AN ASSESSMENT OF THE LADWP COMMERCIAL LIGHTING EFFICIENCY OFFER (CLEO) PROGRAM

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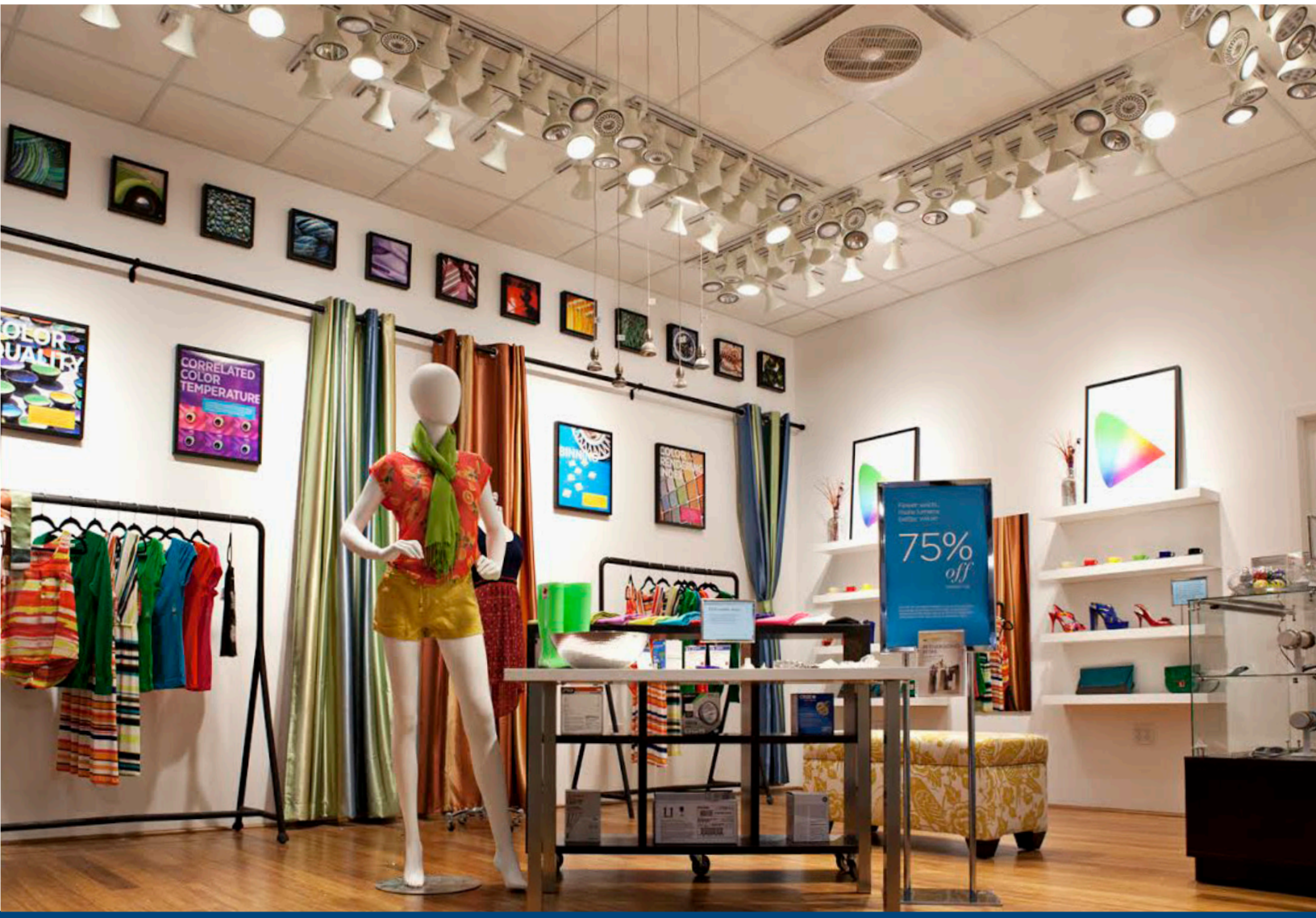

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PROJECT OVERVIEW

The research presented in this report was conducted by the Energy Efficiency Center (EEC) at the University of California, Davis, in collaboration with the California Lighting Technology Center (CLTC) and the Los Angeles Department of Water and Power (LADWP).

It pertains to the LADWP Commercial Lighting Efficiency Offer Program Assessment, a student-led project. LADWP's Commercial Lighting Efficiency Offer (CLEO) Program is a menu-based commercial lighting rebate program that is used to incentivize energy-efficient lighting technologies.

Project Goals

1. To provide a learning opportunity for a student researcher

2. To provide LADWP with a systematic overview of potential alterations to the CLEO Program that can inform program revisions for 2014

Key Objectives

The student fellow will:

Task 1: Assess the compliance of the current lighting portfolio with 2013 Title 24, Part 6 standards to be implemented in 2014

Task 2: Compare the CLEO program with commercial lighting rebate programs at other municipally owned utilities (MOUs) as well as investor-owned utilities (IOUs), using interviews with utility contacts and online resources and paying particular attention to upcoming measures designed to support market adoption of LED lighting products.

