Codes and Standards Enhancement (CASE) Initiative

2028 California Energy Code

Indoor Lighting Controls

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Draft CASE Report

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Acronyms

Table 1 presents a list of acronyms used in this report. Title24stakeholders.com also maintains a glossary of terms.

Table 1: List of Acronyms

Acronym	Definition
ACM	Alternative Calculation Method
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
ATT	Acceptance Test Technician
BCR	Benefit-to-cost Ratio
Btu	British Thermal Units
CALGreen	California Green Building Standards Code
CARB	California Air Resources Board
CASE	Codes and Standards Enhancement
CBECC	California Building Energy Code Compliance Software
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CBO	Community-Based Organization
CPUC	California Public Utilities Commission
CZ	Climate Zone
DAC	Disadvantaged Community
DOSH	Division of Occupational Safety and Health
ECC	Energy Code Compliance
EPIC	Electric Program Investment Charge
ESJ	Environmental and Social Justice
GHG	Greenhouse Gas
GWh	Gigawatt-Hour
HVAC	Heating, Ventilation, and Air Conditioning
IDF	Input Data File
IECC	International Energy Conservation Code
IOU	Investor-Owned Utility
kWh	Kilowatt-Hour
kWh/year	Kilowatt-Hour Per Year
LED	Light Emitting Diode
LPD	Lighting Power Density

Acronym	Definition
LSC	Long-term System Cost
MeasureSET	CASE Measure Savings Estimation Template
PV	Present Value
W	Watt

1. Introduction

This is a draft report. The Statewide Codes and Standards Enhancement (CASE) Team encourages readers to provide comments on the proposed code changes and supporting analyses. The CEC will evaluate proposals that the Statewide CASE Team and other stakeholders submit and may revise or reject proposals. More information about the rulemaking schedule and how to participate in the process can be found on CEC's 2028 code cycle website. Suggested revisions will be considered when refining proposals and analyses. The final CASE Report will be submitted to the CEC later in 2026.

For this report, the Statewide CASE Team is requesting input on the following:

1. *We are looking to improve our energy and cost analyses, specifically, additional data on the material and labor (installation, commissioning, maintenance, and acceptance testing) costs, assumptions of spaces that may be impacted statewide, and material data. Additional measure-specific requests are below.*
2. *Parking Garage Daylight Adaptation Zones Nighttime Controls*
    a. *How big is the daylight adaptation zone? For example, what percentage of daylight adaptation zones is typically within the entire parking structure, and does the daylight adaptation zone lighting cover both sides in a two-way entrance/exit?*
    b. *What percentage of commercial buildings in dense urban areas feature integrated parking garages?*
3. *Require Occupant Sensing Controls in more Spaces*
    a. *Cost of HVAC integration for occupied standby controls*
    b. *Additional efforts (design, coordination, commissioning, and testing) required due to occupied standby controls.*
4. *Update Multilevel Lighting Controls Requirements*
    a. *Feedback on switching from an LPD-based trigger to a wattage-based trigger*
    b. *Feedback on allowing the use of scene control to comply with the manual dimmer requirement*

Email comments and suggestions to info@title24stakeholders.com and ywen@energy-solution.com*. Comments will either not be released for public review or will be anonymized if shared.*

1.1 Report Context

This proposal describes specific energy-efficiency code changes (referred to as "measures") aimed at reducing wasteful, uneconomic, inefficient, or unnecessary consumption of energy in California. These measures are submitted to the California Energy Commission (CEC) for consideration and potential inclusion in California's Energy Code (Title 24, Part 6), which sets statewide energy efficiency requirements for newly constructed buildings and for additions and alterations to existing buildings. Measures may also be considered for inclusion in CALGreen (Title 24, Part 11) as voluntary energy efficiency standards, which would take effect only if adopted by a local jurisdiction seeking to exceed the minimum requirements of the Energy Code. Measures submitted to the CEC will be reviewed, may be modified, and may be incorporated into a broader regulatory package proposed and adopted by the CEC. To be included in the Energy Code, proposed measures must be both cost-effective and technically feasible.

1.2 Proposal Sponsors and Support

Three California Investor-Owned Utilities (IOUs) — Pacific Gas & Electric Company, San Diego Gas & Electric, and Southern California Edison sponsored this effort as a group. Where the term, "Statewide CASE Team" is used in this report, it refers the authors of the CASE report and the Codes & Standards programs of the supporting California Investor-Owned Utilities. The California Energy Alliance (CEA) proposed to revise the current threshold for triggering the multilevel lighting controls requirement. This proposal was included within this CASE Report and the CEA has remained engaged, providing support on this measure.

1.3 Stakeholder Engagement to Inform Proposal

When developing the code change proposal and associated technical information presented in this report, the Statewide CASE Team worked with many industry stakeholders, including manufacturers, industry associations, lighting specifiers, electrical engineers, energy consultants, commissioning providers, lighting controls acceptance test technicians, facility managers, Title 24 energy analysts, state agencies, and others involved in the code compliance process. The proposal incorporates feedback received during a public stakeholder workshop that the Statewide CASE Team held on September 24, 2025.

The Statewide CASE Team discussed the proposed code changes with lighting control solution manufacturers, most of whom are also part of the same industry association and confirmed the technical feasibility of the proposed changes from the manufacturers' perspective. The team organized follow-up calls with facility managers at large

institutions, who provided initial feedback during the public stakeholder workshop, to better understand users' viewpoints and revised the proposed changes presented in this draft report based on their input. For changes that involve updating the acceptance test methods, lighting controls Acceptance Test Technicians (ATTs) were consulted to confirm feasibility, assess potential test burden, and estimate the resulting cost impacts. Two surveys were conducted to collect data and insights into the proposed changes. The first survey, containing high-level, mostly multiple-choice questions, was distributed to the broad stakeholder group. The second survey targeted a smaller group of stakeholders with whom the Statewide CASE Team maintains close contact and who would be willing to spend more time providing detailed feedback. Both versions of the surveys are still ongoing at the time this report was drafted, and results will be incorporated and reflected in the revised code change proposal in the Final CASE Report.

See Appendix E for details on the Statewide CASE Team's stakeholder engagement.

2. Parking Garage Daylight Adaptation Zones Nighttime Controls

2.1 Parking Garage Daylight Adaptation Zones Nighttime Controls - Measure Description

2.1.1 Proposed Code Change

This proposed measure requires nighttime controls in parking garage daylight-adaptation zones, which will increase energy savings and, more importantly, ensure proper visual adaptation for drivers entering parking garages at night. During the day, adaptation zones lessen the visual transition from light to dark by using high-LPD daylight-adaptation-zone lighting near entrances. These areas improve driver visibility during daylight hours but have ten times the lighting power density (LPD) of other garage areas and are not dimmed after sunset. The proposed measure would add controls to lower the lighting power in daylight-adaptation zones from sunset to sunrise to match the rest of the parking garage's lighting levels. This proposal would include daylight adaptation controls as recommended by IES RP-8-25 and require similar adaptation compensation controls as in ANSI/ASHRAE/IES 90.1-2022: Energy Standard for Buildings § 9.4.1.2(c). The proposed measure would implement nighttime adaptation compensation controls within designated daylight adaptation zone lighting systems. This proposal will affect new construction, additions, and alterations. However, this code change would not affect residential or multifamily building types. It would need a dedicated acceptance test as part of the lighting controls acceptance tests for the garage space.

Table 2 summarizes the scope of the proposed code change.

Table 2: Scope of Proposed Code Change1

A ☑ indicates the proposed code change is relevant.

Building Type(s)	Construction Type(s)	Type of Change
☐ Single Family	☑ New Construction	☑ Mandatory
☐ Multifamily	☑ Additions	☐ Prescriptive
☑ Nonresidential (Not Group R uses)	☑ Alterations	☐ Performance

[1] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Application Climate Zones	Energy Code Sections	Compliance Forms	Sections of ACM Reference Manuals
Climate Zones 1-16	• Part 6, Section 130.1 • Nonresidential Reference Appendix Section	NRCC/LMCC-LTI-E; NRCI/LMCI-LTI-E; NRCA-LTI-02-A; NRCA-03-A	N/A

Third Party Verification)	Updates to Compliance Software
☑ No changes to third party verification	☐ No updates
☐ Update existing verification requirements	☑ Update existing feature
☑ Add new verification requirements	☐ Add new feature

a. The scope of this proposed code change does not include Group R residential and multifamily buildings.

