incentives offered by the program.

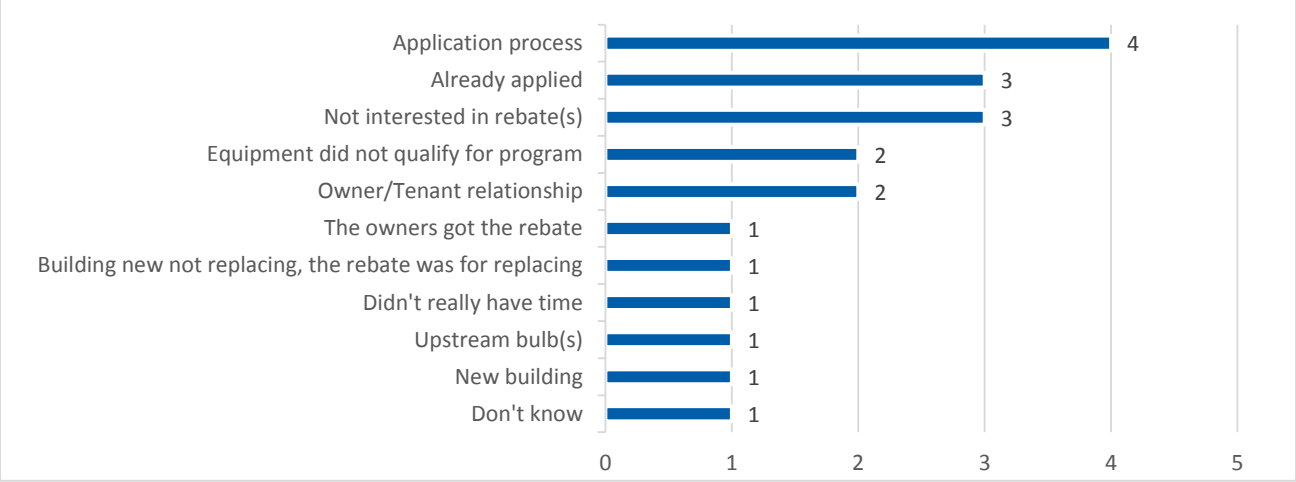
Program Information

Nonparticipants most often suggested bill inserts (54%) as the best way for Xcel Energy to inform them of energy efficiency programs. E-mail (21%) came in a distant second for receiving information on energy efficiency programs.

Reasons for Nonparticipation

Nonparticipants who purchased/installed efficient lighting without receiving rebates expressed a variety of reasons why their company declined to participate in the Lighting Efficiency program. Although no more than four respondents offered a single reason, the application process emerged as most common reason, as shown in Figure 8. The remaining 17 that had installed energy efficient lighting equipment without getting a rebate were not aware of the program.

Figure 8. Reasons for Nonparticipation



Source: C5. When your company installed the efficiency lighting equipment you mentioned previously, why did your company decide NOT to participate in the Lighting Efficiency program? (n=19)

For respondents unaware of the program, 13 of 17 (77%) said their company would have been somewhat to very interested in participating in the Lighting Efficiency program, had they known about it. The few not interested cited the time required and/or measures already installed as participation barriers.

Prior Program Participation

Unlike participating respondents, most nonparticipants (86%) had not participated in other energy efficiency programs from Xcel Energy. Of 10 respondents participating in other programs, Motors and Drive Efficiency, Cooling Efficiency, and Lighting - Small Business were the most common.

Trade Partner Experience

Similar to participants, over one-half (56%) of nonparticipants worked with an outside company to design, procure, or install lighting for their company, turning most commonly to contractors/electricians (55%). Just over one-half of those working with outside companies (10 of 18) said they received different efficiency levels as options for their lighting projects. Further, most (75%) found the input from these trade partners important in their decisions for lighting types to install.

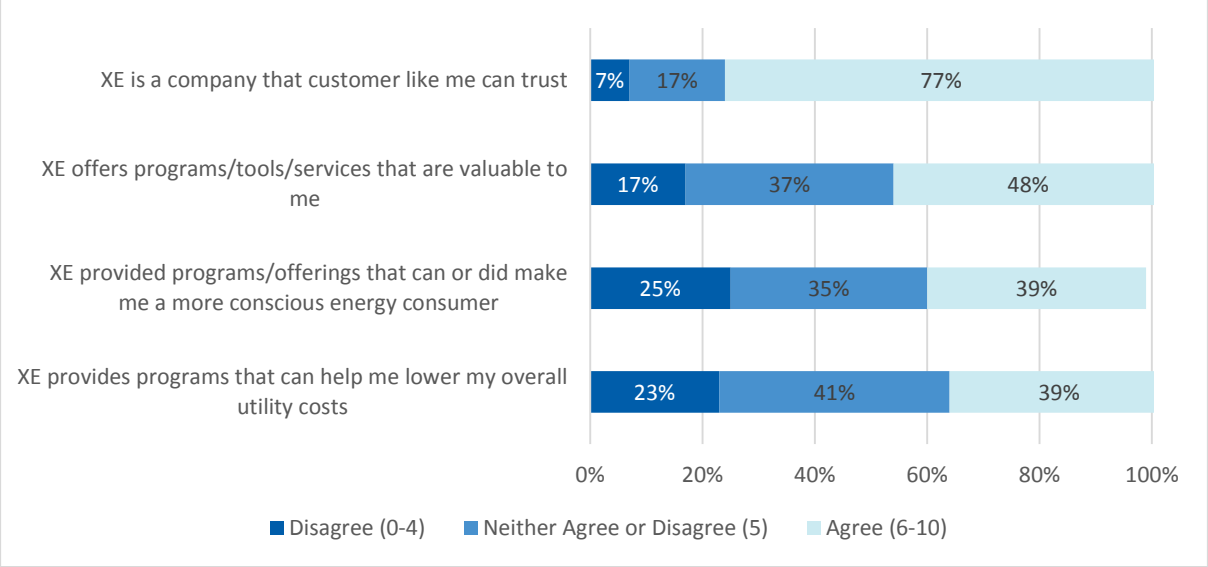
Spillover

Spillover analysis is included in the NTG section of this report.

Engagement with Xcel Energy

Nonparticipants were less likely than participants to agree with four customer engagement statements. As shown in Figure 9, over three-quarters (77%) considered Xcel Energy as a company they could trust. More respondents (41%) expressed ambivalence levels (a 5 rating on 0–10 scale) for Xcel Energy providing programs that could help lower overall utility costs. Nonparticipants provided lower mean score ratings on all four customer engagement items compared to participants (see Figure 6).

Figure 9. Nonparticipant Customer Engagement



Source: F1-F4, To what extent do you agree with the following statements… (n=71)

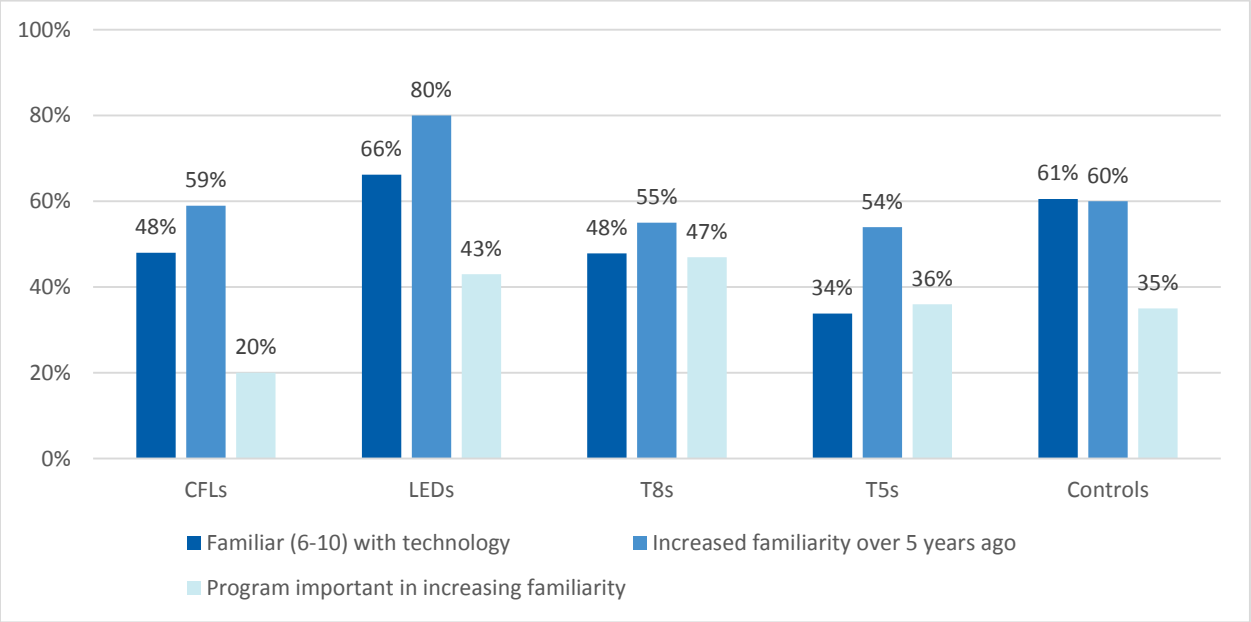
Barriers

Most nonparticipants (82%) identified challenges to making energy-saving improvements in their facilities. Similar to participants, they most commonly cited costs (43%), lack of capital (15%), and cost-effective measures (13%). Although fewer nonparticipants could offer suggestions for how Xcel Energy could help overcome these challenges, a few respondents identified additional rebates (17%), energy audit recommendations (15%), and financing (15%).

Familiarity and Market Conditions

Unlike participants, less than one-half of nonparticipants were familiar with the five types of lighting technologies, except for LEDs (66% indicating familiarity), as shown in Figure 10. Despite lower familiarity levels, more than one-half indicated their familiarity with these technologies increased during the past five years.

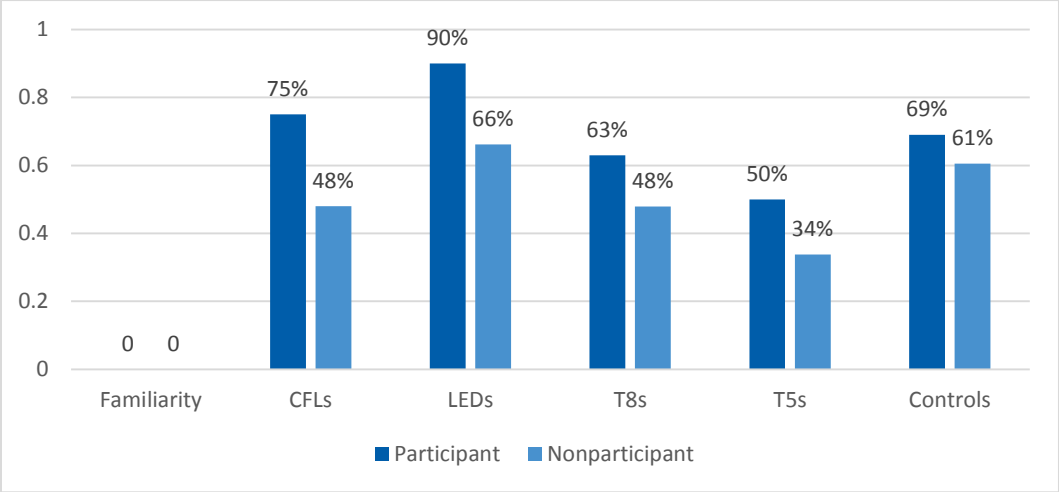
Figure 10. Technology Familiarity and Trends



Source: H1a-H1e (n=71), H2a – H2e n sizes vary, H3a – H3e (n sizes vary).

While nonparticipants showed similar trends in familiarity levels between technologies, fewer nonparticipants than participants were familiar with all technology types (Figure 11).

Figure 11. Familiarity with Technologies; Participant/Nonparticipant Comparison



Source: Same questions referenced in Figures 7 and 10; Familiarity = 6-10 rating.

Similar to participants, lighting contractors served as common advice sources for business lighting needs. Nonparticipants (32%), however, were more likely than participants to seek advice/equipment recommendations from retail sources, particularly home improvement stores

Nonparticipant Profile

Compared to participants, nonparticipants tended to have smaller facilities, fewer employees, and leased space. Facility uses were evenly distributed among different company types, with office (18%) and services (14%) the most common uses. Just under one-half (47%) had facilities of 7,500 square feet or less, and 46% were owner-occupied facilities. A larger proportion (81%) of nonparticipants had 20 or fewer employees.

Program Awareness and Motivation

The Lighting Efficiency program remains fairly well-known in the commercial marketplace; just over one-half (55%) of nonparticipants had heard of Xcel Energy's program and were familiar with rebates or incentives offered through the program. Bill inserts (30%) and lighting professionals (24%) served as common perceived sources of program awareness for nonparticipants. Although the program does not currently use bill inserts for marketing the program, customers' perceptions may relate to an earlier experience when they first became aware of the program or a more general energy efficiency message that was not specific to the current Lighting Efficiency program.

Participants learn about the program largely through **connections with lighting professionals** (50%), such as contractors, electricians, and lighting distributors. Just under one-half (46%) of participants had participated previously in another Xcel Energy program. Motors & Drives, Cooling Efficiency, and Small Business Lighting were common programs exhibiting participation overlap with Lighting Efficiency.