Task 3: Identify opportunities for CLEO program improvement and make recommendations, with input from UC Davis's California Lighting Technology Center (CLTC).

This report pertains to Tasks 1, 2 and 3, and is to serve as the final report for the project. Student research for this project took place in September to December of 2013.

A student-led project with input from the California Lighting Technology Center

TITLE 24 COMPLIANCE

The first stage of this project consisted of a basic assessment of CLEO program offerings to determine if they meet California's 2013 non-residential building standards (Title 24, Part 6). This is of particular importance to utilities that offer lighting rebate programs to incentivize code-compliant options.

Title 24 compliance also serves as the basis for many incentives provided for holistic projects, such as through calculated savings programs. It should also be noted that while utilities such as LADWP seek program alignment with Title 24 to make the compliance process easier for users, enforcement of Title 24 standards is not the responsibility of utilities. The LADWP CLEO program is a menu-based (also called "prescriptive" or "deemed") incentive program, comprised of a list of incentivized technologies that pertain to interior lighting, exterior lighting and sign lighting. The lighting section(s) of Title 24, Part 6 can be divided into these three categories: interior lighting, exterior lighting and sign lighting.

Standards for lighting controls specific to these categories also constitute a significant portion of the requirements in Title 24, Part 6. The specific sections of Title 24, Part 6 relevant to the CLEO program include Subchapter 4 (pg. 137-154), which primarily addresses lighting controls as they apply to indoor spaces, outdoor areas and signage, as well as Subchapter 5, Sections 140.6, 140.7 and 140.8 (pg. 179-198), which mainly cover prescriptive compliance measures for indoor lighting, outdoor lighting and sign lighting.

The CLEO program might be made substantially more effective by more closely aligning the program offerings with the structure and content of Title 24, Part 6 in a way such that they meet or exceed the latest Title 24, Part 6 requirements. Experts from CLTC provided detailed recommendations for updating and enhancing the CLEO program. These recommendations follow in the next section of this report.

INITIAL RECOMMENDATIONS

The UC Davis California Lighting Technology Center (CLTC) identified opportunities to enhance the CLEO program and better align it with the requirements of California's 2013 Building Energy Efficiency Standards (Title 24, Part 6), which this report sometimes references as "the Standards."

These recommendations also reflect shifts in the lighting marketplace, including the increased availability of cost-effective, solid-state lighting solutions for almost every commercial lighting application.

This information is intended to provide a starting point for discussion with the LADWP program development team. CLTC recommends an in-depth market analysis of specific measures that the LADWP team chooses to pursue. CLTC is able to conduct this market analysis if LADWP is in agreement.

General Recommendations

Program Organization

Not all lighting projects undertaken in LADWP territory for occupancy groups covered by the Standards[1] require compliance with the new Title 24, Part 6 requirements. Some of these projects, such as relamping with the same source type, may qualify as maintenance or repairs. Such projects often provide an opportunity to reduce lighting energy use without extensive or costly upgrades.

CLTC recommends the CLEO program clearly delineate between measures that include technologies or strategies likely to trigger Title 24, Part 6 requirements and those that target energy savings through maintenance or repairs. As part of this effort, it is important to create replacement lamp specifications for products to be used in projects that must comply with the new Standards.

CLTC recognizes that replacement lamp measures bring significant value to the CLEO program; for this reason, they should be updated to reflect the new Title 24, Part 6 requirements.

CLTC also recommends outreach and education to help customers understand which projects are considered maintenance and repair projects and which may require more systemic renovations to comply with the new Title 24, Part 6 requirements.

For measures other than those that specifically address replacement lamps and for those projects that would be characterized as retrofits or alterations, CLTC staff reviewed the existing CLEO Qualified Products List and recommends reorganizing these products into indoor and outdoor lighting categories, to align this content's organization more closely with that of Title 24, Part 6.

CLTC also recommends reducing incentives for technologies that have already achieved widespread use and are at a price point that no longer warrants incentives.

CLTC also recommends creating measures for specific LED fixture categories to encourage the adoption of these emerging technologies in applications where they can provide the greatest energy savings, from the introduction of LED sources and through controls integration, in a cost-effective manner.

Dimmable Lamps and Luminaires

The 2013 Standards significantly increase lighting controls requirements, compared to the 2008 Standards. Rebate measures should reflect this change by incentivizing the installation of dimmable lamps and luminaires with rare exceptions.

In retrofit and renovation projects, incentivized lamps and luminaires should allow for compliance with performance criteria outlined in Table 130.1-A of the Standards.

Table 130.1-A lists requirements for multi-level lighting controls and lighting uniformity by light source type.

