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Comment on Outdoor Lighting Controls for 45-Day Language

Additional submitted attachment is included below.

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Comment on Outdoor Lighting Controls for 45-Day Language

CALIFORNIA STATEWIDE UTILITY CODES AND STANDARDS TEAM

June 1, 2021

1. Introduction

The California Statewide Utility Codes and Standards Enhancement Team (Statewide CASE Team) appreciates the opportunity to participate in the review of the 45-Day Express Terms for the 2022 California Energy Code (Title 24, Part 6).

The Statewide CASE Team actively supports code-setting bodies in developing and revising building energy codes and standards. The program's objective is to achieve significant energy savings and assist in meeting other energy-related state policy goals through the development of reasonable, responsible, and cost-effective code changes. This program is funded by California utility customers and administered by Pacific Gas and Electric Company, San Diego Gas & Electric Company (SDG&E®) and Southern California Edison Company under the auspices of the California Public Utilities Commission. The Statewide CASE Team is actively supporting the California Energy Commission (Energy Commission) in Title 24, Part 6 for the 2022 code update cycle. Through Codes and Standards Enhancement (CASE) Reports, the Statewide CASE Team provides the Energy Commission with technical and cost-effectiveness information required to make informed judgments on proposed standards for promising energy efficiency design practices and technologies.

The Statewide CASE Team encourages the Energy Commission to consider the recommendations presented in this document.

2. Summary of Issue and Recommendations

Section 130.2(c)3 of Title 24, Part 6 requires motion sensing controls for outdoor lighting for luminaires rated greater than 40 watts and mounted 24 feet or lower that are serving areas other than Building Façade, Ornamental Hardscape, Outdoor Dining, or Outdoor Sales Frontage lighting.

The 45-Day Express Terms has proposed a new exception to this section as follows:

> **EXCEPTION 4 to Section 130.2(c)3:** For parking lots, luminaires with a maximum rated wattage of 78 watts each are not required to have motion sensing controls.

Section 160.5(c)2C, which is the new multifamily section, has the same outdoor lighting controls requirements, including the new exception:

> **EXCEPTION 4 to Section 160.5(c)2C:** For parking lots, luminaires with a maximum rated wattage of 78 watts each are not required to have motion sensing controls.

In the Initial Statement of Reasons the Energy Commission provided the following rationale for adding Exception 4 to Section 130.2(c)3:

> "**Necessity:** This change is necessary to ensure energy efficiency via cost-effective building design standards, as directed by California Public Resources Code Sections 25213 and 25402."[1]

The Statewide CASE Team recommends these new exceptions be removed because it represents a decrease in stringency and will increase electricity consumption. This exception would increase statewide electricity use by approximately 12 GWh in 2023, the first year the 2022 code is in effect. Electricity use would increase an additional approximately 12 GWh per year for every subsequent year.

The Statewide CASE Team developed a CASE Report for the 2019 Title 24, Part 6 code cycle that proposed reducing the wattage threshold for outdoor lighting motion controls from 75 watts to 30 watts.[2] The CASE Report documented that motion controls for parking lot lighting for were cost effective with a 30-watt threshold for all outdoor applications evaluated.[3] Increasing the wattage threshold to 78 watts lacks cost-effectiveness justification and represents a roll-back of the stringency of Title 24, Part 6. No new publicly available evidence has been provided to demonstrate the assertion in the Initial Statement of Reasons that the current requirements are not cost effective. The following sections summarize the cost-effectiveness analysis the Statewide CASE Team completed for the 2019 code cycle, as well as other considerations documented in the 2019 CASE Report.