The Lighting Efficiency program delivers its intended benefits. Customers are motivated to participate in the program to save money on utility bills (35%) and to reduce costs/receive a rebate (32%). The

availability of program rebates and Xcel Energy savings calculations also proved very important in participants' decisions for the type and size of projects they initiated.

Trade Partner Experience

Participants and nonparticipants confirmed the **importance of trade partners** as factors in their awareness of the program, understanding the variety of efficient lighting options available, and decisions on equipment to install. Trade partners largely offer energy-efficient options (75% and 55% for participants and nonparticipants, respectively) to customers and in promoting program measures.

Program Satisfaction and Customer Engagement

Nearly all participants (96%) expressed satisfaction with the Lighting Efficiency program overall. Participants also expressed high satisfaction levels with information provided about requirements (84%) and the application process (83%). All participants would somewhat (23%) to very likely (77%) recommend the program to others.

More participants (81%–94%) than nonparticipants (39%–77%) agreed with the four customer engagement statements about Xcel Energy:

1. As a company they can trust
2. Providing valuable programs
3. Providing tools/services for lowering costs
4. Helping make customers more energy conscious

These finding are consistent with customer engagement research that has shown higher engagement and satisfaction levels with utilities from participating customers.

Barriers and Market Conditions

Upfront costs, capital, and identifying cost-effective measures stood as the key challenges cited by participants and nonparticipants in regard to making energy-efficient improvements in their facilities. Respondents most often suggested offering rebates as a way for Xcel Energy to help them overcome such challenges.

Although not highly prevalent as a concern among participants, **a few nonparticipants cited the application process as a participation barrier**. The 2009 Prescriptive Commercial Lighting program evaluation recommended addressing the complexity of the application process, and this appears to have improved, given participants' relative lack of concerns about this issue.

Continue to streamline application processes and encourage support from trade partners to assist with the more challenging aspects of the application process.

Participants were more familiar (50%–90%) with five efficient lighting technologies (e.g., CFLs, LEDs, T8s, T5s, controls) than nonparticipants (34%–66%), but over one-half of each respondent type indicated their familiarity with these technologies increased within the past five years. Participants were more

likely than nonparticipants to acknowledge Xcel Energy's role in helping increase their familiarity with the technologies. Both participants (90%) and nonparticipants (66%) were most familiar with LED lighting technologies and least familiar with T5s (50% and 34%, respectively).

Program Impacts: Please refer to the NTG section of this report for detailed findings regarding freeridership and spillover.

Trade Partner Interviews

Introduction

Cadmus conducted interviews with the program's primary trade partners—contractors and distributors registered with the program in 2014 and those not having participated in the program over the last two years. This section of the report summarizes data collected through these interviews.

Objectives

Participating trade partner interviews sought to achieve the following:

- Understand contractors' experiences with the Lighting Efficiency program;
- Investigate the program's impact on the market;
- Identify program challenges and opportunities for improvements; and
- Identify possible program spillover.

In addition to these objectives, nonparticipating trade partner interviews sought to achieve the following:

- Understand contractors' participation barriers to the Lighting Efficiency program; and
- Investigate opportunities to encourage future program participation by nonparticipating trade partners.

Methodology

In-depth interviews with contractors and distributors registered with the program addressed the following topics:

- Contractor satisfaction and support
- Program design and implementation
- Marketing and training
- Reasons for nonparticipation (in recent years)
- Market transformation
- Barriers
- Spillover

Cadmus interviewed contractor staff (e.g., contractors, energy consultants, distributors) from 23 firms (20 participating, 3 non-participating). Twenty participating trade partners possessed sufficient knowledge of their companies' practices to address all areas included in the interview questions. Two interviewed contractors had more limited knowledge of their companies' practices, and they could not answer interview questions about program marketing or design. One contractor indicated their organization only specializes in refrigerated case lighting and lighting for walk-in freezers; therefore, the respondent's feedback only applied to LED lighting for cold storage applications.

Xcel Energy's Lighting Efficiency program staff provided a list of trade partners, by their unique identification number (opportunity ID), that completed projects for customers receiving rebates from the Lighting Efficiency program in 2014. Interviews focused on distributors and contractors having direct contact with Xcel Energy customers. Cadmus categorized trade partners as high activity (i.e., 10 or more projects) or low activity (i.e., less than 10 projects), based on the number of projects they completed in the last two years (2013 and 2014).

Cadmus prioritized interviews with eight trade partners Xcel Energy identified as highly engaged in the program, including high-activity and low-activity trade partners, and completed interviews with five of the identified firms. For the remaining 15 interviews, we randomly sorted lists of high-activity and low-activity trade partners, seeking to complete an equal number of interviews from each list.

In all, Cadmus interviewed 11 high-activity and nine low-activity trade partners, as shown in Table 3.

Table 3. Categories of Contractors/Distributors Interviewed

Category	Number of Contractors Interviewed
High activity (trade partners working on more than 10 projects that participated in the program during the last two years).	11
Low activity (trade partners working on less than 10 projects that participated in the program during the last two years).	9
Nonparticipating trade partners (trade partners whose projects did not participate in the program during the last two years).	3

Originally, Cadmus defined nonparticipating trade partners as those not participating in the program or not participating during the last five years. Xcel Energy provided a list of all Colorado trade partners, and we filtered out those that participated in 2014 or 2015. We then randomly sorted the list. Several phone numbers and contact names listed on the trade partners list were found to be outdated. Some contact names listed for contractor/distributor organization had not worked for the organization during the past three to five years.

Cadmus encountered difficulty, however, in reaching trade partners meeting the nonparticipant definition, finding that many trade partners contacted actually do actively participate in the program or have participated during the past five years. Working closely with Xcel Energy, we expanded the definition of nonparticipating trade partners to exclude only those participating in 2014 or 2015 (rather than those that participated during the past five years).

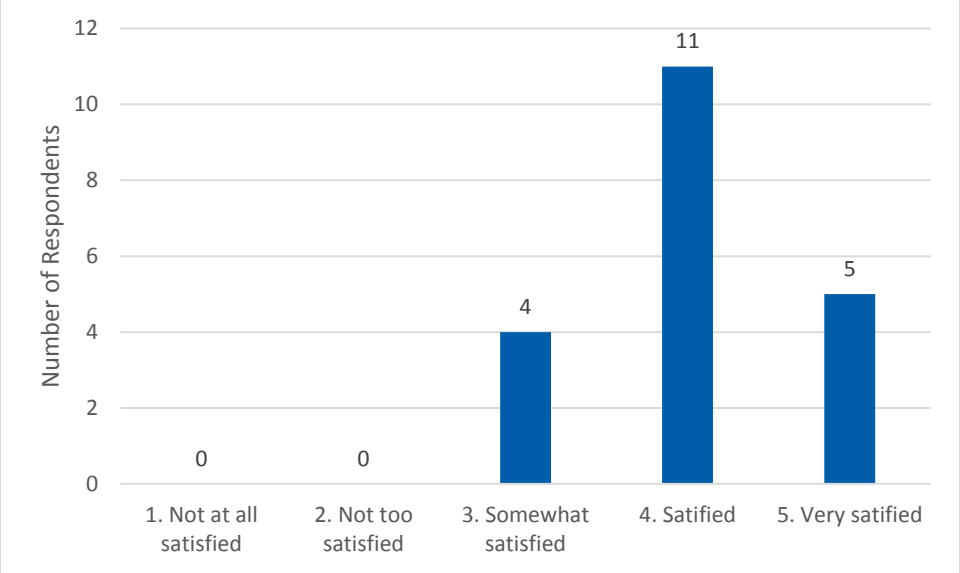
Despite this change, Cadmus could only complete interviews with three (out of the original target of 10) non-participating trade partners, again finding that many trade partners contacted actively served customers targeted by the Lighting Efficiency program. This difficulty in reaching nonparticipating trade partners illustrated the Lighting Efficiency program's extensive trade partner network.

Findings

Contractor Satisfaction

Figure 12 shows contractors and distributors ranged from *somewhat satisfied* to *very satisfied* with the Lighting Efficiency program, with 16 respondents rating the program a 4 and 5 on a scale from 1 (= not at all satisfied) to 5 (= very satisfied). Of these 16 respondents, 12 noted they appreciated the support provided by CLEAResult (the implementer) during the application process and the overall clarity Xcel Energy offered in rebate eligibility requirements. Nineteen participating contractors and distributors stated they helped their customers fill out the prescriptive and custom rebate application forms; while the remaining contractor said their organization relied on CLEAResult to help fill out rebate applications. A majority of contractors were satisfied with the measure offerings and rebate amounts.

Figure 12. Trade Partner Satisfaction with Lighting Efficiency Program



Three contractors cited Xcel Energy's program as the most comprehensive program of its type (in terms of the measure mix) and the most generous (in terms of rebate amounts). One contractor said: "Most others (utility programs) use Xcel as a template; Xcel is better than a lot, though eligibility problems are similar." Contractors said they favored Black Hills's rebate application process over Xcel Energy's process, given its reduced processing time (two weeks) and easy application steps. They acknowledged, however, that Xcel Energy's program is much larger in scale, which may explain the increased processing times. Another contractor stated: "Omaha Utility makes participants go through training before you can apply to be an approved vendor" and suggested that Xcel Energy considers something similar.

In general, contractors agreed that Tri-State, Rocky Mountain Power, and Black Hills Power have similar programs in terms of the measure mix, but offered lower incentive amounts and quicker application processing times than Xcel Energy. Four contractors who rated their satisfaction as a 3 tied their lower rating to the length of rebate processing times, the program's inability to track the application status in

real time, or underestimations of rebate amounts leading to customer dissatisfaction. One distributor indicated dissatisfaction about the program because they were no longer provided incentives for one particular measure they had promoted.

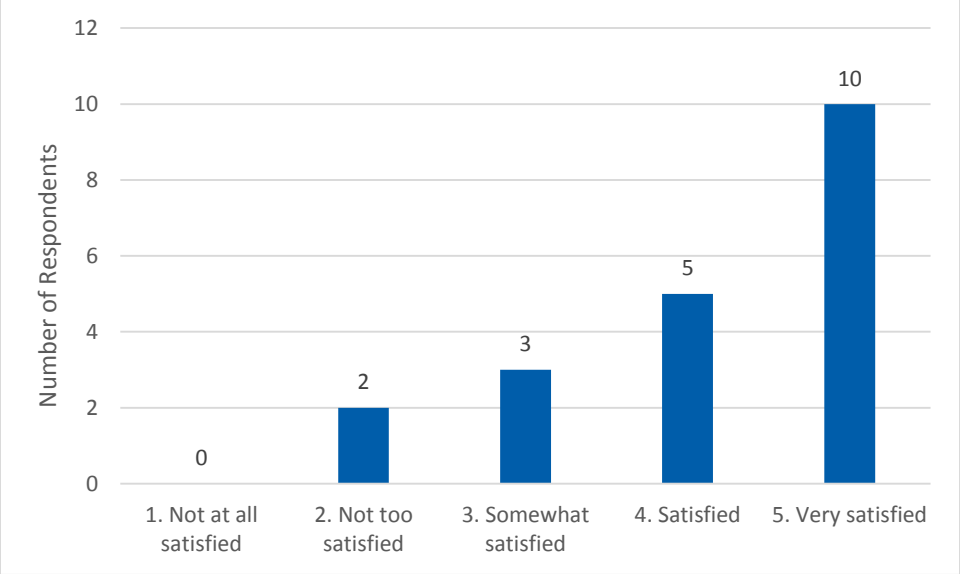
Program Design

Cadmus used the contractor and distributor interviews to collect feedback categorized by the type of rebate: prescriptive and custom.

Prescriptive Rebates

All participating trade partners stated they assisted customers in filling out prescriptive rebate applications. Figure 13 shows that out of 20 participating trade partners, 10 rated the prescriptive application process at a 5 (extremely satisfied), five trade partners rated it a 4 (satisfied) with the prescriptive application process, and five trade partners rated it a 2 or 3 (not satisfied or somewhat satisfied).