2.1.2 Benefits of Proposed Change

Current requirements in Title 24, Part 6, 2025 allow the daylight adaptation zone to have an LPD allowance 10 times higher than the rest of the garage space to increase light levels and improve visibility, as drivers' eyes adapt from bright outdoor daylight to the more dimly lit garage areas. This is the purpose of the adaptation zone LPD allowance in the Energy Code. However, during nighttime hours, the same high LPD lighting can negatively impact the driver's vision as they transition from the garage to the outdoor lighting environment.

The proposed revisions to the mandatory control requirements are consistent with the lighting standards outlined in ASHRAE 90.1-2022. The proposed controls for parking garage daylight adaptation zones reduce lighting power consumption during nighttime hours to align with other garage areas. This adjustment yields substantial energy savings because the adaptation zones have LPD values that are ten times the baseline allowance for the remainder of the garage. It also improves safety from a lighting engineering perspective by reducing illuminance in the daylight-adaptation zones during nighttime hours, so drivers experience lower contrast as they transition from the garage to the outdoor lighting environment.

2.1.3 Background Information

A daylight adaptation zone in a parking garage is the interior pathway for vehicles near the entrance or exit, where drivers must adapt from outdoor daylight levels to interior lighting levels. This transition can significantly reduce driver visibility as drivers' eyes adapt from light to dark in areas with potentially high vehicle and foot traffic and the potential for vehicle and pedestrian conflicts. To address concerns about low visual performance, parking garages use daylight-adaptation zone lighting to extend the transition zone from high illuminance to much lower interior illuminance, allowing the

eyes to adapt while maintaining better visual performance. Carefully considering the adaptation zone when completing a lighting plan for a parking facility is standard industry practice. Control of the daylight adaptation zone lighting systems are independent from the rest of the parking garage lighting. Title 24, Part 6, sets the maximum LPD for these lighting systems at ten times the level of all other garage lighting and exempts them from automatic daylighting controls, which reduce electric light levels in response to changes in daylight availability. This additional LPD allowance enables the daylight adaptation zones to deliver the high lighting levels necessary to support visual adaptation when drivers enter the parking garage during daylight hours.

However, from sunset to sunrise, the high LPD in these zones can have the opposite effect, making adaptation more complex by having drivers enter a very high-illuminance zone and then transition to one with approximately one-tenth the light levels beyond the adaptation zone. In addition, these areas are often also garage exits. Operating the adaptation lighting at night presents the opposite problem: drivers exiting the garage are driving from an area of very high illuminance to an area of much lower illuminance beyond the garage confines. This visual adaptation challenge is a concern for drivers departing an area of higher illuminance to an area of lower illuminance because the visual system adapts slower when entering darker zones (Hood 1986). The current code also allows for greatly increased energy consumption in the adaptation zone and allows these systems to operate at maximum capacity regardless of ambient light levels or time of day.

2.1.4 Modifications to Energy Code Documents

This section provides descriptions of how the proposed code change will affect each Energy Code document. See Section 2.6: Parking Garage Daylight Adaptation Zones Nighttime Controls - Proposed Language of this report for detailed revisions to code language.

2.1.4.1 Energy Code Change Summary

130.1 – MANDATORY INDOOR LIGHTING CONTROLS

Subsection 130.1(g): The proposed measure adds subsection (g) to section 130.1, requiring separate daylight-adaptation zone controls to reduce lighting power from sunset to sunrise automatically. Daylight adaptation zones are currently exempt from parking garage daylighting control requirements.

EXCEPTION to Section 130.1(g): The proposed measure adds an exception to section 103.1(g) that applies to Group R occupancies and common or public use areas. .

EXCEPTION 6 to Section 130.1(d): The proposed measure adjusts this exemption for luminaires located in the daylight adaptation zones so that it only applies to Group R occupancies and common or public use areas.

2.1.4.2 Reference Appendices Change Summary

NA7.6.1.4 Continuous Dimming Control Systems Functional Testing Daylight Responsive Controls Acceptance Tests: The proposed measure would update the existing testing language in section NA7.6.1.4, eliminating the testing procedure described in section NA7.6.1.4 (d).

2.1.4.3 Compliance Manuals Change Summary

5. Nonresidential Indoor Lighting. Daylight Responsive Controls in Parking Garages:

Add the following language:

"For parking garage daylight adaptation zones, daylight responsive or timeclock controls are required to meet the following criteria:

> The LPD of daylight adaptation zones must be reduced to match parking areas and loading and unloading areas between sunset and sunrise."

Remove the following on page 5-33:

"EXCEPTION: Daylight responsive controls are not required for luminaires in the daylight adaptation zone within the parking garage areas."

2.1.4.4 Alternative Calculation Method Reference Manual Change Summary

There are no proposed changes to the Nonresidential and Multifamily Alternative Calculation Method Reference Manual.

2.1.4.5 Compliance Forms Change Summary

The Statewide CASE Team anticipates that updates to forms NRCC/LMCC-LTI-E, NRCI/LMCI-LTI-E, NRCA-LTI-02-A, and NRCA-03-A will be required for the design team to certify that they have designed an adaptation zone lighting control system that has the controls capability that meets the proposed regulations; either a photocell or an astronomic clock, and operating either a switched lighting system or a dimming system.

2.1.5 Measure Context

2.1.5.1 Comparable Model Codes or Standards

The proposed revisions to the mandatory control requirements align with ANSI/ASHRAE/IES 90.1-2022: Energy Standard for Buildings lighting requirements. The nighttime adaptation compensation controls for the parking garage daylight adaptation zone are an existing requirement in ANSI/ASHRAE/IES 90.1-2022: Energy Standard for Buildings §9.4.1.2(c).

The proposed code change also aligns with ANSI/IES RP-8-25 Recommended Practices for Lighting Roadway and Parking Facilities. Although the ANSI/IES RP-8 lighting industry standard does not explicitly require nighttime dimming controls, it provides a recommended luminance ratio between the daylight adaptation zones and the general parking areas, which this code change would help to facilitate.

2.1.5.2 Interactions with Other Regulations

There are no known federal, state, or local regulatory requirements that address or conflict with the proposed measure.

2.2 Parking Garage Daylight Adaptation Zones Nighttime Controls - Compliance and Enforcement

2.2.1 Compliance Considerations

The Statewide CASE Team worked with stakeholders to develop a recommended compliance and enforcement process and to identify how this process would affect various market actors. While developing this proposal, the Statewide CASE Team considered ways to streamline the compliance and enforcement process and how to reduce negative impacts on market actors involved. The activities that need to occur during each phase of the project are as follows:

- **Design Phase:** Designers will need to include daylight adaptation zone controls in the design set that meet new specifications. They will also need to notate the added testing protocol triggered by these new requirements. Designers will need to ensure that there is adequate lighting in the adaptation zone through the general lighting allowance for the space to meet lighting requirements during the daytime, since the adaptation zone lighting will not be operating at full power during that time.
- **Permit Application Phase:** Design packages submitted for permits will need to include new controls and support controlled daylight adaptation zones. Plan examiners will need to be aware of the new requirements when reviewing the project design set submitted.

- **Construction Phase:** The design drawings approved for the building permit will include and support the installation of new controlled daylight adaptation zone lighting.
- **Inspection Phase:** The Statewide CASE Team anticipates the addition of a lighting controls acceptance test to confirm that the adaptation zone controls are functioning as intended.

Care must be taken during these phases to ensure continued recognition that due to AB 130 Group R occupancies are exempt from these requirements.

2.2.2 Impact on Market Actors

As shown in Table 3 below, the proposed compliance process would slightly increase the workload for many market actors. Changes include documenting compliance with the new requirement for both lighting designers and energy consultants, new equipment and testing for the controls contractors, and new testing protocols for the acceptance test technicians (ATTs). Table 3 summarizes the impacts and recommends outreach and education efforts that could help them prepare. Since this change would not affect residential or multifamily buildings, market actors working exclusively in those sectors would not be affected.