[1] See Section 100.0, Scope, in the 2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings

TABLE 130.1-A MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS

Luminaire Type	Minimum Required Control Steps (percent of full rated power[1])				Uniform level of illuminance shall be achieved by:
Line-voltage sockets except GU-24 Low-voltage incandescent systems LED luminaires and LED source systems GU-24 rated for LED	Continuous dimming 10-100 percent				
GU-24 sockets rated for fluorescent > 20 watts Pin-based compact fluorescent > 20 watts[2]	Continuous dimming 20-100 percent				
GU-24 sockets rated for fluorescent ≤ 20 watts Pin-based compact fluorescent ≤ 20 watts[2] Linear fluorescent and U-bent fluorescent ≤ 13 watts	Minimum one step between 30-70 percent				Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range:				Stepped dimming; or Continuous dimming; or switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire, illuminating the same area and in the same manner
	20-40 %	50-70 %	80-85 %	100 %	
Track Lighting	Minimum one step between 30 – 70 percent				Step dimming; or Continuous dimming; or Separately switching circuits in multi-circuit track with a minimum of two circuits.
HID > 20 watts Induction > 25 watts Other light sources	Minimum one step between 50 - 70 percent				Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.

1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor

2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps

TABLE 140.6-A LIGHTING POWER DENSITY ADJUSTMENT FACTORS (PAF)

TYPE OF CONTROL		TYPE OF AREA		FACTOR
a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2 b. Only one PAF may be used for each qualifying luminaire unless combined below. c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF				
1. Partial-ON Occupant Sensing Control		Any area ≤ 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, conference or waiting room.		0.20
2. Occupant Sensing Controls in Large Open Plan Offices		In open plan offices > 250 square feet: One sensor controlling an area that is:	No larger than 125 square feet	0.40
			From 126 to 250 square feet	0.30
			From 251 to 500 square feet	0.20
3. Dimming System	Manual Dimming	Hotels/motels, restaurants, auditoriums, theaters		0.10
	Multiscene Programmable			0.20
4. Demand Responsive Control		All building types less than 10,000 square feet. Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF		0.05
5. Combined Manual Dimming plus Partial-ON Occupant Sensing Control		Any area ≤ 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, conference or waiting room		0.25

As utility programs are designed to incentivize energy savings beyond those required by codes and standards, programs should incentivize the installation of additional lighting control devices and systems that exceed the Standards.

Some examples are described in Table 140.6-A of the 2013 Standards, which lists Power Adjustment Factors allotted for the installation of certain controls in certain types of areas. These would be installed in addition to the lighting controls required for compliance with Title 24, Part 6, Section 140.6(a)2.

Incentivizing application-specific controls aligns with LADWP's intention to offer an expanded customer rebate program. As listed in Table 140.6-A, the most substantial power adjustment factor (0.40) offered under the non-residential Standards is associated with open-plan offices greater than 250 square feet with occupancy sensors controlling zones no greater than 125 square feet.

An incentive measure specific to open offices willing to install controls with this granularity would certainly exceed code, and it would incentivize an energy-saving strategy that has yet to be widely adopted or measured.

Lighting controls maximize the energy savings achieved with the purchase and installation of dimmable lighting systems (i.e., dimmable lamps and ballasts). Lighting control devices and systems incentivized by LADWP should be certified to the California Energy Commission and accessible through the Energy Commission's Appliance Efficiency Database (www.appliances.energy.ca.gov).[2]

Certified Contractors for Lighting Controls Projects

CLTC recommends that LADWP offer an additional incentive for lighting controls projects that use an installation team certified through the California Advanced Lighting Controls Training Program (CALCTP). This could mean incentivizing such projects at a higher rate than others. More information on CALCTP is available at www.calctp.org. For its 2013 Advanced Lighting Controls incentive program, the Sacramento Municipal Utility District (SMUD) currently offers a $200 per kWh bonus for using a CALCTP-certified contractor. For more information on SMUD's Advanced Lighting Control Incentive Program, contact Dave Bisbee at dave.bisbee@smud.org, or visit www.smud.org/en/business/save-energy/rebates-incentives-financing/lighting/documents/ALC-faqs.pdf.

[2] In preparation for the new standards, The Energy Commission is currently updating and archiving the lighting technologies listed in this database. This will greatly reduce the number of non-compliant products erroneously listed and will make the database a more useful tool.

LED Replacement Lamps

A-19 LED Replacement Lamps

If LED lamps in the A-19 form factor are included in the program, LADWP could require that incentivized products meet the criteria outlined in the Energy Commission's Voluntary California Quality LED Lamp Specification.

Many applications, including those in hospitality, restaurants and retail establishments, would benefit from some of the more stringent requirements set forth in this specification. For example, the dimming and color quality criteria of the new specification have the potential to improve customer satisfaction and sales in retail boutiques or dining areas in small restaurants.

Program deployment teams may choose to offer higher incentives for applications where lighting quality is more relevant. Providing customers with education materials on the importance of lighting quality in certain commercial settings is yet another way the CLEO program can support the new Quality Specification and its goals. CLTC can review the Quality Specification with the staff assigned to develop a program on this topic as needed.

Statewide, representatives from utility programs that address replacement lamps and emerging technologies have expressed concern to CLTC that the quality of LED replacement lamps is largely unknown. These individuals are also concerned that the number of lamps that meet the Quality Specification is speculative.