Figure 13. Trade Partner Satisfaction with Prescriptive Rebate Application Process



The five partners awarding the prescriptive application process a lower rating (2 or 3) cited the following reasons:

- Xcel Energy's account managers contacted them multiple times, seeking additional data
- Applicants, told the equipment would qualify for prescriptive approach, found the equipment ineligible upon submission
- The application lacked specific measure details
- Rigid application process requirements
- Shifting directions provided by different Xcel Energy account management staff

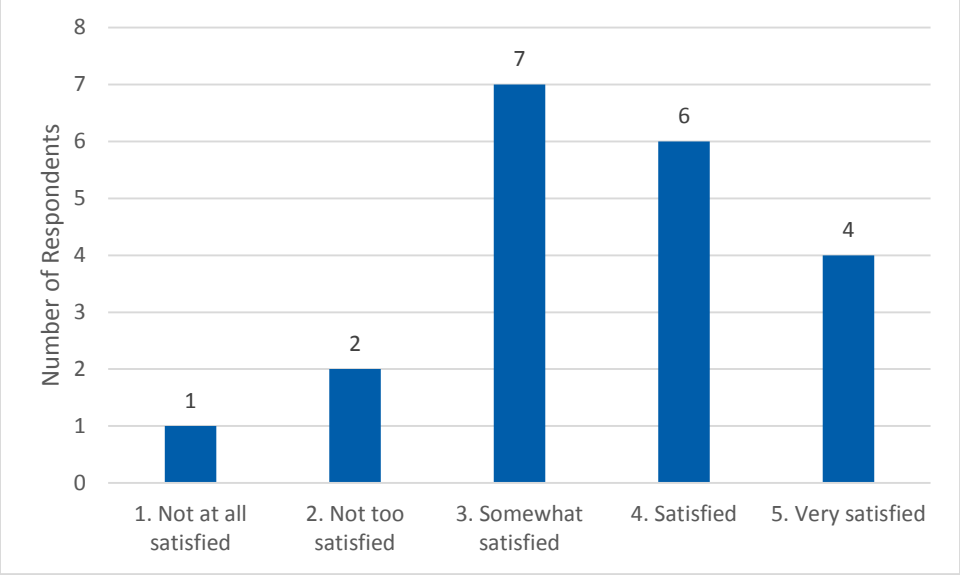
Cadmus asked trade partners to offer suggestions to help improve the prescriptive rebate's application process. Six partners stated they had no suggestions and expressed satisfaction with the prescriptive application process. The remaining 14 trade partners provided the following suggestions to improve the application process:

- Improve the response time to two weeks or less.
- Further simplify eligibility requirements for rebates, based on the types of existing fixtures.
- Increase rebate amounts for LED technology measures.
- Develop an online application/editable rebate application form and FAQ (frequently asked questions) section.
- Adopt more consistency in determining eligible equipment. (Four trade partners had similar experiences, where recommending the same technologies on different projects qualified for one project but not for another, at the discretion of the account manager or Xcel Energy program staff.)
- Add a contact name to the prescriptive rebate form in addition to the 1-800 helpline.
- Add more technologies to the prescriptive measure mix, such as the following: industrial high-bay LEDs; LEDs for warehouses; induction lighting; wrap fixtures; LED strips; cobb lights; direct line voltage lamps; metal halides with higher lumens and wattages for replacing metal halides (so the total installed fixture wattage would be lower than total existing fixture wattage); and allow for use of certain equipment eligible under the residential measure mix for specific applications.
- Trade partners with a large customer base within the horticulture industry said incorporating LED fixtures for horticulture applications would uncap huge savings potential, but they acknowledged that thorough published research would be needed to determine the impact of LED lighting on crop growth patterns.

Custom Rebate

When asked about their satisfaction level in working on custom rebate applications, 10 contractors rated their satisfaction as a 4 or a 5 on a scale of 1 (=very dissatisfied) to 5 (= extremely satisfied), while the other 10 contractors rated their satisfaction between 1 and 3. Contractors providing a higher rating mostly were high-activity contractors who regularly interacted with Xcel Energy's team. Figure 14 shows satisfaction levels for working on the custom rebate applications.

Figure 14. Trader Partner Satisfaction with Custom Rebate Application Process



Those providing a lower rating cited the following primary reasons:

- There was a lack of transparency and reasoning behind identical measures across different projects not having identical rebate qualifications.
- Five contractors indicated application processing times took too long in comparison to other local utilities' programs.
- Two contractors suggested relaxing the prescriptive measure's mix of eligibility requirements for LEDs, allowing more equipment to qualify under prescriptive rebate. Upon further probing, they stated that Xcel Energy required a majority of its replacement bulbs to be DesignLights Consortium (DLC) qualified, but the DLC-qualified rating did not necessarily guarantee superior performance, based on their installation and maintenance experience. Some DLC-qualified bulbs may have a shorter lamp life than some non-DLC-qualified lamps, though both may be comparable in efficacy.
- Four contractors suggested using fewer technical terms on the application form.
- One contractor would prefer having the flexibility to submit the application to entities other than their assigned account managers, citing differing measure approval rates among account managers.
- One contractor said their organization often faced compatibility issues with a Mac operating system and suggested Xcel Energy consider developing Mac-compatible application forms.
- Three contractors said current application forms' status in Word and PDF format made them hard to edit and tended to increase the possibility of human error.

Cadmus asked trade partners about suggestions to help improve the prescriptive rebate application process. Seven partners did not offer suggestions and expressed their satisfaction with the custom

application process. The remaining trade partners provided the following suggestions to help improve the application process:

- Reduce processing times to two weeks or less to increase customer participation.
- Create the custom rebate application in Excel spreadsheet form. A general majority of contractors preferred having an online application system, where they can track their application's status.
- Expand the eligible equipment definition to qualify for prescriptive rebates.
- Educate account managers to deliver consistent messages regarding equipment eligibility and approval outcomes for identical measures.
- Set up an online application submission and tracking system.
- Relax the equipment description requirements for existing equipment as most existing fixture parts have been discontinued in the market.

Program Implementation

Contractors regularly received program updates through e-mail and training sessions. While 18 participating trade partners knew of Xcel Energy's training activities, 13 of those participating trade partners actually attended one or more trainings activities. These participants most commonly attended training updates on rebate offerings, program processes and overviews, and bonus offering criteria.

Four trade partners said they relied more on Xcel Energy's assigned account managers and CLEAResult staff to guide them through the eligibility requirements during initial meetings. They found this training opportunity most beneficial as it customized their understanding of eligibility criteria to specific projects in which they were involved. In general, all trade partners found CLEAResult's involvement tremendously helpful in simplifying the overall application process.

Multiple contractors said they would prefer an online application system, where they could submit applications and supporting documentation electronically and could track their application's status. According to trade partners, their customers expressed frustration about not being able to track their application's status. Contractors suggested that Xcel Energy ensure its account managers maintain a consistent understanding of eligibility requirements. Given the amount of lighting technology change and the fact that Xcel Energy is launching new prescriptive rebates several times a year, responding to this request is challenging.

One contractor who regularly attended training hosted by Xcel Energy stated that, though the overall training content appeared very useful, trainings often were presented by one particular manufacturer, and they would like to see presentation/trainings also delivered by other manufacturers to receive multiple perspectives.

Marketing, Training, and Support

Contractors considered Xcel Energy's marketing efforts effective and reported that a significant portion of customers knew about the program before contractors met with them. Eleven contractor/distributors stated they had been involved in the Lighting Efficiency program for more than five years, with most stating they had participated since the program's inception in 2006.

When participants were asked about the ways that their organizations promoted Xcel Energy's Lighting Efficiency program, 19 participant contractors said they included rebate information and pricing in their proposals, and 14 indicated they educated their customers about program offerings while making a sales pitch. About 25% of participating contractors shared program information with their customers via e-mails. One contractor stated they shared flyers with their customers. One distributor indicated that they had signage in their retail store informing customers about Xcel Energy's one for one replacement measure, however they stopped doing so after Xcel Energy excluded them from participating in this offering. When asked whether participating contractors/distributors used any of Xcel Energy's program overview or case studies to promote the program, eight out of 20 contractors stated they use the case studies, promotional write-ups about rebate offerings, news about the bonus offerings and program overview. One contractor mentioned that Franklin (previous implementers for this program) had some case studies for industrial application in the past, and they would like to have similar case studies for industrial application showcasing the more recent LED technology.

When asked what other material the program could provide to help with promotion, three out of eight contractors expressed the need for more case studies show casing diverse lighting technologies and representing various application (office, warehouse, healthcare, hospitality, horticulture facilities, etc.) One contractor suggested that Xcel Energy provide flyers during trainings that contractors and distributors could share with their customers, and they emphasized the need for such marketing material generated directly by Xcel Energy to add greater credibility to the rebate's potential.

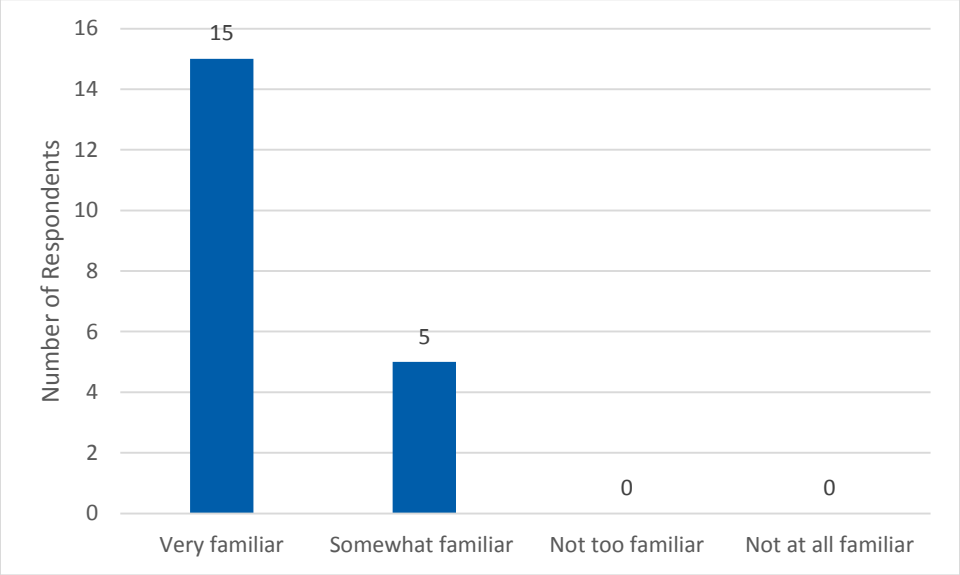
Cadmus asked participating contractors about actions Xcel Energy could take to promote the program to customers and to increase participation. Contractors suggested that Xcel Energy should target methods to inform and educate building operations and maintenance staff. They noted that rebate information provided along with utility bills often only reaches the customer's accounting and billing departments, not facility management staff.

One contractor suggested including marketing material in newspapers or facility engineering journals. Three contractors suggested that Xcel Energy should consider providing a list of participating trade partners on its website. Three low-activity contractors said they were not very aware about Xcel Energy's equipment eligibility criteria and that it would be a good idea if Xcel Energy targeted some training opportunities specifically for them. Another low-activity contractor stated that since their location was approximately four hours away, it was almost impossible for them to attend trainings regularly. Upon further probing, he said they would prefer in-person training sessions, if Xcel Energy offered them regionally.

Market Transformation

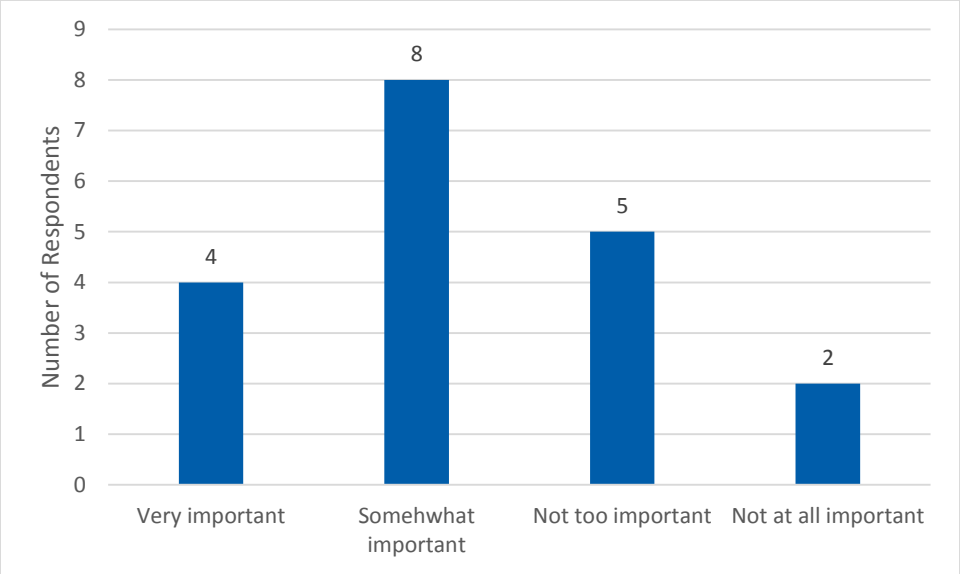
When asked about their familiarity with high-efficiency lighting technologies, 15 contractors/distributors stated they were very familiar with the technology, while the remaining five stated they were somewhat familiar, as shown in Figure 15.

Figure 15. Trade Partner Familiarity with High-Efficiency Lighting Technology



As shown in **Error! Reference source not found.**, 19 out of 20 participating contractors/distributors said their familiarity with efficient lighting technologies increased in comparison to previous five years. Twelve of the
19 contractors thought Xcel Energy's Lighting Efficiency program played a *very important* or *somewhat important* role in increasing this familiarity.