Table 3: Impacts on Market Actors and Suggested Training and Education Opportunities

Market Actor	Impact(s)	Suggested Outreach and Education
Builders [a]	• Would require additional training and testing. • Be able to support user experience with installed daylight adaptation zone lighting controls.	Provide controls programing training materials for lighting designers/engineers, as well as lighting ATTs.
Design Professionals [b]	Would need to include daylight adaptation zone controls in the design set that meet new specifications. They would also need to notate the added testing protocol triggered by these new requirements, and document compliance with new requirement. New code may dictate alterative lighting fixture selections.	• Coordinate with lighting designers or engineers, and, if necessary, controls contractor regarding the control systems for parking structure. • Software training updates would need to occur. • Update NRCC forms with new requirements.
Construction Team [c]	Would need to acquire, install, and facilitate testing of daylight adaptation zone lighting controls.	• Update NRCA testing criteria. • Coordinate new controls programing with lighting designers/engineers, as well as lighting controls ATTs.

Market Actor	Impact(s)	Suggested Outreach and Education
		• Coordinate new controls programing with lighting designers/engineers, as well as lighting controls ATTs.
Building Departments [d]	Be aware of and enforce new mandatory control requirements and ATT verification requirements.	Update training to include all new control requirements.
Verification Testers [e]	Require new testing protocols for new controls.	• Update NRCA testing criteria. • If there is commissioning, commissioning agent would work with controls contractors, and lighting ATTs.
Building Owners, Managers, and Occupants	Would need to pay any additional cost for control systems installation, and testing. Additional lighting controls system maintenance. Reduced energy bills.	Update training to include all new control requirements.
Manufacturers and Distributors	Adapt production and purchasing practices to accommodate additional sales of existing lighting control equipment.	Provide publicly available listing of new control requirements and listing of product types that meet the new requirement.

a. Builders include builders and developers.
b. Design professionals include architects, interior designers, engineers (mechanical, electrical, plumbing, structural), specification writers, cost estimators, commissioning agents, lighting designers, and energy consultants.
c. Construction team includes general contractors, design-build contractors, installation contractors (e.g., HVAC, plumbing, electrical), commissioning agents, and tradespeople.
d. Building departments include plan reviewers, building inspectors, specialty inspectors, permit counter technicians, and sustainability department staff.
e. Verification testers include commissioning agents, ECC Raters, and Acceptance Test Technicians.

The 2028 CASE Methodology Report presents a quantitative assessment of how changes to the California building code impact builders, building designers and energy consultants, and building owners and occupants. The analysis in the methodology report is not specific to the code change presented in this report. The following provides a qualitative description of how this specific code change affects various market actors and additional quantitative analyses of its potential impacts on building industry subsectors.

Builders. The proposed change would likely not affect commercial builders; it would likely not impact firms focused on the construction or retrofitting of industrial buildings, utility systems, public infrastructure, or other heavy construction. The proposed change would not affect all firms and workers in the commercial building industries equally; instead, it would primarily affect specific subsectors within the industry. Table 4 shows

the commercial building subsectors the Statewide CASE Team expects to be impacted by the changes proposed in this report. The proposed measure primarily impacts nonresidential electrical contractors, who will be responsible for installing the compliant control systems.

The values in the table below are preliminary estimates and may be updated as the Statewide CASE Team continues data collection ***on impact to the commercial building industry in California. Finalized values will be included in the Final CASE Report.***

Table 4: Specific Subsectors of the California Commercial Building Industry Impacted by Proposed Change to Code/Standard by Subsector in 2025 (Estimated)[2]

Construction Subsector	Establishments*	Employment	Annual Payroll (Billions $)
Commercial Building Construction	5,491	87,450	$10.6
Nonresidential Poured Foundation Contractors	497	15,884	$1.4
Nonresidential Structural Steel Contractors	365	11,899	$1.1
Nonresidential Framing Contractors	137	3,037	$0.2
Nonresidential Masonry Contractors	217	4,028	$0.3
Nonresidential Glass and Glazing Contractors	307	5,079	$0.5
Nonresidential Roofing Contractors	385	11,413	$1.0
Nonresidential Siding Contractors	32	735	$0.1
Other Nonresidential Exterior Contractors	234	2,259	$0.1
Nonresidential Electrical Contractors	3,245	72,794	$7.8
Nonresidential Plumbing & HVAC Contractors	2,270	55,182	$5.8
Other Nonresidential Equipment Contractors	580	9,749	$1.1
Nonresidential Drywall Contractors	593	19,328	$1.8
Nonresidential Painting Contractors	501	9,225	$0.7
Nonresidential Flooring Contractors	286	4,011	$0.4
Nonresidential Tile and Terrazzo Contractors	151	2,223	$0.2
Nonresidential Finish Carpentry Contractors	313	3,697	$0.3
Other Nonresidential Finishing Contractors	492	7,241	$0.6
Nonresidential Site Preparation Contractors	1,147	19,273	$1.9
All Other Nonresidential Trade Contractors	948	17,084	$1.7

Source: Analysis by the Title 24 CASE Team of QCEW data from the California Employment Development

[2] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Department https://labormarketinfo.edd.ca.gov/cgi/dataanalysis/areaselection.asp?tablename=industry

*An establishment is single economic unit, typically at one physical location, that engages in one, or predominantly one, type of economic activity for which a single industrial classification may be applied. Many businesses are composed of multiple establishments. US Bureau of Labor Statistics, Handbook of Methods. https://www.bls.gov/opub/hom/cew/concepts.htm

Manufacturers. This proposed controls change may have a minor impact on some California-based lighting or lighting control manufacturers. The Statewide CASE Team does not anticipate a significant impact since many building construction applications already require these systems. The measure proposes adding a new layer of lighting controls, which may lead to a slightly higher number of lighting control device sales in the state.

2.2.3 Compliance Software Updates

The proposed measure would necessitate an update to an existing software feature.

2.2.4 Cost of Enforcement

The Statewide CASE Team acknowledges that changes to the code will impact enforcement costs. This report is an evaluation of specific measures, and the collective impact of all proposed changes for the 2028 Title 24, Part 6 may represent an increase in training and/or workload for enforcement personnel.

The Statewide CASE Team expects no additional costs to the state or local governments associated with the enforcement of the proposed measure. The current enforcement framework already accounts for LPD requirements, and the proposed measure only lowers enforced values. This incremental adjustment does not require the development of new programs or significant changes to existing enforcement protocols.

The existing training infrastructure sufficiently supports the minor increase in enforcement activity, so officials do not anticipate creating new training programs. Similarly, in the construction industry, the proposed measure does not introduce new design or installation practices, so they do not anticipate additional workforce training beyond that already covered under current guidelines.

As such, the state will not incur any new costs for compliance assurance, enforcement, or training associated with this proposal.

2.3 Parking Garage Daylight Adaptation Zones Nighttime Controls - Market and Economic Analysis

2.3.1 Market Structure and Availability

2.3.1.1 Current Market Structure and Availability

The Statewide CASE Team will continue to verify estimates of current product availability, analyze market trends, and evaluate how the proposed standard might impact individual market players, including additional costs associated with complying with the proposed measure. The Statewide CASE Team will continue to verify estimates of market size and measure applicability through outreach to stakeholders. The Statewide CASE Team stakeholder outreach includes utility program employees, Energy Commission staff, and a wide range of industry participants. In addition to personalized outreach, the CASE Team also requests input into the current market structure and potential barriers during utility-sponsored stakeholder meetings.

2.3.1.2 Market Challenges and Solutions

The Statewide CASE Team will continue to assess market readiness by establishing whether practitioners, primarily lighting designers and electrical engineers, can specify and implement nighttime dimming controls. The Statewide CASE Team will also include an analysis of the current market adoption of these control systems in the assessment.

Market readiness is unlikely to be a barrier because the same requirements are already part of ASHRAE 90.1-2022 building energy standards.

See Section 2.2 for a description of potential workforce training to ensure effective design, installation, and commissioning.

2.3.2 Design and Construction Practices

2.3.2.1 Current Design and Construction Practices

ANSI/ASHRAE/IES Standard 90.1-2022 guidelines require the use of daylight-reactive dimming controls for parking garage daylight adaptation zones. This international organization considers installing dimming or shutoff controls for garage entrance lighting systems as standard practice for energy efficiency and enhancing safety. Compliant control systems can use clock or photocell controls to reduce nighttime demand. The adaptation zone lighting design can also use a separate lighting system from the main garage lighting system with on/off switching, or an extension of the main lighting system with separate dimming controls for LPD reduction.