3. Cost Effectiveness of 40-Watt Threshold for Motion Controls

[1] Page 62, TN #: 237716, Initial Statement of Reasons 2022 Energy Code Proposed Changes, CEC, posted 5/6/21. https://efiling.energy.ca.gov/GetDocument.aspx?tn=237716&DocumentContentId=70938

[2] The Statewide CASE Team's CASE Report recommended 30 Watts but during the 2019 Rulemaking process, this was updated to 40 Watts. This is documented in the Statewide CASE Team's CASE Results Report: http://title24stakeholders.com/wp-content/uploads/2019/01/T24-2019-CASE-Study-Results-Reports-Outdoor-Lighting-Controls_Final_with_Attachments-.pdf

[3] 2019 CASE Report: Nonresidential Outdoor Lighting Controls – Final Report. September 2017 http://title24stakeholders.com/wp-content/uploads/2017/09/2019-T24-CASE-Report_Outdoor-Ltg-Controls_Final_September-2017.pdf

The 2016 version of Title 24, Part 6 had the following luminaire wattage exception to the outdoor lighting motion sensing control requirements:

> **EXCEPTION 3 to Section 130.2(c)3:,** Outdoor lighting, where luminaire rated wattage is determined in accordance with Section 130.0(c), and which meet one of the following conditions:
>
> A. Pole-mounted luminaires each with a maximum rated wattage of 75 watts; or
> B. Non-pole mounted luminaires with a maximum rated wattage of 30 watts each; or
> C. Linear lighting with a maximum wattage of 4 watts per linear foot of luminaire.

In 2017, the Statewide CASE Team identified that approximately half of the pole mounted luminaires under 15,000 lumens in the DesignLights Consortium (DLC) database were less than 75 watts. Thus, a significant fraction of luminaires mounted on poles less than 24 feet would be exempted. With rising luminaire efficacies, the fraction of market captured by the 75-watt threshold would be diminished. The Statewide CASE Team evaluated whether the exception could be simplified by collapsing the threshold to a single, greater than 30-watt threshold wattage.

The Statewide CASE Team relied on three primary sources of occupancy data as inputs to the model to calculate savings from occupancy-based controls: the Western Exterior Occupancy Survey (WEOS) for Exterior Adaptive Lighting Applications (phase 2 performed by the California Lighting Technology Center, at the University of California Davis (CLTC) for Pacific Gas & Electric, Southern California Edison, and Bonneville Power Administration in 2014), the Energy Technology Assistance Program (ETAP) performed by Energy Solutions for the Energy Commission from 2010 to 2012, and the 2016 CASE Report statistically modeled occupancy data for auto sales lots and gas stations.

For the 2019 Nonresidential Outdoor Lighting Controls CASE Report, the Statewide CASE Team used this occupancy data to calculate the energy savings associated with a high/low motion control: lights are set to full light output when occupied and dimmed to 50 percent of power when unoccupied. Based on an incremental cost of $59 for the motion sensor, the Statewide CASE Team calculated a benefit-to-cost (B/C) ratio for a 31-watt pole mounted luminaire for all applications in Figure 1 below. All of these applications were cost effective because they had B/C ratios greater than 1.0.

Table 22: Lifecycle Cost-Effectiveness Summary: Remove 75 Watt Threshold

Space Type	Benefits TDV Energy Cost Savings + Other PV Savings[a] (2020 PV $)	Costs Total Incremental PV Costs[b] (2020 PV $)	Benefit-to-Cost Ratio
Retail Building Supply Franchise	$133	$59	2.3
Big Box Retail (24hr)	$115	$59	1.9
Outdoor Shopping Center	$91	$59	1.5
Fast Food Restaurant (24hr)	$74	$59	1.3
K-12 School	$154	$59	2.6
Large Office Building	$163	$59	2.8
Office Campus	$161	$59	2.7
Medium Office Building	$156	$59	2.6
Recreational Parks	$167	$59	2.8
Government Center	$163	$59	2.8
Health Center	$149	$59	2.5
Auto Sales Lot	$118	$59	2.0
Gas Station	$71	$59	1.2

Figure 1: Lifecycle cost-effectiveness summary for the 30-watt threshold from the 2019 Nonresidential Outdoor Lighting Controls CASE Report.

Ultimately, a 40-watt threshold was adopted for outdoor lighting motion controls for the 2019 standards. With a 40-watt threshold, the energy savings proportionately increases as compared to a 30-watt threshold, while the cost of the motion sensor stays the same for both. The per-luminaire energy savings is based on full load hours (FLHs) multiplied by lighting wattage. The FLHs are consistent because they are a function of the control and the application and not the wattage. In evaluating the cost-effectiveness of the wattage threshold, the worst-case energy savings and the energy cost savings of the lowest wattage above the threshold are analyzed. 31 watts was evaluated (and found to be cost effective) for the 2019 CASE Report. Therefore, the B/C ratios are 132 percent (41 watts / 31 watts) of the values listed in Figure 1 above. With this modification to account for a 40-watt threshold, the B/C ratio of motion controls for parking lot lighting varies between 1.6 and 3.7, which is well above the 1.0 breakpoint used for determining cost effectiveness. While the higher wattage threshold results in higher per-luminaire energy savings, it results in lower statewide savings because more outdoor lighting applications within the state are exempt from the requirement.