LADWP has the opportunity to participate in the creation of a database designed to offer utilities access to the information they need to create stronger programs around the Quality Specification. CLTC has partnered with Pacific Gas and Electric Company (PG&E) to create this database. The database will be accessible through a Web-based interface.

It will provide access to LED replacement lamp test results, including electrical and photometric characterization. This valuable resource will include data from multiple sources, including CLTC, other research facilities or certified laboratories, and manufacturers. CLTC has completed the initial design work associated with developing the database and the website.

Users will be able to search data on LED replacement lamps listed in the database for use in performing statistical operations and comparative evaluation. CLTC is currently testing a beta version of the website and collaborating with California's Investor Owned Utilities to refine the site before it is launched. LADWP has been invited by the primary project lead, Patrick Eilert, to discuss a role for LADWP in the database's creation and use. Pat is available, via e-mail at PLE2@pge.com.

Non-A-19 LED Replacement Lamps

For LED lamps that are outside of the A-19 category, a more robust incentive could be offered for products that meet the Quality Specification and are part of a color-critical application.

For example, the current incentive of $12.50 for LED MR-16 lamps between 6 and 10 watts is generous when compared to lower priced lamps of lesser quality, but it may simply be appropriate, or even low, when compared to the cost of higher quality products. In applications where MR-16 lamps are used and color rendering is important (e.g., hospitality, retail, and small restaurants), lamps with 90 CRI or better can be expected to increase customer satisfaction and support sales, in turn encouraging continued use of LED technology.

Non-A-19 LED replacement lamps using 10 watts or more should also have a baseline efficacy of at least 45 lumens per watt (lm/W), per ENERGY STAR requirements. Quality criteria and incentive levels for each lamp category and application should be determined based on a review of customer demand and projected participation.

CLTC recently evaluated the Helen Lamp from Lunera, an LED replacement for fluorescent GU24-base lamps, on behalf of PG&E's Alternative Qualification Process (AQP).

The Helen Lamp promises to reduce lighting energy use 30–50% by replacing 4-pin G24-base compact fluorescent lamps installed in many downlights with an LED solution that utilizes the existing fluorescent ballast.

The Helen Lamp is the first product of its kind evaluated for possible inclusion in a PG&E incentive program. It is expected that more LED GU24 replacements will emerge if the Helen Lamp is approved for incentives.

CLTC expects to evaluate this type of product further in 2014. For more information, contact Chris Corcoran, Customer Energy Solutions, PG&E at c5ct@pge.com.

The Helen Lamp is not dimmable at this time. As Title 24, Part 6 standards require dimming in a large number of commercial applications, the Helen Lamp and other non-dimmable products should be incentivized only through programs clearly targeted for projects that do not require compliance with the latest Standards, such as maintenance and repairs.

Tubular LED Replacement Lamps

CLTC is collaborating with utilities and California Energy Commission stakeholders to develop a specification for the inclusion of tubular LED products in California utility rebate programs. To participate in the process of creating this specification, please contact CLTC Senior Development Engineer Nicole Graeber at negraeber@ucdavis.edu.

Next Steps

In addition to these general recommendations, CLTC can assist LADWP in providing market analysis to determine incentive levels and technical specifications that should be included in new or adjusted measures. CLTC recommends that LADWP review the results of this market analysis and identify the most promising measures then meet with CLTC to discuss the top three to five opportunities and create a plan to further develop these incentive measures.

Recommended Incentive Removal or Reduction

CLTC has identified the following CLEO program technologies or measures as good candidates for revision: linear fluorescent relamping, ceramic metal halide lamps, and high-intensity discharge (HID) lamps, ballasts and luminaires. Further market research and analysis is needed to quantify what level of incentive adjustment would be appropriate for each of these offerings.

As noted previously, in the General Recommendations section of this report, it is advised that the CLEO program clearly delineate between maintenance or repair projects and alterations or renovations. CLTC recommends the following program revisions:

Linear Fluorescent Relamping

- Focus on incentivizing the addition of controls and the installation of dimmable fluorescent ballasts.

- Reduce incentive for 28W linear fluorescent lamps for certain types of projects, as most low-wattage linear fluorescent lamps are not dimmable. Inform customers that if the relamping area is scheduled as part of a retrofit that will trigger compliance with 2013 Title 24, Part 6, the investment in 28W lamps may realize only short-term savings.

Ceramic Metal Halide

- Update the category title to Ceramic Metal Halide Lamps to separate this measure from HID fixtures

- Based on CLTC's knowledge of this technology, it is a viable technology for realizing energy savings, but a reduction in incentive level may be advisable. This recommendation is contingent upon a market survey to determine saving opportunities and customers' perception of affordability based on the current market price.

- Products should have one control step between 50 percent and 70 percent in order to receive an incentive if they are intended for indoor installation or outdoor applications with a mounting height of 24 feet or lower. This specification reflects 2013 Title 24, Part 6 requirements.