2.3.2.2 Health and Safety Considerations

The proposed nighttime dimming measure for the garage daylight adaptation zones would improve driver visual performance at garage entrances and exits from sunset to sunrise. IES RP-8-25 recommends light-level ratios between the daylight-adaptation zones and general parking areas that are not achievable without the proposed nighttime dimming controls. Dimming controls improve drivers' visibility when entering and exiting the parking garage, increase safety, and potentially reduce accident risk. The proposed measure does not modify any current federal, state, or local safety and health regulations, including those enforced by the California Division of Occupational Safety and Health (DOSH). All existing health and safety rules will stay in effect.

2.3.2.3 Design and Construction Challenges and Solutions

The Statewide CASE Team does not believe there will be significant technical challenges to implementing nighttime dimming in garage daylight adaptation zones. This technology, needed for compliant designs, has a mature market, given that ASHRAE 90.1 and the IECC already have these requirements in place. The technology needed for such control is not dependent on climate zone or geographic region, so technologies designed to meet ASHRAE 90.1 and IECC will comply with the proposed code change.

See Table 3 in Section 2.2.2 for a description of workforce training that could support effective design, installation, and commissioning.

2.3.3 Energy Equity and Environmental Justice

The Statewide CASE Team assessed the potential impacts of the proposed measure, and based on a preliminary review, the measure is unlikely to have significant impacts on energy equity or environmental justice.

This section is still in progress. The Statewide CASE Team is continuing to engage with stakeholders to determine potential impacts on environmental and social justice (ESJ) communities and will update this section with any additional findings.

2.3.4 Impacts on Jobs and Businesses

This section will be completed for the Final CASE Report.

2.3.5 Economic and Fiscal Impacts

This section will be completed for the Final CASE Report.

2.4 Parking Garage Daylight Adaptation Zones Nighttime Controls - Cost Effectiveness

2.4.1 Cost Effectiveness Methodology

The Statewide CASE Team collaborated with the CEC staff to confirm that the cost-effectiveness methodology aligns with the CEC guidelines, including cost inclusion parameters. The 2028 CASE Methodology Report and Appendix A provide reproducibility details.

Per California Law (Public Resources Code 25000), a measure is considered cost effective if its Benefit-Cost Ratio (BCR) is 1.0 or greater, amortized over the economic life of the structure. The Statewide CASE Team calculates BCR by dividing total dollar benefits by total dollar costs over a 15-year analysis period for lighting equipment.

Benefits are based on Long-term System Cost (LSC), which assigns an hourly dollar value to energy use. LSC hourly factors assign different weights to each hour based on its long-term system value, with hours of high grid demand or high marginal emissions receiving greater weight than low-demand, off-peak periods. These factors are not utility rates, forecasts, or bill estimates. The CEC develops and publishes LSC hourly conversion factors for each code cycle.

Costs include first costs and ongoing maintenance costs assessed over the 30-year period. Benefits and costs are evaluated incrementally, relative to the most recently adopted Energy Code. The analysis excludes design costs and incremental code compliance verification costs.

2.4.2 Energy and Energy Cost Savings Results

To estimate energy savings from daylight adaptation zone lighting controls in parking garages, the Statewide CASE Team developed a model based on average daylight adaptation zone square footage. This model uses the mandatory Maximum Lighting Power Density (LPD) from Title 24, Part 6 Table 140.6-C for garage lighting to determine the total daylight adaptation zone demand at full power, aligning with standard garage lighting LPD levels. These demand values are used to establish both the baseline and measure case models of per-unit demand.

The Statewide CASE Team calculated the base case annual per-unit demand using the full power adaptation zone lighting 24 hours a day for a full year.

The Statewide CASE Team calculated the measure case annual per-unit demand using sunrise and sunset times at California's geographic center in 2029. The Statewide CASE Team developed an hourly model covering a full year (8760 hours), noting the portion of each hour in daylight, and then applied the adaptation zone lighting demand at each LPD to the appropriate hours and partial hours of the model to generate the

annual measure case adaptation zone demand. The calculation then converted the base case and measure case demand levels to per-square-foot based on an average for the daylight adaptation zone size across all building types and climate zones.

The per-unit energy savings of this measure are not dependent on the climate zone or building type. Based on the data collected so far, the Statewide CASE Team calculated the per-square-foot energy savings for the first year to be 3.88 kWh. This energy savings calculation applies to both the dimming and on/off switching options because lighting provides the daylight adaptation zone with the applicable LPD for the same number of hours per year, regardless of the switching system installed. The proposed system controllers do not reduce peak demand during daylight hours, so the Statewide CASE Team does not anticipate any reduction in peak demand kW. The estimate for the first-year source energy savings per square foot is 10.9 kBtu.

Table 5 presents the per-square-foot energy savings and energy cost savings for parking garage new construction and additions across all 16 climate zones, excluding Group R occupancies. The Statewide CASE Team is still collecting data to refine these preliminary energy savings estimates and will present the final energy savings estimates in the Final CASE Report

Table 6 presents the per-square-foot energy savings and energy cost savings in terms of LSC savings realized over a 303015-year period, in 2029 present value dollars (2029 PV$) for parking garage alterations, excluding Group R occupancies. The LSC methodology values peak electricity savings more than electricity savings during non-peak periods. The Statewide CASE Team will continue to collect data, refine the savings estimates, and update these values in the Final CASE Report.

The values are preliminary estimates and will be updated as data collection and analysis on energy savings continues and included in the Final CASE Report.

Table 5: Energy and Energy Cost Savings – Per Square Foot – New Construction and Additions – Parking Garage[3]

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (kW)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	3.88	0.0	0.0	10.6	40.37
2	3.88	0.0	0.0	10.6	40.35
3	3.88	0.0	0.0	10.6	40.75
4	3.88	0.0	0.0	10.6	40.21

[3] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (kW)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
5	3.88	0.0	0.0	10.6	39.67
6	3.88	0.0	0.0	10.6	41.28
7	3.88	0.0	0.0	10.6	40.73
8	3.88	0.0	0.0	10.6	40.11
9	3.88	0.0	0.0	10.6	39.00
10	3.88	0.0	0.0	10.6	39.88
11	3.88	0.0	0.0	10.6	40.28
12	3.88	0.0	0.0	10.6	39.78
13	3.88	0.0	0.0	10.6	40.11
14	3.88	0.0	0.0	10.6	41.23
15	3.88	0.0	0.0	10.6	40.35
16	3.88	0.0	0.0	10.6	39.20

The values in the table below are preliminary estimates and will be updated as the Statewide CASE Team continues data collection and analysis on first year LSC savings. Updated values will be included in the Final CASE Report.

Table 6: 2029 PV LSC Savings Over 30-Year Period of Analysis – Per Square Foot – Alterations – Parking Garage[4]

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	40.37	0.0	40.37
2	40.35	0.0	40.35
3	40.75	0.0	40.75
4	40.21	0.0	40.21
5	39.67	0.0	39.67
6	41.28	0.0	41.28
7	40.73	0.0	40.73
8	40.11	0.0	40.11
9	39.00	0.0	39.00
10	39.88	0.0	39.88
11	40.28	0.0	40.28

[4] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
12	39.78	0.0	39.78
13	40.11	0.0	40.11
14	41.23	0.0	41.23
15	40.35	0.0	40.35
16	39.20	0.0	39.20

2.4.3 Incremental First Cost

As described in the energy analysis, the Statewide CASE Team considered two measure cases:

1. Compliance with time-switch or daylight sensor controls that dim the daylight adaptation lighting.
2. Compliance with time-switch or daylight sensor on/off controls that shut off the daylight adaptation lighting.

The Statewide CASE Team collected costs for both proposed codes change compliant control systems and compared the base case with both systems to estimate two incremental first costs. This is because the proposed updates to Section 130.1(c) in Title 24, Part 6 allow builders the flexibility to implement these controls in either an isolated daylight adaptation zone lighting system that turns off completely or an integrated system that dims to match the main garage lighting levels.

The Statewide CASE Team used RSMeans to generate initial cost estimates for the two measure cases for the proposed code change. The collected costs include an overhead and profit (O&P) cost estimate adjustment. To get more accurate cost estimates, the Statewide CASE Team will continue to engage with industry stakeholders and refine the estimates for the final report.

The results in this Draft CASE Report reflect a combination of stakeholder feedback and RSMeans data. Stakeholder engagement included input from lighting representatives, controls sales reps, and manufacturers to ensure that the design methodology and cost estimates are based on reasonable assumptions.