Figure 16. Trade Partner Perception about Program's Contribution to Increasing Technology Familiarity



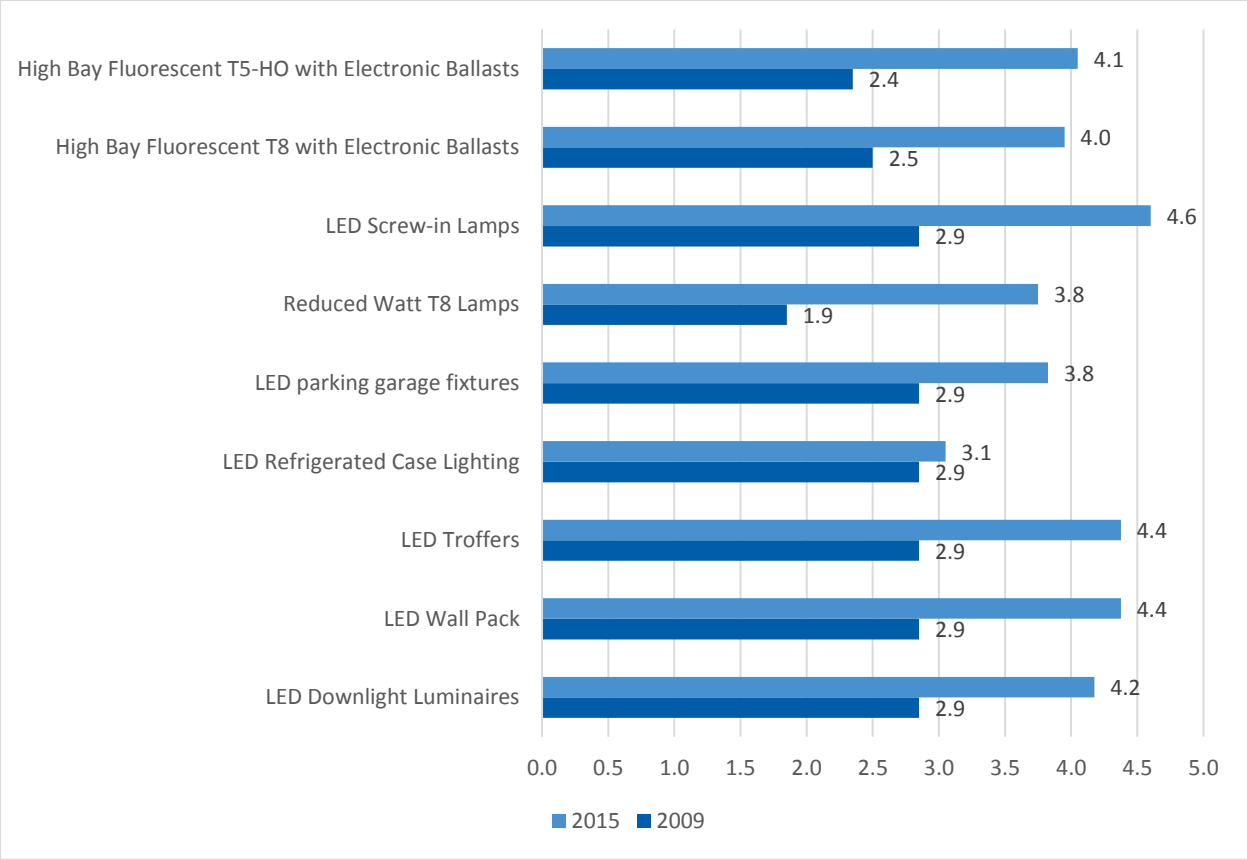
As seen in Figure 16, twelve trade partners thought the program was "very important" or "somewhat important" for increasing their familiarity with energy efficient technologies. Cadmus asked contractors/distributors to rate their end-use customer's awareness of various energy-efficient lighting technologies, using a scale of 1 (=not at all aware) to 5 (= very aware). Respondents indicated a majority of their customer base was somewhat aware or aware of energy-efficient lighting technologies. Table 4 summarizes customer awareness for various lighting technologies.

Table 4. Awareness of Various Energy Efficient Lighting Technology

Technology	Rating Score -2015					Weighted Average Ratings			
	1 (not at all aware)	2 (not too aware)	3 (somewhat aware)	4 (aware)	5 (extremely aware)	2015		2009	
						Amongst End-users	Amongst Retailers/ Contractors	Amongst End-users	Amongst Retailers/ Contractors
LED Downlight Luminaires	0	4	4	8	4	3.6	4.75	2.3	3.4
LED Wall Pack	0	2	2	10	6	4.0	4.75		
LED Troffers	1	2	5	5	7	3.8	5		
LED Refrigerated Case Lighting	3	2	9	2	4	3.1	3		
LED parking garage fixtures	0	0	11	5	4	3.7	4		
Reduced Watt T8 Lamps	0	3	8	5	4	3.5	4	2.0	1.7
LED Screw-in Lamps	0	2	1	8	9	4.2	5	2.3	3.4
High Bay Fluorescent T8 with Electronic Ballasts	1	2	3	11	3	3.7	4.25	2.4	2.6
High Bay Fluorescent T5-HO with Electronic Ballasts	1	1	6	9	3	3.6	4.5	2.4	2.3

As shown, contractors and distributors said the majority of their end-use customers and retail customers mostly were aware of the various energy-efficient lighting technologies.

Figure 17. Comparison of awareness of lighting technologies between 2009 vs 2015



As seen in Figure 17, when awareness of lighting technologies evaluated in the 2009 evaluation study is compared to findings in 2015 (Table 4), there appears to be a significant increase among end-users and retail customers about LED lighting technologies as well as High Bay T8 lamps and low wattage T8 lamps. This is indicative of the fast evolving efficient lighting industry.

Almost all contractors indicated that they stocked or ordered more energy-efficient lighting equipment now than they did five years ago, and they thought their awareness of lighting technologies has increased due to their participation in Xcel Energy's lighting efficiency program.

Barriers

According to trade partners, high first costs for customers serve as the largest barrier to Xcel Energy's program participation. Though most contractors did not believe Xcel Energy could change this, five contractors suggested increasing the rebate amounts could help overcome this barrier.

Contractors also perceived rigid prescriptive measure eligibility requirements as a participation barrier. Contractors said relaxing the definition for the prescriptive measures eligibility requirements meant more participants would participate as processing times would be reduced, and they could predict rebate amounts more accurately.

For example, three contractors mentioned that in their experience some of the non-DLC qualified lamps or fixtures have comparable performance to a DLC qualified lamp or fixture but have a better average life than their DLC counterparts but since Xcel Energy's rebate offering is only available for DLC qualified lamps, they have to exclude these lamps from the prescriptive application to preserve their customer's desire for opting a lamp with longer run life. Easing the requirement for lamps to be "DLC qualified" and rather comparing the rated performance on these lamps may be an option to relax eligibility requirements.

Contractors also cited the inability to make decisions that favor energy-efficient lighting technologies in leased buildings, where the tenant customer has little influence on the building owner's and facility manager's decisions. Contractors further suggested including an ROI calculator in the application would help demonstrate the long-term benefits of choosing energy-efficient equipment.

One contractor of out of three participating contractors that indicated they catered to the horticulture industry said that, though the horticulture market had high untapped lighting energy-savings potential, participation remained low. They said this largely resulted from the very cumbersome application for horticulture facilities, given the detail level required—not just about savings potential but about the impact of efficient lighting technology on crop growth output that is often requested by the customer. Contractors specializing in this industry recommended that Xcel Energy present some measured and verified case studies as guidance for lighting design and technology selection to help inform their customers. This comment implies that contractors are not aware of the four new case studies developed by Xcel Energy within the past year.

Reasons for Nonparticipation

For nonparticipant trade partners, Cadmus interviewed only three contractors/distributors, as the majority of contractors and distributors originally thought to be nonparticipating trade partners indeed participated in the program. This indicated that Xcel Energy has succeeded in attracting a broad network of participating trade partners.

Therefore, Cadmus redefined nonparticipating trade partners as trade partners who had not participated in Lighting Efficiency program in the last two to three years. These nonparticipant trade partners indicated that they did not participate during that time because they were not well-versed with the program's latest offerings or because they felt customers were not interested due to high first costs and required paperwork.

One nonparticipating contractor indicated they had a couple of customers who postponed lighting upgrade projects while waiting for LED technology to become sufficiently cost-effective, allowing them to afford it while receiving rebates from the programs.

Another contractor said his organization currently did not promote the program. Upon probing, he suggested making paperwork (e.g., application forms, invoice requirements) easier for customers may

make their organizations more likely to participate. He did not see much the program could do to mitigate high first costs. Nonparticipating trade partners also suggested increasing the rebate amounts.

In general, all three nonparticipating contractors/distributors said they were "very familiar" or "somewhat familiar" with energy-efficient lighting technologies and that familiarity increased over the past five years. While one contractor indicated that Xcel Energy's program was "very important" in increasing this familiarity, the second contractor said it was "not at all important," while the third said it was "not too important" as they were educating themselves about emerging technologies, regardless of Xcel Energy's program.

All nonparticipating trade partners said they still recommended energy-efficient fixtures to their customers, and, in most cases, they succeeded in convincing customers to opt for energy-saving alternatives (such as replacing T8s and T12 with LED tubes or low-watt T8 lamps). All three contractors recommended energy-efficient lighting to customers in 95%–100% of sales situations.

Spillover

Cadmus investigated if contractors' actions created additional energy savings attributable to the program by asking contractors whether their customers purchased high-efficiency equipment without receiving program rebates; further, we asked if the program proved influential in these purchases. Though the specific analysis of these questions will be presented in the NTG section of this report, most contractors reported their customers did not install efficient lighting measures outside of the program.

Recommendations from Contractors

This section summarizes program recommendations offered by the contractors:

- **Create awareness amongst contractors about the recently developed cases studies for various commercial applications** showcasing successful installations and operations of the latest energy-saving lighting technologies. Present more case studies on energy efficient lighting installation in horticulture applications.
- **Expand the prescriptive equipment measure mix** by including the following: industrial high-bay LEDs; LEDs for warehouses; induction lighting; wrap fixtures; LED strips; cobb lights; direct line voltage lamps; and metal halides with higher lumens and wattages for replacing low-lumen metal halides.
- **Reduce custom application processing times** to less than two weeks.
- **Launch an online application** submission and tracking system.
- **Expand the eligible equipment definition** allow more products to qualify for the prescriptive rebate.

  Educate account managers to deliver consistent messages regarding equipment eligibility and consistent approval outcomes for identical measures.

Net-to-Gross Analysis

This chapter outlines Cadmus' method, analysis, and findings for determining net-to-gross (NTG) for Xcel Energy's Colorado Lighting Efficiency program, using the following NTG formula:

$$NTG = (1 - Freeridership) + Participant\ Spillover + Nonparticipant\ Spillover + Trade\ Ally\ Spillover + Market\ Effects$$

We calculated the freeridership and spillover estimates based on responses to participating customer surveys. Nonparticipant spillover was assessed from surveys with nonparticipants and trade partners. Market effects was determined based on changes in efficient lighting saturations. Xcel Energy reviewed our survey and algorithms, and provided input to ensure the approach accounted for important program design elements.

Freeridership, spillover, and market effects differentiate net savings from gross savings, and are defined as follows:

- ***Freeriders*** are participants who would have acquired the same measures on their own, absent the program.
- ***Spillover*** refers to additional reductions in energy or demand due to program influences beyond savings directly tied to participation. Spillover generally takes three forms:
  - ***Participant spillover*** represents *additional* energy savings that occur when a participant—due to the program's influence—installs efficient measures or changes energy-use behaviors outside of program participation.
  - ***Nonparticipant spillover*** occurs when a nonparticipant installs lighting measures or changes energy-use behaviors due to their perception of the program's influence.
  - ***Trade partner spillover*** represents spillover from nonparticipating customers that results from the influence of Xcel Energy's energy efficiency programs on participating trade partners.
- ***Market effects*** are non-program efficient bulb purchases, driven by structural changes in the market that result from program offerings over a long period of time. For the Colorado Lighting Efficiency program, Cadmus assessed how efficient lighting saturations have changed between 2005 (when efficient lighting saturations were last determined during site visits) and 2015 (which were determined during the current evaluation site visits). Cadmus apportioned any increased non-program efficient bulb purchases among naturally occurring conservation as "like spillover" and market effects.

Freeridership

Method

Cadmus determined freeridership, or the percentage of savings that would have occurred in absence of the program, using the results of 70 telephone surveys with a sample of the 1,582 customers who

participated in the Lighting Efficiency program during the 2014. We asked a series of survey questions to determine if, in the absence of a program rebate, the participant would have taken the same energy-efficient action(s). Cadmus estimated freeridership by quantifying respondents' perceptions of the program's *influence* on their participation decisions and on their *intention* to install energy-efficient equipment or adopt energy efficiency practices. Definitions of these terms follow:

- **Influence** assesses factors that may have influenced respondents' decisions to take energy-efficient actions.
- **Intention** determines actions the respondent most likely would have taken had they not received program assistance. Intention is the likelihood respondents would have purchased and installed energy-efficient equipment or completed an equipment tune-up without program support.

Cadmus determined freeridership by summing the equally weighted intention and influence scores to determine a single score—ranging from 0 (no freeridership) to 100 (complete freeridership)—for each participant. Each component is worth 50% of the total. We then weighted each respondent's freeridership score by their project savings, so overall program freeridership properly represents program savings.

Table 5 summarizes possible response combinations to the survey freeridership questions, along with the intention score assigned to each unique response combination.

Table 5. General Freeridership Intention Component Scoring

Question	Response	Intention Score
1. Which of the following would most likely have happened if you had not received [the program assistance]?	Would not have started the project	0
	Postponed/cancelled	0
	Reduced size, scope, efficiency	Based on response to Q2
	No change	Based on response to Q3
	Don't know	25*
2. By how much would you have reduced the size, scope, or efficiency?	Small amount	37.5
	Moderate amount	25
	Large amount	12.5
	Don't know	25*
3. Would your business have paid the entire cost of the upgrade?	Yes	50
	Don't know	37.5*
	No	25

*Represents the midpoint of possible values for this question.

To estimate program influence, Cadmus offered respondents several options to identify how various program elements (e.g., program staff, trade partners, marketing, financing, rebates, technology, previous program experience) influenced their decisions about implementation of energy efficiency measures. The program influence score equals the maximum rating of any single program element

(rather than an average), because if any given element had a great influence on the respondent's decision, the program was successful in influencing that decision.