HID Fixtures with Electronic Ballasts

- Even though a change from outdated HID lamps and magnetic ballasts to more efficient pulse-start lamps and electronic ballasts reduces energy use, consider a reduced incentive level based on the installed base in LADWP territory and the need for this category to remain at its current level. A calculated reduction may shift the focus to induction, fluorescent and LED fixtures when a source change-out is considered a viable option by the customer.

- Encouraging the adoption of fixtures that offer dimming and time-based and occupancy controls could benefit this measure. This additional amenity could be offered as a higher incentive level and targeted at customers who have HID luminaires that are expected to remain in place for the duration of this iteration of the CLEO program, as opposed to customers considering a redesign.

Recommended Adjustments to Current Categories

T8 or T5 Linear Fluorescent High Bay Fixtures

• Adjust program requirement to support only dimmable luminaires and encourage pairing with controls.

  o Incentivize a package purchase of luminaires and controls, or

  o Incentivize purchases of luminaires that have integrated controls (i.e., "controls on-board")

• Add LED High Bay fixtures to this measure

New Interior or Exterior Induction Lamps and Fixtures

• Require integrated or networked occupancy-based controls for all PV canopy projects and for parking garage and area lighting with a pole mounting height of up to 24 feet

• For low or high bay induction lighting, require, at a minimum, bi-level capability

  o Incentivize a controls-and-luminaire package purchase, or

  o Incentivize an integrated approach, with controls on-board

Bi-Level Stairwell/Hall/Garage Fixture

• Add a category to include LED luminaires and fluorescent luminaires that use more than 13 watts per lamp and that feature continuous dimming from 10–100 percent, which will complement the bi-level offering and be consistent with the requirements of Table 130.1-A in Title 24, Part 6 for LED and fluorescent luminaires.

• Consider adding a measure or a tiered incentive for luminaires that offer an on-board occupancy sensor that reduces lighting power levels by at least 50% during vacant periods.

New Measures

Lighting Controls

• Evaluate the structure of the existing measure, and consider integrating lighting controls with other categories to encourage wider use of controls

• Move occupancy sensors to this new category

• Create a daylighting controls measure for spaces outside those required to have daylighting controls per the Standards

• Investigate the creation of a custom rebate program for networked lighting packages

  o Require completion of a controls education program to participate (for example, an in-person or online learning course in lighting controls basics, offered by a subject matter expert through LADWP)

Indoor LED Fixtures: New Categories

• LED downlights, with three tiered incentive levels

  o LED pin-based replacement lamps that use the existing socket and leave the existing ballast in place for repair projects (contingent on testing results for the Helen Lamp, which will emerge from the PG&E AQP program mentioned previously)

  o LED retrofit kits

  o Dedicated LED luminaires

• LED troffers

  o Luminaire replacements

    - Create a category for products with integrated sensors

  o LED retrofit kits for troffers

    - Clearly define "retrofit kit" to exclude tubular LED lamps

• LED wall packs with integrated occupancy sensors

A GLANCE AT INDUSTRY PRACTICES

The second stage of this project included brief interviews with representatives of other California utilities, both investor-owned and municipally owned. Interview questions were designed to reveal these utilities' practices and plans for 2014.

The information gathered helps provide a better understanding of different utilities' individual approaches and can help identify trends in changes to commercial lighting rebate programs.

For context, rebate programs can be offered in one of three ways; menu-based (or prescriptive), custom calculation or a hybrid of the two programs. All of these program types have intrinsic pros and cons which will be explored in further detail in this report.

Based on conversations with LADWP representatives about their interests, interview questions focused on:

- Basic features of existing programs
- How programs address Title 24, Part 6 standards (including major changes for 2014)
- The role of LED technology
- Communications with other organizations, such as the California Public Utilities Commission (CPUC), the California Energy Commission, the California Municipal Utilities Association (CMUA), and other utilities

Utility Representatives interviewed for this project included SMUD, Silicon Valley Power, Roseville Electric, PG&E, and SCE

- Past and current program obstacles

The interviews described below were conducted in October and November of 2013, and may not reflect program changes made after this time.

Overview of Responses from Municipally Owned Utilities (MOUs)

Representatives from the following MOUs were interviewed for this project: the Sacramento Municipal Utility District (SMUD), Silicon Valley Power, and Roseville Electric. The new Title 24, Part 6 requirements do not impact the decisions of MOUs in the same way they impact IOUs, primarily because MOUs do not face the same penalties for failing to meet government-regulated energy reduction requirements that IOUs do.

These energy consumption reduction requirements imposed on IOUs translate to requirements in the energy efficiency programs they offer. In the case of lighting, IOUs have the best chance of meeting energy consumption reduction requirements if their programs are in alignment with Title 24, part 6 standards.

All of the MOU representatives interviewed for this report indicated that their decisions and methods are based on the needs present in their service territories and the utilities' direction of their programs.

Information on program alteration trends in response to the new Title 24 cycle seems to spread freely from both formal and informal encounters that can occur with other MOUs and even other IOUs. In terms of consistent trends between interviewed MOUs, all are actively pursuing greater LED technology integration into their programs or already have LED technology firmly integrated in their programs.