The first incremental cost for daylight adaptation zone controls in parking garages involves the components listed in Table 7. The cost of these components represents the full incremental cost since the base case is a system without these controls. The Statewide CASE Team estimates the additional costs for design, commissioning, and ATT labor for this system as negligible. The entire garage lighting system already requires dimming systems that need these services, and the adaptation zone accounts for between 0.9 and 6.3 percent of the total parking garage square footage. The

Statewide CASE Team estimated the average cable run length from the lighting fixtures to the control system and power source at 40 feet based on the interviews with a lighting subject matter expert. The incremental cost estimate does not include the cost of the daylight-adaptation zone lighting fixtures because the base case scenario already requires them.

The values are preliminary estimates and will be updated in the final report as data collection and analysis on incremental first costs continues.

Table 7: Incremental Measure First Cost Components per installation in (2029 PV$) - Photocell and Timeclock designs[5]

Cost Component ($/entrance)	Materials (incl. O&P)	Labor (incl. O&P)	Total Photocell	Total Timeclock	Source
Aluminum conduit, 1/2" diameter	$97.5	$416	$513	$513	RSMeans
Aluminum conduit elbows	$16.3	$52.0	$68.3	$68.3	RSMeans
Aluminum conduit couplings	$17.6	$16.3	$33.9	$33.9	RSMeans
Conduit Beam Clamp	$82.2	$162	$244	$244	RSMeans
Astronomic Clock	$573	$104	$0.0	$677	Web Crawl
Cable: Power, steel clad, 600 volt, 3 wire	$58.3	$144	$202	$202	RSMeans
Cable: Controller, jacket non-plenum, twisted	$13.4	$65.0	$78.4	$78.4	RSMeans
Circuit Breaker, 3 pole 600V	$777	$371	$0.0	$1148	RSMeans
Daylight level sensor, on/off or dimming	$240	$130	$370	$0.0	RSMeans
Weatherproof Junction box, connectors, terminations	$6.05	$110	$116	$116	RSMeans
Total	NA	NA	1627	3082	

[5] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

2.4.4 Incremental Maintenance and Replacement Costs

Incremental maintenance cost is the incremental cost of replacing equipment or its parts, as well as the periodic maintenance required to keep the equipment operating, relative to current practices, over the 30-year analysis period. The CEC has established a 30-year measure life for assessing nonresidential lighting measures. The energy savings would persist throughout.

Daylight photocell sensors and timeclock controls typically last 15 years or more and do not require maintenance unless they include battery-operated wireless components, such as sensors. Because the proposed measure applies to parking garages where visible conduit is standard practice, and it is possible to implement the proposed code change with sensors and controls that do not require batteries, it is unlikely that a building owner would install a wireless system that is more expensive and requires maintenance.

For these reasons, the Statewide CASE Team did not include battery replacement in the maintenance cost for daylight photocell sensors or timeclock controls, so the incremental maintenance and replacement cost would be the cost of replacing the photocell itself once per 30-year period for 370 dollars. There are no anticipated maintenance or replacement costs for the time clock option. This assumption is similar to the work done in the 2013 Indoor Lighting Controls Final CASE Report (Statewide CASE Team 2011).

Description of the incremental maintenance and replacement costs, as well as estimation of present value of maintenance and replacement costs, are provided in the 2028 CASE Methodology Report.

2.4.5 Cost Effectiveness

Table 8 through Table 11 present the results of the per-unit cost-effectiveness analyses for the two design scenarios. The values presented in the tables are based on the preliminary energy and cost estimates. The Final CASE Report will include these values as the Statewide CASE Team continues to collect data and refine the estimates.

In the tables below, all values are presented in 2029 present value dollars (2029 PV$). Benefits represent 30-year LSC savings and other savings, including incremental first-cost savings if the proposed first cost is less than the current first cost, incremental maintenance cost savings if the proposed maintenance costs are less than the current maintenance costs, and incremental residual value if proposed residual value is greater than current residual value at the end of the 30-year period of analysis. Costs represent the total incremental PV cost, including incremental equipment, replacement, and maintenance costs over the period of analysis. The analysis treats a negative incremental maintenance cost as a positive benefit. If total incremental costs are zero,

the benefit-cost ratio (BCR) is considered infinite. Costs and other savings are discounted at a real (inflation-adjusted) three percent rate. If there are no total incremental PV costs, the BCR is infinite.

The Statewide CASE Team presents 30-year cost-effectiveness results for both the photocell and timeclock control system designs. The systems offer the same savings per square foot but differ in initial costs. Although the time clock design method has nearly double the upfront cost of the photocell, both systems demonstrate a very positive BCR. The Statewide CASE Team conducted the analysis using an average for the daylight adaptation zone size across all building types and climate zones.

While the size of the adaptation zone will differ, the cost of the control system will stay the same. Thus, the larger the zone, the lower the cost per square foot. However, since the required LPDs are based on the watts used per square foot, the energy savings per square foot will remain consistent. For this reason, for the BCR to reach 1.0 or below, the daylight adaptation zone would need to be 141 square feet for the timeclock design and 74 square feet for the photocell design. Using a minimum one-way commercial garage entrance with a width of 12 feet, the zones would be 11.7 and 6.2 feet deep, respectively. Recommended practice is two times the vertical clearance. In California, the minimum mandatory height is 8.16 feet, making the minimum zone 16.32 feet deep, with maximum adaptation zone depths of 66 feet. The Statewide CASE Team used a representative average daylight adaptation zone size of 25 feet wide and 45 feet deep, or 1125 square feet for calculations. This size is a conservative estimate based on the 2021 International Zoning Code (IZC) minimum commercial two-lane entrance width of 24 feet, and the Title 24, Part 6 Table 140.6-C maximum daylight adaptation zone depth of 66 feet.

The values are preliminary estimates and will be updated in the final report as data collection and analysis on cost effectiveness continues.

Table 8: 30-Year Cost-Effectiveness Summary Per Square Foot – New Construction and Additions – Photocell Design[6]

Building Prototype	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
Assembly	40.09	1.78	22.59
Grocery	40.27	1.78	22.68
Hospital	40.14	1.78	22.61
OfficeLarge	40.05	1.78	22.56
OfficeMediumLab	40.43	1.78	22.78
ParkingGarage	40.36	1.78	22.74
RetailLarge	40.02	1.78	22.54
SchoolLarge	40.01	1.78	22.54

The values are preliminary estimates and will be updated in the final report as data collection and analysis on cost effectiveness continues.

Table 9: 30-Year Cost-Effectiveness Summary Per Square Foot – Alterations – Photocell Design[7]

Building Prototype	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
Assembly	40.10	1.78	22.59
Grocery	40.11	1.78	22.68
Hospital	40.06	1.78	22.61
OfficeLarge	39.99	1.78	22.56
OfficeMediumLab	40.29	1.78	22.78
ParkingGarage	40.07	1.78	22.74
RetailLarge	40.10	1.78	22.54
SchoolLarge	40.00	1.78	22.54

[6] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

[7] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values are preliminary estimates and will be updated in the final report as data collection and analysis on cost effectiveness continues.

Table 10: 30-Year Cost-Effectiveness Summary Per Square Foot – New Construction and Additions – Timeclock Design[8]

Building Prototype	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
Assembly	40.09	2.74	14.63
Grocery	40.27	2.74	14.70
Hospital	40.14	2.74	14.65
OfficeLarge	40.05	2.74	14.62
OfficeMediumLab	40.43	2.74	14.76
ParkingGarage	40.36	2.74	14.73
RetailLarge	40.02	2.74	14.61
SchoolLarge	40.01	2.74	14.60

The values are preliminary estimates and will be updated in the final report as data collection and analysis on cost effectiveness continues.