As shown in Table 6, the lowest score in this example became the influence component of the freeridership score.

Table 6. General Scoring of Freeridership Influence Component

Program Influence Rating	Influence Score
1 – Not at all important	50.0
2 – Not very important	37.5
3 – Somewhat important	12.5
4 – Very important	0.0
Don't know	25.0

High program influence levels and freeridership have an inverse relationship: the greater the program influence, the lower the freeridership. In other words, if a respondent cited the program as very influential, they likely took an energy-efficiency action they would *not* have taken without the market intervention; therefore, we would give the program a low or zero freeridership score.

Results

The freeridership analysis resulted in an overall customer savings-weighted freeridership score of 9.3% for the program. Using a coefficient of variance of 0.5, the precision on the sample is 9.6% at a 90% confidence level for the number of surveys performed. The total freeridership is calculated as:

$$Freeridership = Intention + Influence = 9.2\% + 0.1\% = 9.3\%$$

Intention

The intention portion of the freeridership calculation is 9.2%. Table 7 shows the distribution of answers to the first question of what the respondent would have done without the program.

Table 7. Distribution of Intention Scores Overall

Response Options	Count	Percentage of Total	Intention Score
Canceled or postponed the project at least one year	21	30%	0.00
Reduced the size, scope, or efficiency of the project	13	19%	N/A
Done the exact same project (no change)	21	30%	N/A
Would not have started the project	13	19%	0.00
Refused to answer	0	0%	0.25
Don't know	2	3%	0.25

Table 8 provides additional details of the responses to remaining intention questions, including information on the savings weighting. For each response option per question, the total savings are shown for the survey sample as well as the proportion attributed to the intention score.

Table 8. Distribution of Intention Scores by Question

Intention Question / Response Options E1. If you had not received the rebate from Xcel Energy, which of the following do you believe would have most likely happened?	Intention Score	Count	Intention Score Savings (kWh)	Total Survey Sample Savings (kWh)
Canceled or postponed the project at least one year / Would not have started the project	0.00	34	0	4,112,214
Would have reduced the size, scope, or efficiency of the project **E2. By how much would you have reduced the size, scope, or efficiency? Would you say a ...?**				
Small amount	0.375	2	28,955	77,212
Moderate amount	0.250	8	246,962	987,847
Large amount	0.125	3	17,498	139,984
Refused to answer	0.250	0	-	-
Don't know	0.250	0	-	-
Would have done the exact same project (no change) **E3. How likely would your business have paid full cost to install the same quantity/efficiency of lighting equipment without any rebate from Xcel Energy?**				
Very likely	0.500	14	200,324	400,647
Somewhat likely	0.375	3	40,077	106,873
Not too likely	0.250	2	5,224	20,895
Not at all likely	0.000	2	-	43,003
Refused to answer	0.250	0	-	-
Don't know	0.250	2	3,311	13,245
Total		**70**	**542,350**	**5,901,920**
Intention Score Weighted by Savings (Total Survey Sample kWh Savings / Intention Score kWh Savings)				**9.2%**

Influence

The influence portion of the freeridership calculation is 0.1%. Table 9 shows that a majority of respondents attributed great importance to the rebate and provided the highest influence rating to that attribute, which resulted in low freeridership.

Table 9. Distribution of Influence Ratings and Average Rating per Influence Attribute

Response Options	Influence Score	Xcel Energy Staff	Xcel Energy Equipment Rebates	Xcel Energy Marketing	Xcel Energy Project Savings Calcuations	Xcel Energy Informati on About Energy Efficiency in General	Previous Experince with Xcel Energy Energy Efficiency Programs
1 - Not at all important	0.50	15	0	6	6	7	18
2	0.38	15	1	4	4	4	6
3	0.13	16	14	19	19	32	24
4 – Very important	0.00	17	55	41	41	27	17
Don't know	0.25	3	0	1	0	0	0
Not applicable	0.25	4	0	1	0	0	5
Average		**2.6**	**3.8**	**3.4**	**3.4**	**3.1**	**2.6**

Table 10 shows the final distribution of responses, with 62 of 70 scoring no freeridership influence, and the remaining eight scoring slight freeridership. The influence score is weighted by the sample savings to determine 0.1% freeridership.

Table 10. Distribution of Influence Scores

Maximum Influence Rating	Influence Score	Count	Influence Score Savings (kWh)	Total Survey Sample Savings (kWh)
1 - Not at all important	0.500	0	0	0
2	0.375	0	0	0
3	0.125	8	8,177	65,413
4 - Very important	0.000	62	0	5,836,507
Don't know	0.250	0	0	0
Total			8,177	5,901,920
Average Influence Score Weighted by Savings				**0.1%**

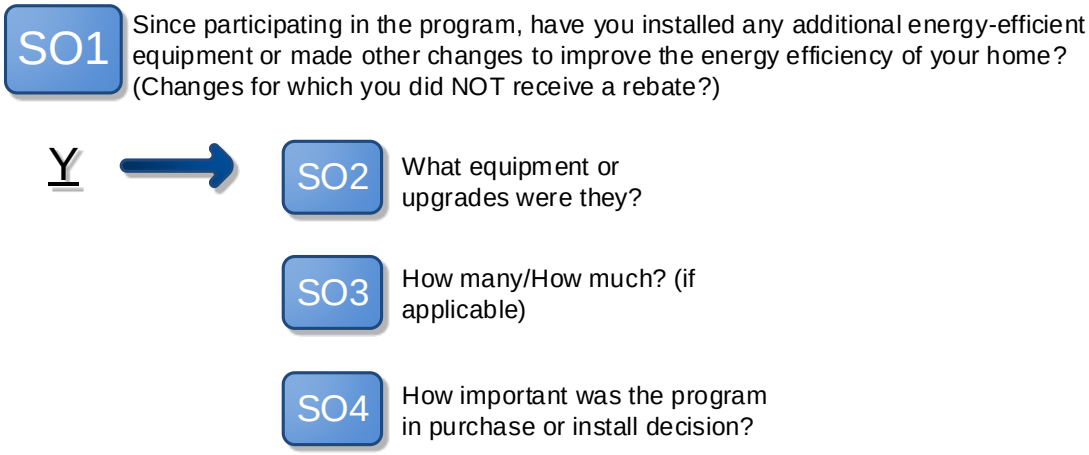
Participant and Nonparticipant Spillover

Cadmus estimated participant spillover, defined as the additional savings generated by the program but not otherwise captured by program records, through surveys with the same 70 participating customers. Nonparticipant spillover was also calculated which represents savings attributed to the program from customers that did not participate in the program.

Method

To determine spillover, Cadmus asked participants about additional equipment they installed since participating in the program; similarly, nonparticipants were asked if they installed any lighting measures outside of the program that may have been influenced by program marketing or trade partners. We then screened the reported spillover measures and removed those for which the customer received a rebate through either one of Xcel Energy's other programs or a non-Xcel Energy program. Figure 18 represents the survey questions we used to capture customer spillover.

Figure 18. Customer Spillover Methodology



For energy-efficient measures the participants and nonparticipants installed without receiving a rebate, Cadmus used a four-point scale to determine the program's importance in that decision. We assigned 100% of the savings to measures for which customers reported the highest program influence rating. We assigned 50% of the savings to measures for which customers reported the second highest program influence rating, and assigned 0% savings to the two lowest program influence rating levels.

The sum of the resulting savings from each group represents the total customer spillover for the survey population. Cadmus then calculated the percentage of customer spillover by extrapolating to the population and dividing the sum of the customer spillover savings by the gross program savings for the population.

Participant Results

Combined, the 70 surveyed participants reported four measures that passed two qualifying screens: (1) the measure was not rebated by another source, and (2) the customer attributed their actions to program influence (in one of the top two ratings). Table 11 provides details of the qualifying spillover measures, the level of program influence for each, and the amount of per-unit savings by fuel type.

Table 11. Customer Spillover Counts and Savings per Unit

Equipment Type	Very Influenced by Program (Count)	Somewhat Influenced by Program	Unit Savings (kWh)
LED	10	0	191[1]
Fluorescent Tubes	8	0	16[2]
Heat Exchangers*	0	2	0
Insulation	1	0	8,666[3]

* This project lacks sufficient information to quantify savings.
1- LED Lamps and Luminaires (ENERGY STAR-qualified); Xcel 2015/2016 Demand-Side Management Plan pg. 431
2- Low-Wattage T8 Fluorescent Lamps; Xcel Energy 2015/2016 Demand-Side Management Plan pg. 431
3- Insulation and Air Sealing Program; Xcel Energy 2015/2016 Demand-Side Management Plan pg. 485

Participant Spillover Quantification

Calculating participant spillover from survey responses is limited by the inability to document sufficient energy use or the efficiency level of the replaced equipment, or to verify the specific efficiency rating of the new equipment. Therefore, Cadmus used savings values from the Xcel Energy 2014 and 2015/2016 DSM Plans with conservative assumptions.

Table 12 shows the steps we followed to quantify customer participant spillover, using 2014 program year gross savings. We calculated the total savings for the survey population, then extrapolated those results to the program population. The total projected spillover savings for the census of program participants is 241,895 kWh, which is 0.3% of the total reported gross savings for the program. Using a coefficient of variance of 0.5, the precision on the sample is 9.6% at a 90% confidence level for the number of surveys performed.

Table 12. Participant Spillover Quantification*

	Step	Value
Survey Population (n=70)	Spillover Savings from Sample	10,703 kWh
Total Program Population (n=1,582)	Extrapolation Multiplier (total population / survey population)	22.6
	Spillover Population Savings (sample savings)	241,895 kWh
	2014 Total Program Reported Gross Installed Savings	77,309,695 kWh
	Spillover Percentage	**0.3%**

Nonparticipant Results

For nonparticipant spillover, 71 surveyed participants also reported four measures that passed three qualifying screens: (1) the measure was not rebated by another source, (2) the respondent had heard of the program prior to the survey, and (3) they gave a “very influential” rating for a program component.

Table 13 provides details of the qualifying spillover measures, the level of program influence for each, and the amount of per-unit savings by fuel type.

Table 13. Nonparticipant Spillover Counts and Savings per Unit

Equipment Type	Very Influenced by Program	Unit Savings (kWh)	Total Savings (kWh)*
LEDs	4	191	764
Linear Fluorescents	2,500	16	39,787
Lighting Controls	2	221	441
Chillers (tons)	60	47	2,811
Total			43,804

*Totals may not sum due to rounding.

Nonparticipant Spillover Quantification

Calculating nonparticipant spillover from survey responses is limited by the inability to document sufficient energy use or the efficiency level of the replaced equipment, or to verify the specific efficiency rating of the new equipment. Therefore, Cadmus used savings values from the Xcel Energy 2014 and 2015/2016 DSM Plans with conservative assumptions.

Table 14 shows the steps we followed to quantify customer nonparticipant spillover. The total calculated spillover savings for the nonparticipants surveyed is 43,804 kWh, which is 0.1% of the total reported gross savings for the program. This value is currently not extrapolated to the over 60,000 customers to provide a conservative estimate. Using a coefficient of variance of 0.5, the precision on the sample is roughly 10% at a 90% confidence level for the number of surveys performed compared to the customer population.

Table 14. Nonparticipant Spillover Quantification*

Step	Value
Spillover Savings from Sample	43,804 kWh
2014 Total Program Reported Gross Installed Savings	77,309,695 kWh
Spillover Percentage	**0.1%**

Participant and Nonparticipant Spillover

The spillover due to program participants and nonparticipants is 0.4%, as show in Table 15.

Table 15. Participant and Nonparticipant Spillover

Spillover	Value
Participant	0.3%
Nonparticipant	0.1%
Total	**0.4%**

Trade Partner Spillover

Method

Cadmus surveyed 20 participating trade partners, asking each respondent for the following information to determine nonparticipant spillover from participating trade partners:

- The number of program-qualified lighting measures sold or installed within the Xcel Energy service territory during the program period;
- The percentage of such installations ***not*** rebated through the program;
- A judgment regarding the specified program's influence on sales of common, program-qualified lighting measures that are not rebated (as assessed with a rating scale);and
- The change in the percentage of time trade partners recommend energy-efficient products before and after working with the program.

Results

Of the 20 trade partners we interviewed, only 12 had program eligible projects that were not rebated through the Lighting Efficiency program. Of those 12, 8 had projects they thought were influenced by the program. Five trade partners reported a change—specifically an increase—in the amount of projects for which they recommend energy-efficient products since working with the program.

After distilling responses down, only one respondent exhibited all the necessary spillover characteristics, and rated Xcel Energy's program as being very important in their efficiency recommendations. This respondent claimed that 35% of their 575 eligible but not rebated projects had been influenced by the program, and said they increased the amount of time they recommend efficient equipment by 25% since participating in the program, resulting in 50 projects being attributed to program spillover.

$$\begin{aligned} &Spillover\ Projects \\ &\quad = 575\ eligible\ projects\ \times 35\%\ program\ influence \\ &\quad \times 25\%\ increase\ in\ EE\ recommendations = 50\ projects \end{aligned}$$

Because it was unreasonable to ask respondents to recall the measure-level savings for projects over the last year, Cadmus calculated the median savings value from the 2014 participant population to use as a proxy project savings value for spillover projects. The median energy savings is 12,422 kWh per project from 1,582 participants.