Sacramento Municipal Utility District (SMUD)

SMUD commercial rebate offerings are determined by using a combined menu/custom calculated approach (which SMUD breaks down into custom, express, prescriptive, and fluorescent).

Title 24 and Major Changes

SMUD no longer uses Title 24, Part 6 as a baseline for

lighting rebate incentive determination due to cost delivery issues; this is only true of calculations pertaining to the lighting baseline. SMUD representatives found that using Title 24, Part 6 as a baseline was both time and labor intensive, and it resulted in relatively small incentives redeemed by customers.

This is primarily because the new standards pertaining to lighting technology are challenging to achieve, which translates to difficulty redeeming incentives for customers. For these reasons, SMUD adopted an existing condition baseline, which the utility finds more effective for its lighting program. This means that program incentives are only available for projects that improve energy efficiency with respect to its current energy usage or the existing condition of energy consumption for that project.

The Role of LED Technology

LED fixtures and retrofit kits are already a substantial factor in the majority of claimed savings for lighting projects that SMUD incentivizes.

Communication with other Organizations

SMUD has planning and strategy groups that are more involved with the regulatory bodies, however interviewing contacts with these groups was not within the scope of this report As a result it was difficult to determine the nature and frequency of SMUD's interaction with the CMUA without further interviewing contacts .

Obstacles

SMUD's programs require that contractors are licensed in order to perform installations; however, it should be stated that code enforcement is not the responsibility of the utility. Since moving towards alternative options other than Title 24, Part 6 for its lighting baseline, SMUD has not seen any decrease in the cost effectiveness of its lighting energy efficiency program.

Silicon Valley Power

Silicon Valley Power commercial lighting rebate offerings are determined using a custom calculations approach (before July 1, 2013, the MOU had a prescriptive program as well). The Silicon Valley Power (SVP) representatives interviewed for this project explained that SVP deemed savings values can be inaccurate reflections of actual energy savings achieved, depending on the facility being retrofitted.

For this reason, prescriptive incentives may overpay or underpay for actual savings achieved. SVP looked to the calculated savings model that has been successfully used in the Pacific Northwest as the basis for its new model.

Title 24 and Major Changes

SVP previously used a combination program that included a prescriptive element as well as a custom element (the latter was reserved for specific applications that fell outside of the parameters of the prescriptive measures). SVP recently changed over to a complete custom calculated program, effective July 1, 2013, in order to more accurately incentivize actual energy savings.

Program incentives are calculated from existing fixtures, with built-in contingencies that align with the requirements established by Title 24, Part 6. This ensures that all options incentivized by SVP are based on exceeding Title 24 compliance standards.

SVP's previous program relied on the Database for Energy Efficient Resources (DEER) in order to determine savings, but this method consistently resulted in noticeable differences between intended/expected energy savings and actual savings.

Since implementing it's new, custom calculated rebate program, SVP's energy savings projections have more accurately aligned with actual energy savings. It should be noted that with this new custom calculation approach, there is more reliance on in-house engineers to assist customers and contractors in filling out the rebate calculator and verifying the accuracy of information entered to validate savings.

Role of LED Technology

The majority of the commercial rebate applications received by SVP pertain to lighting projects, but lighting accounts for only 20–30% of the savings achieved through SVP's rebate programs in any given year. Although SVP has seen a significant increase in the number of LED projects over the last two years, these projects are still not large enough to have a significant impact on the overall program savings.

SVP's customer base is somewhat atypical in that a high number of high-tech companies and data centers fall in SVP territory. As a result, lighting constitutes a smaller-than-usual portion of the electricity load for many SVP customers, who may have large server rooms and other equipment requiring large amounts of energy.

SVP does not expect to see lighting retrofits make up a significant portion of overall energy savings for these customers.

Also, the SVP commercial program does have an existing cap on the rebate amount, meaning that LED incentives cannot exceed the pre-tax cost given that commercial applied LED's pay. The pre-tax cost is based on kWh savings as opposed to a flat price.

Communication with other Organizations

SVP has strong communication with the California Municipal Utilities Association (CMUA) and stays up to date on rebate-relevant information. Silicon Valley Power is a continuous participant at the California Municipal Utilities Association annual meetings as well as other organized meetings with other utilities that are also part of CMUA. In fact, SVP organized a discussion of Title 24, Part 6 with LADWP at the CMUA annual meeting. SVP coordinates with CMUA to participate in CMUA events.

SVP also reports to the California Energy Commission annually and meets with the Northern California Power Agency to converse about rebate program structure and how this structure is affected by regulatory items such as Title 24, Part 6. Due to the lack of centralized information sources for Title 24 alteration preparations SVP utilizes an engineering firm that can assist in a way to ensuring that the program alterations comply.

SVP also feeds information to the Northern California Power Agency as well as the Southern California Public Power Authority and associated members. SVP encourages all contractors to participate in compliance education opportunities, such as the training programs held by PG&E and SMUD, in order to help them understand the impact that Title 24 changes will have on projects in SVP territory.