Table 11: 30-Year Cost-Effectiveness Summary Per Square Foot – Alterations – Timeclock Design[9]

Building Prototype	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
Assembly	40.10	2.74	14.64
Grocery	40.11	2.74	14.64
Hospital	40.06	2.74	14.62
OfficeLarge	39.99	2.74	14.60
OfficeMediumLab	40.29	2.74	14.70
ParkingGarage	40.07	2.74	14.63
RetailLarge	40.10	2.74	14.64
SchoolLarge	40.00	2.74	14.60

[8] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

[9] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

2.5 Parking Garage Daylight Adaptation Zones Nighttime Controls - Statewide Impacts

2.5.1 Statewide Energy and Energy Cost Savings

To assess statewide impacts, the Statewide CASE Team used the CBECC building prototype model floor plans to estimate the number of daylight adaptation zones in the 2029 nonresidential construction forecast. The Statewide CASE Team used the square footage of the Open Parking Garage prototype to estimate the number of parking spaces in each structure, and then to estimate the entrance counts for these parking structures based on potential traffic flow. The Statewide CASE Team used a similar process to capture statewide impacts on parking garages attached to other types of commercial buildings not included as the Open Parking Garage building type in the construction forecast. CBECC building prototype model floor plans for the Large Office, Large Retail, Large School, Assembly, Hospital, Laboratory, and Grocery prototypes were used to develop estimated average entrance counts for building type specific attached commercial parking garages.

The Statewide CASE Team estimated that 50 percent of the appropriate building types in urban climate zones in the 2029 nonresidential construction forecast will include attached parking garages. The Statewide CASE Team then applied the entrance counts for each prototype to estimate the statewide impacted square footage and to calculate the annual base-case and measure-case statewide energy use. Because the analysis does not include all building types across all climate zones, some climate zones do not show impacted new construction.

While the Statewide CASE Team's analysis used multiple building types to estimate statewide impacted square footage, the attached building type does not affect parking garage construction standards or the energy impacts of the proposed code change.

See the 2028 CASE Methodology Report for more details on how statewide savings are calculated. Appendix C presents the assumptions on the percentage of the total construction forecast that the proposed measure would impact.

For more details on the methodology and context about estimating the current market share rate, as well as statewide energy and energy cost savings, see the 2028 CASE Methodology Report.

The tables below present the first-year statewide energy and LSC savings from newly constructed buildings and additions (Table *12*) and alterations (Table 13) by climate zone.

Table 14 presents first-year statewide savings from new construction, additions, and alterations.

These statewide impacts are based on the preliminary per-unit savings in the section above and they will be updated in the final report.

The values in the table below are preliminary estimates and will be updated in the final report as data collection and analysis on statewide impacts continues.

Table *12*: Statewide Energy and LSC Impacts – New Construction and Additions[10]

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2026 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	-	-	-	-	-	$0.00
2	1,125	0.00	-	-	0.01	$0.05
3	36,000	0.14	-	-	0.38	$1.47
4	20,813	0.08	-	-	0.22	$0.84
5	-	-	-	-	-	$0.00
6	30,938	0.12	-	-	0.33	$1.28
7	15,188	0.06	-	-	0.16	$0.62
8	33,188	0.13	-	-	0.35	$1.33
9	35,438	0.14	-	-	0.37	$1.38
10	5,625	0.02	-	-	0.06	$0.22
11	-	-	-	-	-	$0.00
12	18,563	0.07	-	-	0.20	$0.74
13	-	-	-	-	-	$0.00
14	1,125	0.00	-	-	0.01	$0.05
15	-	-	-	-	-	$0.00
16	1,125	0.00	-	-	0.01	$0.04
Total	**199,125**	**0.77**	**-**	**-**	**2.89**	**$8.01**

[10] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values in the table below are preliminary estimates and will be updated in the final report as data collection and analysis on statewide impacts continues.

Table 13: Statewide Energy and LSC Impacts – Alterations[11]

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2026 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	75	0.00	-	-	0.00	$0.00
2	2,850	0.01	-	-	0.03	$0.11
3	94,875	0.37	-	-	1.00	$3.87
4	56,250	0.22	-	-	0.59	$2.26
5	1,575	0.01	-	-	0.02	$0.06
6	59,175	0.23	-	-	0.63	$2.44
7	49,275	0.19	-	-	0.52	$2.01
8	96,300	0.37	-	-	1.02	$3.86
9	139,575	0.54	-	-	1.48	$5.44
10	25,575	0.10	-	-	0.27	$1.02
11	1,800	0.01	-	-	0.02	$0.07
12	72,713	0.28	-	-	0.77	$2.89
13	2,550	0.01	-	-	0.03	$0.10
14	4,500	0.02	-	-	0.05	$0.19
15	900	0.00	-	-	0.01	$0.04
16	2,325	0.01	-	-	0.02	$0.09
Total	**610,313**	**2.37**	**-**	**-**	**6.45**	**$24.46**

[11] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values in the table below are preliminary estimates and will be updated in the final report as data collection and analysis on statewide impacts continues.

Table 14: Statewide Energy and LSC Impacts – New Construction, Additions, and Alterations[12]

Construction Type	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First -Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
New Construction & Additions	0.8	-	-	2.1	8
Alterations	2.4	-	-	6.5	24
Total	**3.1**	**-**	**-**	**8.6**	**32**

[12] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

2.5.2 Statewide Greenhouse Gas Emissions Reductions

Table 15 presents the estimated first-year reduction in GHG emissions resulting from the proposed code change. In this initial year, the Statewide CASE Team expects to avoid 572 metric tons of carbon dioxide equivalent (CO_2e) emissions. These reductions, along with their associated monetary value, were calculated using hourly GHG emissions factors published alongside the LSC hourly factors and source energy hourly factors in the research versions of CBECC, as well as data from the CEC's 2028 Metrics Report. See the 2028 CASE Methodology Report for additional information.

These GHG emission reduction estimates are based on the preliminary per-unit savings in the section above and they will be updated in the final report.

Table 15: First-Year Statewide GHG Emissions Impacts[13]

Construction Type	Reduced GHG Emissions from Electricity Savings (Metric Tons CO2e)	Reduced GHG Emissions from Natural Gas Savings (Metric Tons CO2e)	Total Reduced GHG Emissions (Metric Ton CO2e)	Total Monetary Value of Reduced GHG Emissions ($)
New Construction & Additions	112	0.0	112	$13,732
Alterations	342	0.0	342	$42,089
Total	**454**	**0.0**	**454**	**$55,821**

2.5.3 Statewide Water Use Impacts

The proposed code change will not result in water use impacts.

2.5.4 Statewide Material Impacts

This measure would potentially result in a minimal increase in materials used. This section will be updated as more information becomes available.

2.5.5 Environmental Impacts

The proposed measure would not have a significant environmental impact.

2.5.6 Other Non-Energy Impacts

The proposed measure may minimize light pollution and light trespass due to the reduced light levels at parking garage entries at night.

[13] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

2.6 Parking Garage Daylight Adaptation Zones Nighttime Controls - Proposed Language Code

The proposed code language in this section includes only changes relevant to this measure. The intent is to clearly illustrate the scope of this measure. The proposed code language that encompasses the changes resulting from all the measures in this CASE Report can be found in Appendix G.

2.6.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents should be marked with dark blue underlining (new language) and ~~strikethroughs~~ (deletions).

2.6.2 Administrative Code (Title 24, Part 1)

There are no proposed changes to Title 24, Part 1.

2.6.3 Energy Code (Title 24, Part 6)

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

(g) **Parking Garage Daylight Adaptation Zone Lighting Controls.** Parking garage daylight adaptation zone lighting shall be separately controlled to automatically reduce the lighting to no more than LPD for general lighting in parking zones and ramps from sunset to sunrise.

EXCEPTION to Section 130.1(g): Group R occupancies and common or public use areas.

EXCEPTION to Section 130.1(c)6E: Luminaires located in a parking garage daylight adaptation zone and dedicated to providing illuminance for daylight adaptation.

2.6.4 Reference Appendices

Additional acceptance test procedures will be required to confirm the lighting controls are properly turning off or dimming the lighting to meet the light levels in the general parking spaces (or ramps if the adaptation zone is incorporated into a ramp in the garage) in the parking garage.

2.6.5 Compliance Manuals

The Statewide CASE Team will provide the CEC with recommended revisions to compliance manuals after the 45-Day Language is published.

2.6.6 ACM Reference Manual

There are no proposed changes to the ACM Reference Manual.

2.6.7 Compliance Forms

As discussed in Section 2.1.4.5, updates to forms NRCC/LMCC-LTI-E, NRCI/LMCI-LTI-E, NRCA-LTI-02-A, and NRCA-03-A will be required to incorporate the proposed code change.

The Statewide CASE Team can support the CEC in implementing these updates if the proposed change is adopted.