Table 16 shows the steps for trade partner spillover quantification. We spoke to 20 trade partners out of a possible 202, which produced an extrapolation of 10 times the savings generated by the interview sample. The extrapolated spillover savings yields 8.1% of the gross program savings. The precision at 90% confidence, using a coefficient of variation of 0.5 is 17.6% for the sample of the population.

Table 16. Trade Partner Spillover Quantification*

	Step	Value
Survey Population (n=20)	Spillover Savings from Sample	621,100 kWh
Trade Partner Population (n=202)	Extrapolation Multiplier (total population / survey population)	10.1
	Spillover Population Savings (sample savings)	6,273,110 kWh
	2014 Total Program Reported Gross Installed Savings	77,309,695 kWh
	Spillover Percentage	**8.1%**

Note: Totals may not sum due to rounding.

Market Effects

Method

During the commercial site visits, Cadmus captured facility square footage and inventoried facility lighting, enabling us to estimate an energy usage intensity (EUI) for the sample. Cadmus converted the documented lighting technology saturations into the total lighting end-use load (in kWh) for both 2005 and 2015, then adjusted these results to account for growth in business accounts (since 2005) and the changing mix of business types. We subtracted the resulting 2015 lighting load from the 2005 lighting load to estimate overall net lighting savings occurring between the 2005 and 2015 assessments.

From this result, we subtracted the net evaluated program savings (net of freeridership plus spillover) achieved between the 2005 and 2015 site visits, and determined that the remaining amount is the estimated non-program lighting savings to be apportioned among naturally occurring conservation and market effects.

We also performed a qualitative review of market transformation indicators, examining the customer and trade partner survey results to assess whether the program has influenced efficient lighting purchases outside the program as evidence of possible market effects.

Cadmus estimated the potential for market effects by first determining the cumulative non-program savings occurring since 2005 using the following equation:

$$Cumulative\ Nonprogram\ Savings = LL2005 - LL2015 - Net\ Cumulative\ Program\ Savings$$

Where:

LL2005 = 2005 business lighting load in MWh (normalized for business type mix and total commercial sector size with 2015)

LL2015 = 2015 business lighting load in MWh (normalized for business type mix and total commercial sector size)

Net Cumulative Program Saving = Net evaluated program savings occurring between 2015 site visits and the 2005 baseline study

Results

Cadmus' estimate of lighting market effects is essentially zero. Surveys with participating customers, nonparticipating customers, and trade partners indicate that commercial customers are not significantly adopting high-efficiency lighting without incentives. During the site visits, we found that T12 saturations—the predominant lighting type across the commercial customer class—has not changed since 2005 (and is still 50% overall).

As shown in Table 17, our market effects calculations reveal that overall, normalized 2015 lighting loads had very little additional lighting savings compared to 2005.

Table 17. Potential for Market Effects Calculations

Line	Inputs	Value	Data Source
1	Normalized Average Building SF	15,663	2005 Potential Study
Baseline - 2005			
2	Commercial Lighting Power Density (W/ft^2)	1.47	2005 potential study saturations with 2015 lighting power density (LPD) analysis
3	Adjustment Factor to Normalize LPD for Building Mix	1.08	Lighting density adjustments for building mix
4	Normalized LPD to 2015 Building Type Mix	1.58	Line 2 * Line 3
5	Estimated Hours-of-Use	3,348	2014 CO DSM Plan, pg. 448 (25% Retail, 75% Other Misc.)
6	Average Energy Use Intensity (kWh/SF)	5.31	Line 4 * Line 5/1,000
Current - 2015			
7	Commercial Building Count	61,710	2015 site visits sample frame
8	Commercial Building SF	966,563,730	Line 7 * Line 1
9	Commercial Lighting Power Density (W/ft^2)	1.42	2015 saturations and 2015 LPD analysis
10	Estimated Hours-of-Use	3,279	2014 CO DSM Plan, pg.448 (35% Retail, 65% Other Misc.)
11	Average Energy Use Intensity– (kWh/SF)	4.66	Line 9 * Line 10/1,000
Program Savings			
12	Total Lighting Load Reduced MWh	627,474	((Line 6 - Line 11) * Line 8)/1,000
13	Net Program Displaced MWh (includes freeridership and spillover)	623,983	Sum of program tracking between site visits in 2005 and 2015
14	Cumulative Nonprogram Savings MWh (potential for market effects)	3,491	Difference between baseline and current less program displaced
15	Nonprogram Sales as Percentage of Program Sales	0.6%	Line 14/Line 13

We estimated the lighting power density in 2005 as approximately 1.58 watts per square foot (adjusting for the estimated changing mix of building types),[5] and estimated the 2015 lighting power density as 1.42 watts per square foot.

To determine total energy lighting loads for each year, Cadmus multiplied the lighting power density by average estimated hours-of-use (HOU)[6] and the estimated total commercial square footage (normalized for changing mix of building types). We compared the difference in the overall lighting load to total evaluated commercial lighting savings between 2005 and 2015.[7] The result was 3,491 MWh, or 0.6% of the cumulative program savings.

Due to changing market composition of commercial customers over the period from 2005 to 2015, the inputs to the market effects calculations have considerable uncertainty. Cadmus determined that retail customers, as a percentage of the entire commercial business customer population is larger in 2015 versus 2005. Line 3, in Table 17 above, applies an adjustment factor to account for this as retail businesses have higher lighting density and lower square footage relative to other business sites. Due to lack of information about sampling from the 2005 study, we were not able to discern if similar changes occurred in other commercial business sectors. Our analysis shows that market effects are relatively small. Due to this uncertainty around the changing customer mix, we cannot show that market effects are statistically different from zero. The zero market effects is consistent with customer and trade ally comments that while both types of stakeholders are more aware of energy-efficient options due to the program, most customers still require incentives to overcome the upfront financial barriers to installing more efficient lighting. Only one trade ally reported activity outside the program that qualified as spillover. The relatively low freeridership level (9.3%) is also indicative that the market is not yet transforming to efficient lighting on its own.

Calculated Net-To-Gross

Table 18 shows the freeridership, various spillover, and market effects percentages, along with the resulting NTG for the Colorado Lighting Efficiency program. We calculated the NTG percentage by subtracting freeridership from 100% and adding all the other components.

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[5] We estimate that the retail sales sector—which we estimate to have a higher lighting power density (1.71 versus 1.42 as the average of all buildings)—increased from approximately 25% of commercial building sites to 35% since 2005. We adjusted the overall lighting power density to account for this.

[6] Public Service Company of Colorado. *2014 Demand-Side Management Plan*. Pg. 448. July 1, 2013. Annual operating hours for "Other/Misc." building type of 3,521 hours per year and Retail of 2,829 hours per year. Available online: https://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/2014-CO-DSM-Plan.pdf

[7] Sum of program savings from 2005 through 2014 = 623,983 MWh, provided by Xcel Energy via email.

$$NTG = (1 - Freeridership) + Participant\ Spillover + Nonparticipant\ Spillover + Trade\ Ally\ Spillover + Market\ Effects$$

The resulting overall NTG for the program is 99.2%.

Table 18. Calculated NTG for Lighting Efficiency Program

NTG Component	Value
Freeridership	9.3%
Participant Spillover	0.3%
Nonparticipant Spillover	0.1%
Trade Partner Spillover	8.1%
Market Effects	0.0%
Total	**99.2%**

Benchmarking

Cadmus conducted a benchmarking study comparing elements of Xcel Energy's Colorado Lighting Efficiency program with other commercial lighting programs across the country. Based on input from Xcel Energy, we focused our benchmarking research on these elements:

- Program design attributes
- Measure mix
- Equipment eligibility
- Application process
- Program performance

Methodology

Cadmus reviewed programs offered by regulated utilities similar in design to the Lighting Efficiency program and excluded nonregulated statewide and municipal programs. All of the programs used for benchmarking offer prescriptive and custom rebates. We did not include midstream program models, since Xcel Energy's midstream program was recently launched (January 2015), although some of utilities have offered them. The midstream program will be evaluated in 2016 after it completes a full year cycle.

We used utility websites to collect information on measure offerings and eligibility criteria and researched savings and program performance information, where available, through evaluation reports in Cadmus' benchmarking database including reports prepared for Cadmus' clients. We also researched reports from public utility commission filings for context and comparison.

We reviewed a mix of programs that either function solely as lighting rebate programs or as commercial and industrial energy efficiency programs where lighting is one of the rebate categories.

Table 19 provides a list of the programs we reviewed and the utility and state where they were implemented.

Table 19. Programs Included in Benchmarking Study

Program Sponsor	Program Name	State
Xcel Energy	Colorado Lighting Efficiency Program	Colorado
Pacific Gas and Electric (PG&E)*	Energy Efficiency (Lighting) Rebates for (your) Business program	California
ConEdison*	Commercial and Industrial Energy Efficiency Program Lighting, LEDs and Controls	New York
Duke Energy*	Smart Saver Program	Ohio/ Kentucky
Avista	Non-Residential Prescriptive Program-(Interior/ Exterior Lighting Conversion Rebate Programs)	Idaho
Southeastern utility*	Commercial Prescriptive Incentive Program / Commercial Custom Incentive Program	Southeast
PPL Electric Utilities*	Prescriptive Equipment Program and Custom Program	Pennsylvania
Midwestern utility*	Commercial Prescriptive and Custom Rebate Programs	Midwest

*Lighting is one of the rebate categories within a larger Industrial/Commercial Rebate Program.

Findings

Program Design Attributes

Xcel Energy: Colorado Lighting Efficiency Program[8]

Xcel Energy launched the Lighting Efficiency program in 2006. The program targets commercial customers with a peak demand of 400 kW or greater by offering prescriptive and custom rebates to help lower the upfront cost for the installation of qualifying high-efficiency lighting equipment in new and existing buildings.[9]

Funding is also available for lighting redesign studies, which are conducted to determine the proper lighting levels for the space. To help ensure the program meets its annual energy-savings target, Xcel Energy runs time-limited bonuses to encourage customers to complete projects during the calendar year. This promotion offers customers a 20% bonus on the total rebate amount, with a cap at 75% of the total project cost.

[8] Xcel Energy. Colorado Lighting Efficiency Program. "Lighting Efficiency." Accessed online August 2015: http://www.xcelenergy.com/Energy_Solutions/Business_Solutions/Rebates_&_Energy_Savings/Lighting_Efficiency

[9] Non-managed customers with a peak demand of 400 kW or less are served by the Small Business Lighting Program.

Pacific Gas and Electric (PG&E): Energy Efficiency Rebates for Business[10]

PG&E's Energy Efficiency Rebates for Business program includes lighting rebates for commercial customers who retrofit or install energy-saving lamps and fixtures. The program offers prescriptive and custom rebates to help offset the cost of installing qualifying high-efficiency equipment as part of retrofits or new installations. Rebates are also offered for other non-lighting measures such as pumps and variable-frequency drives (VFDs) in agricultural applications, HVAC and water heating equipment, pool heaters, IT equipment, and food service.

ConEdison, Prescriptive Rebate Program: Lighting and Lighting Controls[11,12]

Commercial and industrial customers in ConEdison's service territory are eligible to receive prescriptive and custom incentives for eligible high-efficiency lighting equipment that passes the total resource cost (TRC) requirement. All incentives in the program are capped at 40% of the total project cost. All projects, including prescriptive rebates, require preapproval prior to purchase and installation. Within its prescriptive rebate offerings, the program also provides incentives for VFDs, HVAC systems, and motors.

Duke Energy: Smart $aver Program [13]

Duke Energy's Smart $aver Prescriptive and Custom Rebates program in Ohio helps facility managers and building owners achieve long-term, cost-effective savings in the commercial and industrial market sector. This program primarily relies on a prescriptive rebate structure, which rewards participants with monetary incentives based on new energy-efficient equipment installations and upgrades. Such upgrades include lighting, VFDs, HVAC, thermal storage, pumps, process equipment, and ENERGY STAR® products. Prescriptive incentives are capped at 50% of the project cost.

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10 PG&E. Energy Efficiency Lighting. "Rebates for your business." Accessed online August 2015: http://www.pge.com/en/mybusiness/save/rebates/byequipment/index.page?WT.mc_id=Vanity_businessrebates

11 ConEdison, Green Team. "Prescriptive Rebates for Lighting, LEDs, and Lighting Control Equipment." Available online: http://cdn.platform.honestbuildings.com/wp-content/uploads/sites/5/2015/04/Lighting-and-LEDs_v111.pdf

12 ConEdison, Green Team. "Custom Program Details." Available online: http://cdn.platform.honestbuildings.com/wp-content/uploads/sites/5/2014/12/Custom_v61.pdf

13 Duke Energy. "The Smart $aver Incentive Program Ohio." Accessed online August 2015: http://www.duke-energy.com/pdfs/SS-Overview_OH.pdf

Avista: Non-Residential Program [14,15]

Through its nonresidential portfolio of programs, Avista promotes the purchase of high-efficiency equipment for commercial utility customers. Avista provides rebates to partially offset the difference in cost between high-efficiency equipment and standard equipment, either in the form of prescriptive rebates or site-specific (custom) rebates. Equipment eligible to receive rebates include: commercial clothes washer, food service equipment, lighting, power management equipment, VFDs, commercial Insulation, and retrocommissioning.

New construction projects and projects that have a 50% or higher change in design are handled under a site-specific (custom) rebate.