Obstacles

Most difficulties are resolved internally in the program. SVP includes a flow chart in their program that helps the customer or contractor navigate the custom calculation process. This not only helps them understand what rebate options are available through the SVP custom calculation rebate program, but it also emphasizes the fact that SVP's rebate program only pays for incentives that exceed Title 24 compliance standards.

Roseville Electric

Roseville Electric's commercial rebate offerings are determined using a menu-based (prescriptive) approach, which is a list of technologies displayed in a catalogue format that customers can go through and select options based on their project needs/desires Roseville Electric's program is focused on reducing peak demand.

Title 24 and Major Changes

Roseville Electric plans to maintain its prescriptive approach, with some alterations designed to bring the

Utilities are actively pursuing greater integration of LED technology in their programs

program in alignment with the 2013 Title 24, Part 6 standards. Roseville Electric also plans on using third-party Title 24 compliance verifiers in order to ensure that the program offerings are in alignment with Title 24, Part 6 content and the corresponding projects are incentivized based on exceeding Title 24, Part 6 requirements.

Roseville Electric relies on knowledge sharing with utilities and regulatory bodies in order to lay the framework for their program. Internal knowledge transferred from utility to utility creates a pool of knowledge by which ideas and topics can be discussed in a way that results in sharing best practices and strategies. Vendors also provide additional insight into how the program is operating in practice and how decisions made in the program planning stage later impacted Roseville Electric customers. This helps Roseville Electric assess its process for altering the program and make changes based on vendor feedback about program effectiveness.

The Role of LED Technology

The Roseville Electric rebate program includes screw-base LED lamps as well as LED MR-16 lamps. Roseville Electric plans to update its program next year to incorporate LEDs into new construction programs and low-revenue programs, as LEDs are not supported in these programs.

Communication with Other Organizations

Roseville Electric reports energy efficiency efforts to the California Energy Commission once a year at an annual meeting. In addition to this communication with the CEC, Roseville Electric also makes a point to communicate with the California Municipal Utilities Association at its annual meetings as well as on monthly conference calls. Roseville Electric also has attendees at Title 24 training sessions offered at different forums.

Obstacles

Much of Roseville Electric's program follows a prescriptive approach, in order to simplify program navigation for customers. Customers and vendors are expected to participate in the program based on ease.

Overview of Responses from Investor Owned Utilities (IOUs)

Representatives from the following IOUs were interviewed for this project: Pacific Gas and Electric (PG&E) and Southern California Edison. Due to the nature of IOUs, the program architecture and incentive offerings of various IOUs exhibit a high degree of similarity. These consistencies are generally in the form of robust or multifaceted programs that take advantage of all of the program types and make use of the DEER database as a reference and a way of standardizing program offerings and operations.

The IOUs interviewed for this project also offered greater incentives for more energy efficient emerging technologies in their programs than incentives attributed to existing technologies. The two IOUs differed in their assessments of how a program aligned with Title 24, Part 6 standards should be facilitated including what aspects of the standards are most cost effective for the program implementation.

Pacific Gas and Electric Company (PG&E)

PG&E's commercial rebate offerings are determined using a prescriptive, calculated and hybrid program. Each program is independent of the others, but they can be used in combination. A representative of PG&E's residential lighting rebate program was interviewed in addition to one representative from PG&E's commercial lighting rebate program; these responses can be found in the appendix (III).

Title 24 and Major Changes

PG&E uses a second-generation T8 linear fluorescent lamp or pulse-start metal halide baseline for most commercial savings claims. This baseline is based on the federal performance guidelines related to linear fluorescents.

The Role of LED Technology

PG&E has significantly increased the role of LEDs in its rebate programs since mid-2012. LEDs were available through the calculated program before 2013, but new prescriptive rebates were rolled out in 2013.

Communication with other Organizations

PG&E works closely with the CPUC at all levels of the organization.

Southern California Edison (SCE)

SCE commercial rebate offerings are determined using a combined menu/custom calculation approach, which SCE calls "express" and "custom solutions," respectively. SCE's program focuses on maximizing potential savings.

Title 24 and Major Changes

Southern California Edison is one of many groups that utilize the DEER Database in order to determine the energy efficiency baseline for their prescriptive program. Edison compliments its use of the DEER database with defined measures in its program requirements that encourages the customer to comply with Title 24, Part 6 standards. They also stated that within federal code there is some validation about utilizing T8 lamps as a baseline for one-to-one swaps.

The changes to Title 24, Part 6 will not alter SCE's custom solutions; however, changes to the program will keep the program in alignment with the DEER database, including those changes related to occupancy-based lighting controls and dimmable lighting system components. In order to better quantify the incentives, SCE utilizes an internal group that does calculations in order to set a base case for savings determination.

This same group communicates with customers regarding the requirements that align with Standards compliance and incorporates these requirements into the eligibility requirements for rebate program participation. One of SCE's overall goals is to explore ways to make future compliance easier.