3. Require Occupant Sensing Controls in More Spaces

3.1 Require Occupant Sensing Controls in More Spaces - Measure Description

3.1.1 Proposed Code Change

The proposed measure expands the list of space types required to use partial or full OFF occupant sensing controls which are currently permitted to comply using time-based automatic shut-OFF controls. The additional space types under consideration include:

- Computer room
- Exercise/fitness and gymnasium area
- Financial transaction area
- Laboratory
- Lobby, main entry
- Lounge, breakroom, or waiting area

For energy savings analysis, these space types are evaluated within the following building types where they are explicitly identified as key space types and have established prototype models in energy modeling software: Large Office, Medium Office, Small Office, and Primary School. Consistent with California Assembly Bill 130 requirements, this measure does not apply to GROUP R OCCUPANCIES AND COMMON USE OR PUBLIC USE AREAS.

This proposal aligns with and supports the expanded application of occupied standby control for HVAC systems, which reduces ventilation and associated energy use when spaces are unoccupied. The use of occupant-sensing controls in both lighting and HVAC systems enables coordinated operation, further improving whole-building energy performance. Energy savings from reduced lighting and ventilation operation are expected, and evaluation of interactive effects between lighting and HVAC systems is included in the analysis.

The proposed change is being considered for new construction, additions, and alterations for nonresidential building prototypes that include the previously listed space types. At the time of this draft, the proposed measure applies to new construction and additions of newly considered space types for all building types. This measure is only required for alterations complying with Section 141.0(b)2Ii and includes an exemption for alterations complying with Sections 141.0(b)2Iii and 141.0(b)2Iiii. Existing

acceptance test procedures for occupant sensing controls are sufficient to verify compliance, and no new or modified test methods are anticipated. Stakeholder outreach and analysis is still underway and any changes to this approach will be updated in the Final CASE Report.

Table 16 summarizes the scope of the proposed code change.

Table 16: Scope of Proposed Code Change – Occupancy Sensing Controls[14]

A ☑ indicates the proposed code change is relevant.

Building Type(s)	Construction Type(s)	Type of Change
☐ Single Family	☑ New Construction	☑ Mandatory
☐ Multifamily	☑ Additions	☐ Prescriptive
☑ Nonresidential (Not Group R uses)	☑ Alterations	☐ Performance

Application Climate Zones	Energy Code Sections	Compliance Forms	Sections of ACM Reference Manuals
Climate Zones 1-16	• Part 6, Section 130.1(c) • Nonresidential Reference Appendix Section	NRCC/LMCC-LTI-E, NRCI/LMCI-LTI-E, NRCC/LMCC-MCH-E, and NRCI/LMCI-MCH-E	Mandatory

Third Party Verification)	Updates to Compliance Software
☑ No changes to third party verification	☐ No updates
☑ Update existing verification requirements	☑ Update existing feature
☐ Add new verification requirements	☐ Add new feature

3.1.2 Benefits of Proposed Change

Expanding the application of partial or full OFF occupant-sensing controls supports California's long-term goals for reducing energy use and greenhouse gas emissions in the building sector. Occupant sensing controls ensure that lighting and ventilation systems operate only when needed, minimizing wasted energy in unoccupied spaces. This measure represents a meaningful step toward more adaptive, occupant-based control strategies that are essential for achieving deeper energy savings and advancing statewide decarbonization objectives. By requiring these controls in additional space types, the proposal strengthens alignment between California's Title 24, Part 6, and the

[14] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

forthcoming ASHRAE 90.1-2025, improving consistency for designers, manufacturers, and building operators who work across jurisdictions.

ANSI/ASHRAE/IES Addendum bd to ANSI/ASHRAE/IES Standard 90.1-2022, which establishes select lighting requirements in the forthcoming ASHRAE 90.1-2025, already requires occupant sensing controls in several space types not currently covered in Title 24, including copy rooms, lounges, breakrooms, and hospital lounges, as well as newly added spaces such as atriums, data centers, and nursing stations (ASHRAE 90.1 Addendum bd 2025). Incorporating similar requirements into Title 24 helps ensure that California buildings continue to reflect leading energy-efficiency practices while remaining compatible with national standards. This approach also responds to opportunities identified in prior codes and standards research, including the application of occupant-sensing controls in rooms housing server racks in data centers (Code Readiness 2026).

Implementing this measure results in measurable reductions in lighting and HVAC energy use. These savings translate into lower operating costs for building owners and occupants, as well as reduced peak demand and emissions on a statewide scale. The measure builds on the framework and assumptions developed in the 2022 Indoor Lighting CASE Report (The Statewide CASE Team 2020).

Overall, this proposal represents a practical, cost-effective enhancement to existing lighting and HVAC control requirements, supporting California's transition toward more intelligent, occupancy-responsive building systems and contributing to long-term energy and carbon reduction goals.

3.1.3 Background Information

Occupant sensing controls are a lighting control strategy that automatically adjusts lighting based on whether a space is occupied. Control solutions supporting this control strategy typically use passive infrared (PIR), ultrasonic, or dual-technology sensors to detect movement or body heat. Microwave and microphonic occupant sensing technologies are also available but are less frequently installed. When no occupants are detected, the system reduces or turns off lighting power after a preset delay period, and in some cases, communicates an unoccupied signal to the HVAC system to reduce ventilation or conditioning in the space. By ensuring that lighting and HVAC systems operate only when needed, occupant-sensing controls save energy, reduce operating costs, and improve overall building efficiency.

Title 24, Part 6 currently requires occupant sensing controls in certain space types, such as offices, classrooms, restrooms, and corridors. However, several other space types are still permitted to meet lighting shut-OFF requirements using time-based controls. Time-based controls turn lights off on a schedule; however, they cannot account for variations in actual occupancy, leading to wasted energy in intermittently used areas

such as lounges, breakrooms, and waiting areas. Expanding the use of occupant-sensing controls to these additional spaces would reduce this waste and improve system responsiveness.

In addition to lighting savings, the proposed change supports integration with HVAC "occupied standby" operation, which allows systems to reduce or shut off ventilation when spaces are unoccupied. This coordination between lighting and HVAC controls can deliver additional energy savings and reduce peak electricity demand, helping buildings operate more efficiently and respond more effectively to grid conditions. As California continues to advance toward a decarbonized energy system that includes options for demand management when price signals or grid needs impose cost or energy-reducing pressures, occupant-based control strategies play an important role in ensuring that buildings consume energy only when needed.

Over the past decade, occupant sensing technologies have become more reliable, cost-effective, and easier to integrate with building management systems. Market adoption has been supported through utility incentive programs, including prescriptive rebates for lighting control retrofits and demand-responsive HVAC systems. Prior research funded through the California Energy Commission's Electric Program Investment Charge (EPIC) and PG&E's Code Readiness initiatives has also evaluated the energy performance and code readiness of occupant-based controls, including a 2025 Code Readiness study that identified rooms housing server racks in data centers as a key opportunity for expanding occupant sensing control requirements (Code Readiness 2026).

National standards and other model codes have also advanced similar provisions. ANSI/ASHRAE/IES Addendum bd to ANSI/ASHRAE/IES Standard 90.1-2022, which establishes select lighting requirements in the forthcoming ASHRAE 90.1-2025, includes expanded requirements for partial or full OFF occupant sensing controls across a wide range of space types, including copy rooms, lounges, hospital lounges, and data centers. Aligning Title 24 requirements with ASHRAE 90.1 promotes consistency for designers and manufacturers while maintaining California's leadership in energy efficiency and code innovation. Expanding these requirements represents a natural progression of the state's ongoing effort to modernize lighting control requirements, enhance interoperability with HVAC systems, and achieve greater whole-building energy savings.

3.1.4 Modifications to Energy Code Documents

This section provides descriptions of how the proposed code change will affect each Energy Code document. See Section 3.7 of this report for detailed revisions to code language.

3.1.4.1 Energy Code Change Summary

The changes to the code sections are summarized below. The proposed changes apply to all nonresidential occupancies, except Residential Group R occupancies and any associated accessory occupancies. The requirements would remain unchanged for Residential Group R occupancies and any associated accessory occupancies.