4. Alternative Lighting Controls

Scheduling controls are also required for outdoor lighting, but they may not provide the energy savings offered by occupancy-based controls. Scheduling controls need to be set for the latest possible times that a parking lot will be reasonably occupied, which can change by day of week, week of year, and differ for visitors, employees, cleaning crews

etc. Due to concerns about liability, security, and safety, lighting schedules are often set to leave lights mostly on regardless of whether the space is supposed to be occupied or whether it occurs outside of normal scheduled hours. These schedule-based outdoor lighting controls have been required since the 2005 Standards, but despite this, a significant fraction of parking lots are still fully illuminated late at night when no occupants are present. In other words, scheduling controls save energy based on the schedule that has been set, but due the issues noted above, schedules are oftentimes set to keep lights on full power for longer hours.

5. Impacts of Adding New 78-Watt Exception

If the new 78-watt exception is accepted into the 2022 version of Title 24, Part 6, it will have significant impacts on the following items:

Energy and Greenhouse Gas Emissions. The new 78-watt exception mostly negates the current outdoor lighting motion control requirement. The 2019 CASE Report for outdoor lighting controls estimated that dropping the threshold from 75 watts to 30 watts would save approximately 12 GWh per year of electricity consumption for each year of new construction and alterations. Reversing the requirement would have the opposite effect and increase energy consumption by approximately 12 GWh per year and increase carbon emissions by approximately 2,880 Tons of CO_2e per year, for each year's construction.[4]

Light Pollution and Visual Trespass. The average night-time (sunset to sunrise) duration is around 12 hours, with parking lots being occupied a relatively short fraction of this time. For most of these hours, occupancy sensors can turn off or dim the lights. This reduces sky glow, visual trespass, and associated impact on the natural environment and circadian disruption.

6. Proposed Code Language

Recommended revisions to the 45-Day Express Terms are included in this document in red. The Statewide CASE Team's recommended language deletions are shown as ~~struck~~.

SECTION 130.2 –OUTDOOR LIGHTING CONTROLS AND EQUIPMENT

…

[4] Based on 240.4 Metric Tons CO_2e per GWh, based on 2016 eGRID GHG estimates for WECC subregion.

(c) **Controls for Outdoor Lighting.** Outdoor lighting shall be independently controlled from other electrical loads, and the controls for outdoor lighting shall meet the following functional requirements:

…

~~**EXCEPTION 4 to Section 130.2(c)3:** For parking lots, luminaires with a maximum rated wattage of 78 watts each are not required to have motion sensing controls.~~

SECTION 160.5 – MANDATORY LIGHTING REQUIREMENTS FOR INDOOR AND OUTDOOR SPACES

…

2. Controls for Outdoor Lighting. Outdoor lighting shall be independently controlled from other electrical loads, and the controls for outdoor lighting shall meet the following functional requirements:

…

(c) Outdoor Lighting and Controls Equipment. Multifamily buildings shall comply with the applicable requirements of Sections 160.5(c)1 through 160.5(c)2.

…

~~**EXCEPTION 4 to Section 160.5(c)2C:** For parking lots, luminaires with a maximum rated wattage of 78 watts each are not required to have motion sensing controls.~~

7. Concluding Remarks

The Statewide CASE Team appreciates the opportunity to provide input on the 45-Day Express Terms. The comments presented in this document are intended to ensure the feasible and cost-effective energy efficiency measures from the prior versions of the California Energy Efficiency Standards are maintained while revising to add or adjust cost-effective measures for even greater energy savings. The Statewide CASE Team recommends that the newly added Exception 4 to Section 130.2(c)3 and 160.5(c)2C be removed.

We welcome further discussion on this topic.