The Role of LED Technology

SCE facilitates its LED technology through a third-party program as opposed to being a direct constituent of their base rebate program. Unfortunately Edison has not experienced savings that are enough to provide a basis for justifying the inclusion of LED technology into a mainstream approach however they are considering moving into upstream rebate replacements rather than LED at this point in time. Edison is also seeking to work

with PG&E on creating a plan to incorporate high bay LED technology into their existing rebate program.

Communication with other Organizations

Southern California Edison has an internal committee that meets with the California Energy Commission separately from SCE's main group of contacts.

Alongside directed interaction with the California Energy Commission, SCE representatives frequently interact with the California Public Utilities Commission, namely in regards the potential studies that SCE conducts.

SCE also interacts heavily with DEER to determine the SCE rebate program's level of compliance with DEER and to validate the general compliance of items that may not be directly included in DEER specifications but are relevant.

Obstacles

SCE has identified challenges related to its custom calculated approach, including customer navigation difficulties and the tediousness of the auditing process. In order to resolve these problems, SCE is pursuing vendor training to improve program competency and reframing its expectations for the savings that the program will offer to identify areas of improvement the program life cycle.

STUDENT LEARNING OUTCOME

For the student author, this project provided valuable access to utility program representatives and provided insights on the inner workings of utilities. It also afforded a better understanding of the ways that utilities promote lighting energy efficiency through rebate programs, and how regulatory documentation impacts utilities' decisions regarding their rebate programs.

This project also provided numerous opportunities to improve various skills, including interviewing and technical writing. These skills are valuable in both academic and professional settings.

The Los Angeles Department of Water and Power provides invaluable opportunities for students to expand their knowledge and skill sets by partnering with the UC Davis Energy Efficiency Center on projects like this one.

"A BETTER UNDERSTANDING OF THE WAYS THAT UTILITIES PROMOTE LIGHTING ENERGY EFFICIENCY"

APPENDIX

I. List of Utility Contacts

Pacific Gas and Electric

David Thayer, Senior Project Manager, D1TQ@pge.com (Residential Program Contact)

Chris Corcoran, Senior Product Manager, c5ct@pge.com (Non Residential Program Contact)

Roseville Electric

Roy Gillham, Senior Energy Efficiency Program Manager, RGillham@roseville.ca.us

Sacramento Municipal Utility District (SMUD)

Steve Oliver, Principle Mechanical Engineer, solive1@smud.org

Silicon Valley Power

Mary McEnroe, Program Manager: Energy and Marketing, mmedeiros@santaclaraca.gov

Southern California Edison

Brian Okeefe, Energy Engineer, brian.okeefe@sce.com

II. Questions to Utilities

General questions asked to all interviewees:

• What is your occupation and what responsibilities do you hold?

• Would you classify your rebate program as a menu, custom calculation or other type of program? Would you care to extrapolate or give more insight as to why your utility chose this particular approach?

For menu/deemed/prescriptive programs specifically:

• What is your basis for choosing which lighting technology to incentivize?

• Historically, how have you ensured compliance with Title 24, Part 6 standards while retaining the menu-based approach? And how do you plan to continue ensuring compliance with 2013 Title 24, Part 6 standards?

• In your opinion, does your program address certain requirements explicitly stated in the 2013 Title 24, Part 6 standards, such as specific lighting power density requirements? If so, how?

For custom calculation-based programs, specifically:

• Historically, how have you ensured compliance with Title 24, Part 6 standards while retaining the custom calculation approach? And how do you plan on continuing compliance with 2013 Title 24, Part 6 standards?

• In your opinion, have you had any issues with customers navigating the custom calculation spreadsheet/form/document integral to your program? If so, how were they addressed?

• Given how robust your program is, are there any prescriptive/menu/deemed elements staying?

III. PG&E Residential Lighting Rebate Program Interview

Pacific Gas and Electric Residential Interview Summary

PG&E residential rebate offerings are determined by using a menu based approach. PG&E's focus is on resource acquisition and savings capturing.

Title 24 and major changes

PG&E utilizes technology that is tried and tested in the energy efficiency realm, an example being ENERGY STAR-approved technology. PG&E also utilizes the recommendations of manufacturers that create the technology that is implemented into rebate programs.

This helps them get a more holistic understanding of the technology specifications that they are implementing. The requirements of the residential program are structured so that the customer is aware of the necessity for compliance that is in alignment with Title 24, Part 6.

This is implemented in order to alleviate the tedious nature of the pre- and post-auditing process. This auditing process is necessary for residential and nonresidential programs alike.

The role of LED technology in the PG&E rebate program

The LED technology that is supported in the PG&E residential program includes only lamps that are in full compliance with Title 24, Part 6 technology specifications

for LEDs. PG&E is committed to moving to LED technology holistically for their programs. CFL options also still remain for low-cost applications that are available in PG&E's residential program.

Communication with other organizations

Along with other utilities such as SCE and SDGE, PG&E attends statewide meetings with the California Public Utilities Commission. Conversation is generally focused on clarifying questions about specifications and process as well as more specific questions regarding PG&E's potential studies and emerging technology studies.

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