Southeastern utility: Commercial Incentive Program[16,17]

A southeastern utility offers custom and prescriptive incentives to large commercial customers. Under the prescriptive path, incentives are paid up to 50% of the equipment cost (not exceeding incentive amount) and capped at $25,000 for all equipment types combined per building per year. Incentives are available for new fixture systems or for retrofitting existing fixtures with new lamps and ballasts. Incentives are not available for de-lamping. Custom program measures require preapproval. In addition to lighting, the southeastern utility also provides prescriptive rebates and incentives for envelope measures, appliances, HVAC, compressors, controls, commercial cooking appliance, motors, office equipment, process cooling and heating, refrigeration systems, and water heating equipment.

PPL Electric Utilities: Prescriptive Equipment and Custom Equipment Program[18,19]

Through its program, PPL Electric Utilities offers two types of rebate options—prescriptive and custom. Originally launched in 2009, the program is in its sixth year of implementation. All prescriptive and custom projects need preapproval. The utility also offers a direct discount program for conducting an

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14 Cadmus. *Avista 2013 Idaho Electric Impact Report*. June 17 2014. Available online: http://www.puc.idaho.gov/fileroom/cases/gas/AVU/AVUG1402/company/20140812FOLSOM%20EXHIBIT%201%20DSM%20REPORT.PDF ; Page 34

15 Avista. "Commercial Lighting Incentives Program Announcement." Accessed online August 2015: http://www.avistautilities.com/business/rebates/washington/Documents/Commerical%20Lighting%20Announcement%20072214.pdf

16 Website reference not provided to retain confidentiality.

17 Report not publically available.

18 PPL Electric Utilities - https://www.pplelectric.com/save-energy-and-money/for-trade-allies/rebate-applications.aspx

19 Cadmus. *Process Evaluation Report: PPL Electric EE&C Plan, Program Year Four*. November 15, 2013. Available online: http://www.puc.state.pa.us/pcdocs/1259847.pdf

energy assessment and successfully installing the proposed measure; however, that is not within the scope of this benchmarking study.

Midwestern utility: Commercial Prescriptive and Custom Rebate Program[20]

A Midwestern utility offers the Commercial Prescriptive and Custom Rebate program by offering a fixed rebate amount based on efficient equipment installed in replacement or retrofit projects. New construction projects can qualify for rebates under the new construction program by demonstrating a lighting power density (LPD) reduction for interior lighting, compared to ASHRAE/IESNA 90.1 Standard as a baseline. Other rebated measures under this program are HVAC equipment, drives, motors, and compressed air equipment. Efficient lighting measures that do not qualify for prescriptive rebate can receive incentives under the Custom Rebate Program. Funds are reserved upon application approval.

Table 20 identifies which programs require preapproval based on delivery method and presents the application submission requirements for all of the programs described above. All utilities showed the following common application protocols:

- Custom rebates for all benchmarked utilities require preapproval.
- Rebate (prescriptive and custom) applications can be submitted by the vendor or the customer.
- All utilities that involve submission of the prescriptive rebate application after installation require that qualifying equipment be operating.

Table 20. Application submission process and timeline

Utilities	Rebate Vehicle	Pre-Approval Required?	Application timeline
Xcel Energy	Prescriptive Rebate	N	• Submit invoices within 12 months of purchase, product spec sheet along with complete application. • Incentive payments of qualifying applications are made in 6 to 8 weeks.
Pacific Gas and Electric (PG&E)	Prescriptive Rebate	N	• Submit invoices within the program year of purchase; submit product spec sheet along with complete application. • Incentive payments of qualifying applications are made in 6 to 8 weeks.
ConEdison	Prescriptive Rebate	Y	• The customer and/or vendor is required to submit prequalification application to reserve funds at least 4 weeks ahead of installation. • Incentive payments of qualifying applications are made 6 to 8 weeks after installations.

[20] Cadmus. *2013 Evaluation, Measurement and Verification Report*. May 12, 2014. Not available to the public.

Utilities	Rebate Vehicle	Pre-Approval Required?	Application timeline
Duke Energy - Ohio	Prescriptive Rebate	N	• Submit invoices within 90 days of installation; submit product spec sheet along with complete application. • Incentive payments of qualifying applications are made in 4-6 weeks, after a percentage of equipment installed is site-verified by Duke Energy representative.
Avista	Prescriptive Rebate	N	• Submit invoices within 90 days of installation; submit product spec sheet along with complete application. • Incentive payments of qualifying applications are made in 4 to 6 weeks.
Southeastern utility	Prescriptive Rebate	N	• Submit invoices within 90 days of purchase; product spec sheet along with complete application. Equipment should be installed and operational prior to submission.
PPL Electric Utilities	Prescriptive Rebate	Y	• Submit prequalification application to reserve funds. Upon approval submit invoices, product spec sheet, and scope of work description along with complete application. • Incentive payments of qualifying applications are made in 6 to 8 weeks after installations.
Midwestern utility	Prescriptive Rebate	Y	• For prequalified applications, submit proof of purchase within 60 days of approval and must be installed and operational within 120 days of application. • Midwestern utility requires it be notified of installation, after which funds are assigned within approximately 30 days.

Measure Mix

Most of the benchmarked programs include core prescriptive measures, such as CFLs, LEDs, linear fluorescents, lighting controls, T12 replacements, and de-lamping that are similar to Xcel Energy's Lighting Efficiency program. Although Xcel Energy's rebate offerings for lighting equipment is one of the most comprehensive mix of measures, a few utilities provide additional incentives for adoption of energy-efficient technologies such as vending machine controls and tubular skylights.

All of the programs Cadmus reviewed include a one-for-one replacement or fixture retrofit, and all but Duke Energy contain a random post-installation measurement and verification component for quality assurance purposes (left to the discretion of program officials). Duke Energy audits a select sample of installed measures for each site.

Error! Not a valid bookmark self-reference. compares the prescriptive measures offered by each of the programs we reviewed.

Table 21. Benchmarked Program Prescriptive Measures

Program	Additional Measures												
	Fluorescent Lighting Retrofits	LED replacing HID/ Fluorescent	Compact Fluorescent (CFL)	LED Exterior/ Garage HID to	Interior LED	Sensors and Controls	De-lamping	Exterior Lamps (excluding LEDs)	Low Wattage (T8) Lamps	HE Electronic Ballasts	High Pressure sodium	Metal Halides	
Xcel Energy Colorado Lighting Efficiency Program	X	X	X	X	X	X	X		X	X	X	X	• Refrigerated LEDs case lighting • Pulse start metal halides
Pacific Gas and Electric (PG&E) Energy Efficiency (Lighting) Rebates for your Business	X	X	X	X	X			X	X				• LED accent, surface, pendant, track and accent recessed downlight fixtures • Interior induction fixtures
ConEdison Commercial and Industrial Energy Efficiency Program Lighting, LEDs and Controls	X	X		X	X	X	X		X			X	• LED display case and LED Exit signs • HPT8 lamps • Pulse start or ceramic HID

Program	Additional Measures												
	Fluorescent Lighting Retrofits	LED replacing HID/ Fluorescent	Compact Fluorescent (CFL)	LED Exterior/ Garage HID to	Interior LED	Sensors and Controls	De-lamping	Exterior Lamps (excluding LEDs)	Low Wattage (T8) Lamps	HE Electronic Ballasts	High Pressure sodium	Metal Halides	
Duke Energy Smart $aver Program	X	X	X	X	X	X			X			X	• HPT8 lamps • LED panels • LED: portable task light, track, display case, shelf mounted, exit freezer/cooler case, LED case lighting sensor • Exterior LED motion sensor control • Pulse start or ceramic metal halide • Tubular skylight
Avista Non-Residential Program	X	X		X	X	X							• Can light kit • Exit LEDs
Southeastern Utility Commercial Prescriptive Incentive Program	X		X	X	X	X		X					• Exit LEDs • CFLs(retrofit only) • 10% wattage reduction
PPL Electric Utilities Prescriptive Equipment Program	X				X	X	X		X				• De-lamp and install reflectors • LED Exit signs

Program	Additional Measures												
	Fluorescent Lighting Retrofits	LED replacing HID/ Fluorescent	Compact Fluorescent (CFL)	LED Exterior/ Garage HID to	Interior LED	Sensors and Controls	De-lamping	Exterior Lamps (excluding LEDs)	Low Wattage (T8) Lamps	HE Electronic Ballasts	High Pressure sodium	Metal Halides	
Midwestern Utility Commercial Prescriptive Rebate	X		X	X	X	X	X						• Fluorescent high bay/ low bay replacing HID • CFLs(retrofit only) • Tubular skylight • Plug Load Occupancy Sensor • Vending Equipment Controller

Equipment Eligibility

Although most utilities require that eligible equipment be rated to industry standards, some reach beyond these requirements to emphasize fixture performance by establishing requirements for color rendition index and ballast factor. We discovered that among all benchmarked utilities, downlight LEDs are required to be qualified by either Design Lights Consortium (DLC) or ENERGY STAR.

Xcel Energy is the only utility that requires equipment to use three to six times less energy than what is being replaced, known as the "3-6 times rule" for LEDs replacing incandescent, halogens, and exterior HID (high intensity discharge) fixtures, in addition to requiring that downlights also meet DLC or ENERGY STAR criteria. These requirements limit the fixture selection significantly for these fixture types.

PG&E requires downlight LEDs and Duke Energy requires exterior LEDs to have minimum efficacy requirements in addition to requiring DLC or ENERGY STAR qualification. Unlike the 3-6 times rule, these requirements define eligibility criteria by setting efficacy requirements or mentioning maximum lamp wattage to filter qualifying products (LEDs replacing incandescent, halogens, and exterior HIDs) within the DLC and ENERGY STAR databases and still attempt to target wattage reduction.

Similarly, Xcel Energy is the only utility requiring CFLs replacing incandescent to meet the 3-5 times rule. Although utilities such as PG&E cap CFL incentives for lamps within the 14W to 28W range, others like the Midwestern utility require CFLs to be ENERGY STAR-rated. Still others, such as the southeastern utility and Duke Energy, do not have specific eligibility criteria for retrofit CFLs.

For low wattage T8 lamps, Xcel Energy provides rebates to only 25W and 28W lamps, whereas utilities such as PG&E, ConEdison, Duke, and PPL Electric require that low-watt T8 lamps and ballasts be rated by Consortium for Energy Efficiency (CEE). The Midwestern utility requires low-watt T8 to be $\leq$28W and be a CEE-rated fixture.

Xcel Energy does not require specific eligibility criteria for fixtures such as high bay fluorescents. Other utilities such as PG&E require them to be (either one or all) CEE-rated, to meet minimum color rendering index (CRI) criteria, and to be high ballast factors or rapid start ballasts. For occupancy sensors and daylight sensors, ConEd and other utilities require that ballasts for fixtures connected to occupancy sensors have programmable rapid start ballasts or CEE-rated electronic ballasts for T8 and T5 fixtures. Xcel Energy, however, does not state specific eligibility criteria, apart from minimum connected load requirements.

Similar to Xcel Energy, the Midwestern utility, PPL Electric and ConEd also provide rebates for de-lamping that causes net reduction in quantity of lamps, in addition to fixture replacement/retrofit rebates.

Table 22 summarizes the relevant fixture eligibility requirements by each utility.

Table 22. Benchmarked Program Prescriptive Measure Eligibility Requirements

Utility Name	Fixture Type	Eligibility Criteria
Xcel Energy	LED: • Troffer fixture & retrofit kits • Parking garage fixture	• Design Light Consortium (DLC)-qualified product list (QPL)
	LED: • Screw in and pin based	• ENERGY STAR-qualified (ES)
	LED: • Downlight luminaires replacing Incandescent or halogen	• ENERGY STAR-qualified (ES) • 3-6 times rule
	CFLs replacing incandescent	• 3-5 times rule
	Exterior LED canopy replacing HID	• 3-6 times rule
	Low watt T8 lamps	• 28W or 25W only
	Interior /exterior linear fluorescent • High bay fluorescent replacing HID • High efficiency T8 • LED wall pack fixtures • LED cooler freezer case light replacing less efficient fluorescent • T12 to T8 retrofits • Parking garage T8 lamps • Occupancy and daylight sensors	No specific eligibility requirement
Utility Name	**Fixture Type**	**Eligibility Criteria**
PG&E	LED: high/low bay • High-bay luminaires (fixtures and retrofit kits) • Low-bay luminaires (fixtures and retrofit kits) • High-bay aisle luminaires (fixtures)	• State of California QPL (similar in equivalency to DLC)
	LED: exterior area lighting	• State of California QPL (similar in equivalency to DLC)
	Interior high bay lighting: • High performance T8/T5, super T8, T8VHO or T5 HO	• 32-watt T8 lamps must be HP T8 or super T8 lamps and cee1.org listed. • All lamps be rated equal to or greater than 20,000 hours of average-rated lamp life based on three hours per start - rapid-start ballasts. • Color Rendering Index (CRI) ≥82. • All T8 ballasts must be rated as National Electrical Manufacturers Association (NEMA) premium or designated HP electronic ballast as listed on cee1.org • T5 HO rapid start ballast.
	High bay CFL	• Ballast power factor (BF) ≥0.9.
	Interior induction fixtures (non-screw based)	• Ballast separate from lamp

	Exterior induction fixtures (non-screw)	• Ballast separate from lamp.
	Low watt T8 lamps	• 28W or 25W only; CEE1.org listed
	CFL reflector lamp (14-28 watts screw in only)	• ENERGY STAR-qualified lamp and ballast
	LED track or mono directional Luminaires	• DLC qualified (State of California QPL [similar to in equivalency to DLC])
	LED downlights: • Recessed, surface, pendant or retrofits • Accent lights	• State of California QPL (similar to in equivalency to DLC), • ENERGY STAR-qualified • Efficacy of 35 lumen/watts (lm/W) • Downlights in insulated ceilings - CEC Title 20
Utility Name	**Fixture Type**	**Eligibility Criteria**
ConEd	High efficiency LED: • LED interior screw-in and pin-based • LED exterior • LED interior downlights • LED Interior Garage & canopy	• ENERGY STAR- or DLC-Qualified • TRC test if existing lamp condition varies from program assumptions
	LED display cases and exit signs	No specific eligibility requirement
	High-performance T8 (HPT8) lamps (retrofit)	• CEE certified ballast • 4ft t8 lamps – CEE certified • 2ft, 3ft and 8ft T8 and T5 replacement lamps-CRI ≥80
	Low-watt T8 lamps	• CEE certified ballast
	T5 and T5 HO lamps	• UL listed system (lamp + ballast)
	De-lamping fixtures	• Net reduction in lamp quantity and improvement in efficiency
	HID lighting	• Electronic ballast • Pulse start of ceramic metal halide.
	Induction fixtures	• One-for-one replacement of incandescent or HID • New fixture wattage ≤250W.
	High-efficiency troffers	• CEE-certified ballast • Fixture efficiency >80%
	High-efficiency low glare fixture	• CEE-certified ballast • Fixture efficiency >80% +15% zonal lumen between 60 & 90 degrees • Glare control and light distribution features
	High-intensity fluorescent	• CEE-certified ballast • 15ft or higher • Fixture efficiency >80% • Fixture wattage >125W

	Pendant/wall-mounted indirect fluorescent fixture	• CEE-certified ballast • Fixture efficiency >80% • Ceiling reflectivity ≥ 80% • Uplight component ≥60%
	High bay/high output (interior only)	• 15ft or higher • CEE certified ballast for HPT8
	Lighting controls: • Occupancy sensors • Bi-level stairwell lighting controls	• Occupancy sensors use programmable rapid start ballasts • T8/T5 with CEE-qualified electronic ballasts or DLC-qualified LEDs. • 50% or less wattage during unoccupied hours in stairs
Utility Name	**Fixture Type**	**Eligibility Criteria**
Duke Energy	High-performance T8 (HPT8) Lamps (retrofit) • High performance or reduced wattage T8	• CEE-qualified lamp + ballast • Ballast factor >90% • Ballast harmonic distortion ≤20% • Electronic ballast
	LED panels (indoor conditioned space only)	• DLC-Qualified
	Fluorescent high bay fixtures replacing HID	• CEE-qualified lamp + ballast • Ballast factor >90% • Ballast harmonic distortion ≤20% • T5, T8 high bays have mirror like or white reflectors
	LED bay lighting replacing HID	• DLC-qualified (retrofit kits and new fixtures)
	CFL lamps and fixtures	• No specific eligibility requirement
	LED lamps and fixtures (indoor conditioned space only)	• Downlights ENERGY STAR downlights and 18W or less • All bulbs be ENERGY STAR-qualified • DLC Qualified or ENERGY STAR-qualified • Exit signs < 5 W meet, UL listed. • Case lights must be DLC-qualified LED case light
	Metal halides (pulse start and Ceramic)	• Retrofit fixture must be hardwired • Only pulse start that uses 320W
	Tubular skylight	• At least one tube be on daylight sensor.
	Sensors	• Either occupancy or daylight sensors

	LED or induction outdoor lighting: • Exterior, parking garage, pedestrian, traffic signals, landscape	• Minimum of 35 lm/W • Outdoor and garage lighting must result in power reduction of ≥ 40% and be DLC- or ENERGY STAR-qualified. • DLC-qualified fuel pump canopy retrofit kits • DLC- or ENERGY STAR-qualified LED bollards. • Exterior motion sensors control to be controlled by photocell or timer
Utility Name	**Fixture Type**	**Eligibility Criteria**
Avista	High performance linear fluorescents	• CEE-qualified
	LED lamps	• DLC-qualified
	Occupancy sensors with relays for room control	• No specific eligibility requirement
	Exterior LED lighting Canopy fixture retrofit (excluding pole, wallpack, soffit)	• Minimum operation 4,288 hours • DLC or Seattle Lighting Design Lab-qualified
	LED signage lighting	• Life expectancy >40,000 hours
Utility Name	**Fixture Type**	**Eligibility Criteria**
Southeastern utility	Interior Lighting: linear fluorescent, high bay, LED fixture and other (except T5 adapter kits)	• LEDs to be ENERGY STAR or DLC or LDL (Lighting Design Lab) qualified or pass LM-79 test • Minimum 10% wattage reduction from existing
	Exterior lighting	• Outdoor pole mounted lights to be metered.
	Occupancy sensors	• No specific eligibility requirement
	Daylight sensors	• No specific eligibility requirement
	CFL (retrofit) • Screw-in • Hardwired	• No specific eligibility requirement
Utility Name	**Fixture Type**	**Eligibility Criteria**
PPL Electric	High performance and low wattage fluorescent (T8)	• High performance/reduced wattage fixture (lamp + ballast) • T8 lamps and ballast CEE-qualified. • T5HO and T8 must be >100W, replacing ≥150W
	De-lamp and install reflectors	• 4’ T8 lamps CEE-qualified. • 8’ lamps, net reduction in lamp length, other fewer lamps
	LED (screw- in) bulbs	• ENERGY STAR- or DLC-qualified.
	Other LED bulbs	• 10 maximum bulb types per customer/year. • Manufactures producing DLC or ENERGY STAR qualifying products.

	Occupancy sensors	• Passive infrared/ultrasonic sensors controlling >=100W.
	LED exit signs (replacing incandescent or CFLs)	• ≤5W per face • Meet UL-924/ local fire code or ETL requirements. • Rated life of ≥5 years
Utility Name	**Fixture Type**	**Eligibility Criteria**
Midwestern utility	Fluorescent lighting: • Regular T8 and reduced watt T8	• Hardwired fixture (lamp + ballast) UL-listed. • T8 ballast factor ≤0.78 • Lamps ≤28W; CEE-certified lamp +ballast
	Fluorescent high-bay lighting replacing HID	• No specific eligibility requirement
	LED lighting replacing HID or fluorescent	• DLC- or ENERGY STAR- or LDL-qualified
	Permanent lamp removal (de-lamping)	• Removal of lamps/ballasts and unused lamp holders
		• Preapproval required
	Re-lamping (reduced watts replacements)	• ≤28W • Ballast factor ≤0.88 • 500 sq ft minimum area • CEE-qualified lamps • Preapproval required
	CFL lighting replacing incandescent	• ENERGY STAR Rated
	Sensors and Controls • Occupancy sensors • Remote mounted photocell • Fixture mounted photocell • Dimmable ballast w/ daylight Sensors • Central lighting control • Switching controls for multilevel lighting	• 50% lamp turn-off capability/continuous/step dimming • Passive infrared/ultrasonic sensors • Preferred programmable or rapid start ballasts
	LED exterior or garage HID to LED/induction lighting LED Interior LED lighting retrofit	• ENERGY STAR-qualified screw-ins and recessed downlights
	Tubular skylight	• Minimum of 1 light tube be controlled by photocell
	Vending equipment controller	• Passive infrared sensor to turn of light and control compressor
	Plug load occupancy sensor	• Passive Infrared or ultrasonic detectors

Application Process

Xcel Energy requires applicants to submit invoices and product details along with their prescriptive applications to ensure equipment eligibility. For quality assurance purposes, Xcel Energy chooses to

randomly audit sites with installed equipment at its own discretion. Similarly, for larger projects, account managers sometimes conduct an on-site verification.

Xcel Energy also requires participating customers to retain samples of old equipment for three months to help confirm the type of equipment in place prior to retrofit.

For measures that do not qualify for prescriptive rebates, customers may choose to apply for custom rebates where eligible equipment can be assessed on a case-by-case basis. The Xcel Energy engineering team is highly involved in the operation of the Lighting Efficiency program. They analyze all custom projects and also help develop and review the deemed savings estimates and technical assumptions used to calculate project savings and cost-effectiveness. Custom application participation requires preapproval, which is typical of all of the benchmarked utilities.

Some of the other utility programs differ from Xcel Energy's prescriptive application approach by requiring preapproval for prescriptive measures. Typically, these utilities (Midwestern utility, PPL Electric, and ConEd) require that customers partner with a preferred vendor to complete the rebate application and submit it along with contact information, equipment specifications (make and model of existing and new equipment), and quoted cost of new equipment. Incomplete applications are rejected and resubmitting them resets the applicant's position in the rebate receiving queue. Program staff reviews the application, verifies information and, if all information looks accurate, reserves rebate funds for the project. Customers and their vendors have a 30- to 60-day (varies by utility) window to submit proof of purchase for the approved measures. Any invoices received after this period will no longer have funds reserved. In this case, customers can chose to reapply for the rebate but they will be placed in the back of the queue and may or may not receive the rebate depending on the availability of funds.

PG&E, ConEd, the southeastern utility, and the Midwestern utility have online rebate applications, which provide tracking features that allow customers to log in to their application to review its status. ConEd's application recommends submitting the online application at least four weeks prior to the project start date. Overall, it appears these online systems streamline the documentation effort, ensure that each application is completed adequately, and make it easier to track data in the database.

We also found that all utilities require customers to report the type of existing equipment that is being replaced. However, unlike Xcel Energy, they did not explicitly require the customers to maintain samples of existing equipment. Utilities that require preapproval rely on field inspections of existing equipment at a random selection of sites in addition to asking the applicants to list equipment on the application form.

Program Performance

Although often similar in design and documentation requirements, lighting rebate programs often feature nuanced differences in eligibility rules, measure mix, rebate amounts, implementation strategies, and delivery practices, which limits the applicability of direct comparisons of program performance. Moreover, savings associated with lighting measures are often rolled up into commercial

program savings, which makes it difficult to compare the impacts associated solely with lighting measures.

Table 23 shows a comparison of the benchmarked programs' net annual kWh savings, participation, savings per participant, and NTG ratios found in regulatory filings and evaluation reports.

Table 23. Net Annual Savings (kWh) and Participation

Program / Year Report Published	Net Annual Savings (kWh)	Number of Participants	Savings per Participant (kWh)	NTG	Notes
Xcel Energy (2014)	71,534,278	1,608 unique participants	44,486	84%	Commercial Lighting Net Gen. Savings [a]
Pacific Gas and Electric (PG&E) (2013-2014)	Not Available	Not Available	Not Available	Not Avail-able	Evaluation is currently underway
ConEdison (2014)	35,127,214	632 unique participants	55,581	74%	Electric (lighting and non-lighting) Evaluated Net Savings [b]
Duke Energy - Ohio/Kentucky (2013)	Not Available	319,532 lighting measures	Not Available	68.2%	Participant lighting only. Net savings and NTG-Lighting and VFD [c]
Avista (2013)	16,595,342	4,784 lighting measures 598 lighting measures in Idaho	Not Available	81%	Lighting measures [d] NTG and Net savings are for all Non- residential measures (lighting and non-lighting) in Idaho
Southeastern utility (2014)	146,549,038	4,694 unique participants	31,220	91.7%	Commercial Sector DSM savings [e]
PPL Electric Utilities (2014)	81,170,000	996 unique participants	81,495	Not Avail-able	PPL Commercial savings [f]
Midwestern utility (2014-2015)	Not Available	1,217 unique participants	Not Available	Not Avail-able	Lighting Savings [g]

[a] Xcel Energy – http://www.xcelenergy.com/staticfiles/xe-responsive/Admin/Managed%20Documents%20&%20PDFs/2014-CO-DSM-Annual-Status-Report.pdf.pdf

[b] ConEd EEPS Programs Impact Evaluation of Large Commercial and Industrial Program Group, December 11 2014, DNV KEMA, Opinion Dynamics, Apprise, Navigant. http://www.coned.com/energyefficiency/PDF/EEPS%20CY1%20ConEd-LCI%20Impact%20Evaluation%20Final%20Report-APPROVED%201-2-15.pdf

[c] Duke Energy – https://www.duke-energy.com/pdfs/Part4-2014-280DukeEnergyKentuckyApplicationtoAmendDSM.pdf

[d] Avista 2013 Idaho Electric Impact Evaluation Report, June 17 2014, Cadmus

[e] Report is not publically available

[f] PPL Electric Utilities - https://www.pplelectric.com/save-energy-and-money/for-trade-allies/rebate-applications.aspx
[g] Report is not publically available

As seen in the table, utilities choose to report participation differently. Although some choose to count each site as one unique participant, which may be either just lighting applications or a combination of lighting and non-lighting applications, others choose to count each lighting measure as a participant.

Given how quickly the lighting technology market is evolving, to provide comparable savings values we chose to rely on studies conducted in 2012 or later. However, a straightforward comparison on net savings and NTG is even more challenging since not every utility isolates lighting or reports the NTG ratio publicly. The majority of the utilities we benchmarked choose not to share budgetary information publicly. Duke Energy's report was the only study that provided lighting savings (energy and demand) per unit by measure type.