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

Subsection 130.1(c): The proposed regulations update the shut-OFF control requirements to ensure that all installed indoor lighting automatically reduces lighting power when spaces are typically unoccupied. This update enhances energy savings opportunities by expanding requirements for full or partial-OFF occupant-sensing controls to a broader set of space types including: exercise/fitness centers, gymnasium areas, auditorium areas, lounge, breakrooms, waiting areas, hotel function areas, financial transaction areas, laboratory, computer rooms, main entry lobbies, civic meeting place areas, religious worship areas, and museum exhibition/display areas.

3.1.4.2 Reference Appendices Change Summary

This proposal revises specific sections of the Reference Appendices.

Appendix NA7 – Installation and Acceptance Requirements for Nonresidential Buildings and Covered Processes

NA7.5.17 – Occupied Standby: Clarifies HVAC requirements for proposed space types and their interaction with occupancy sensing controls to ensure proper pre-occupancy ventilation rates and compliance with Section 120.1(d)2.

NA7.6.2.3 – Occupancy Sensing Lighting Control Functional Testing: Updates the acceptance test procedure to include additional space types where testing is required.

3.1.4.3 Compliance Manuals Change Summary

The proposed code change revises the following section of the Nonresidential Compliance Manual:

Section 4.5.1.3 – Occupied Standby Controls:
Expands the table summarizing proposed building space types required to include occupied standby controls.

Section 5.4.3.4 – Partial-OFF Occupant Sensing Controls:
Update the existing partial-OFF occupant sensing controls section to include new space types.

3.1.4.4 Alternative Calculation Method Reference Manual Change Summary

Table N4 in the nonresidential performance compliance form NRCC/LMCC-PRF-E would need to be updated to incorporate the revised mandatory lighting control requirements established by the proposed change. Corresponding updates to the Nonresidential Alternative Calculation Method (ACM) Reference Manual would be required to align performance modeling assumptions within CBECC, ensuring that compliance software accurately reflects the new control requirements and baseline energy use assumed for spaces now required to use occupancy sensors for both lighting and HVAC occupied standby.

3.1.4.5 Compliance Forms Change Summary

The nonresidential lighting and mechanical compliance and installation forms (NRCC/LMCC-LTI-E, NRCI/LMCI-LTI-E, NRCC/LMCC-MCH-E, and NRCI/LMCI-MCH-E) would require updates to Table H to incorporate the revised mandatory lighting control requirements. The nonresidential performance form NRCC/LMCC-PRF-E would require updates to Table N4 to align with the updated mandatory control requirements.

3.1.5 Measure Context

3.1.5.1 Comparable Model Codes or Standards

The proposed code change aligns closely with the provisions of ANSI/ASHRAE/IES Addendum bd to ANSI/ASHRAE/IES Standard 90.1-2022, which establishes select lighting requirements in the forthcoming ASHRAE Standard 90.1-2025 (ASHRAE 90.1 Addendum bd 2025), which expands requirements for partial-OFF and full-OFF occupant sensing controls to a broader range of space types, including copy rooms, lounges, hospital lounges, and data centers. The proposed Title 24 updates mirror this direction by requiring occupant-sensing controls in additional intermittently occupied spaces, such as lounges, breakrooms, waiting areas, and other spaces that are currently permitted to meet shut-off requirements using only time-based controls. Aligning California's requirements with ASHRAE 90.1 promotes national consistency in code requirements and simplifies compliance for design professionals and manufacturers working across jurisdictions. For California in particular, this update supports statewide decarbonization and grid reliability goals by reducing unnecessary lighting and HVAC energy use during peak demand periods, when these intermittently occupied spaces are most likely to be vacant. By shifting from purely schedule-based controls to real-time, occupant-responsive strategies, the proposal helps capture energy savings that reflect actual building use patterns common in California's flexible, hybrid, and extended-hour commercial and institutional facilities.

The timing of this alignment is driven by rapid growth in advanced lighting controls, building automation systems, and connected devices across new construction and major retrofits in California. Establishing clear, consistent requirements now ensures these systems are designed and commissioned with occupant-based functionality as a baseline capability, rather than as an optional or value-engineered feature, improving long-term persistence of energy savings.

The proposal does not rely on a specific industry standard test procedure. Performance characteristics of occupant sensing controls, such as detection technology, coverage, and delay timing, are already addressed through existing product standards and manufacturer specifications (e.g., NEMA WD 7 for occupancy motion sensors). The code change does not modify product performance testing; rather, it expands the application of these controls to additional space types.

Overall, the proposed update is consistent with national model code direction and industry best practices, advancing California's leadership in whole-building energy management by expanding the use of occupant-based control strategies.

3.1.5.2 Interactions with Other Regulations

There are no known federal, state, or local regulations, codes, standards, or certification programs that address the same topic, conflict with, or duplicate the proposed change.

3.2 Require Occupant Sensing Controls in More Spaces - Compliance and Enforcement

3.2.1 Compliance Considerations

The proposed code change is designed to be straightforward to enforce and verify through existing compliance and acceptance testing processes for lighting controls. The proposal expands the application of occupant sensing controls to additional space types but does not introduce new control technologies, test procedures, or documentation forms that would add complexity for designers, installers, or enforcement authorities. It is important to note that Group R occupancies are excluded and will follow the 2025 code instead for consistency with AB 130.

Feasibility of Compliance & Enforcement: While the proposed measure builds on existing mandatory lighting control requirements and HVAC occupied standby requirements for small offices, stakeholder feedback from enforcement agencies and design professionals provided to the Compliance Improvement Team indicates that compliance and enforcement are currently challenging. Existing requirements related to occupancy sensing and occupied standby are frequently misunderstood and inconsistently applied, particularly where they intersect with HVAC system design. Expanding the space types subject to occupied standby will increase complexity and is

expected to have direct implications for HVAC system selection, control strategies, and equipment sizing. To support effective implementation, compliance documentation, guidance, and training will need to be updated and clarified. The NRCC/LMCC-LTI-E, NRCC/LMCC-MCH-E, and NRCC/LMCC-PRF-E forms will be revised to reflect the expanded space types and associated requirements, with additional emphasis on improving clarity for designers and enforcement agencies.

Field Verification or Diagnostic Testing: While no new lighting-specific field verification or diagnostic testing requirements are proposed, the expansion of occupant sensing and occupied standby requirements is expected to have implications beyond lighting controls. Occupant sensing controls will continue to be verified through existing Lighting Controls Acceptance Tests (NRCA-LTI-02-A) conducted by certified Acceptance Test Technicians (ATTs); however, stakeholder feedback indicates that these changes may also affect mechanical system testing and acceptance. Additional coordination will be needed to determine how mechanical testing protocols may need to be updated to verify appropriate HVAC system response to occupancy status. Further clarification and potential revisions to testing procedures and guidance documents may be required to ensure consistent application and enforcement across lighting and mechanical systems.

Compliance Burden: The proposal is expected to increase compliance and enforcement burden. Stakeholder feedback from enforcement authorities and design professionals indicates that existing occupancy sensing and occupied standby requirements are already challenging to interpret, implement, and verify in practice. Expanding these requirements to additional space types introduces additional layers of complexity that will further complicate design coordination, inspection, and acceptance. These changes may affect control sequences, HVAC system configuration, and equipment selection, increasing the effort required for plan review and field verification. As a result, enforcement authorities will require clearer documentation, enhanced guidance, and targeted training to support consistent and effective enforcement of the proposed requirements.

Definitions & Harmonization: No new definitions are required for this measure. All terminology related to occupant sensing controls and lighting shut-OFF requirements remains consistent with existing definitions in Title 24, Part 6, and coordinated with related sections of the California Electrical Code and California Mechanical Code to avoid confusion and maintain alignment across code parts.

3.2.2 Impact on Market Actors

Table 17 summarizes impacts on market actors and suggests outreach and education that might be helpful to support market actors as they prepare for the effective date of the requirements.

Table 17: Impacts on Market Actors and Suggested Training and Education Opportunities[15]

Market Actor	Impact(s)	Suggested Outreach and Education
Builders [a]	Consider sensor placement, coordination with zones, and integration with other systems. Workflow adjustments will be needed.	Updated guidance is recommended on new space types, zoning considerations, and integration with HVAC controls.
Design Professionals [b]	Specify occupancy sensors for additional space types, coordinate with HVAC and lighting zones, and be aware of how these requirements may dictate alternative mechanical design considerations.	Recommended training for lighting design professionals and HVAC design professionals on new space-type requirements, best practices for HVAC coordination, and lighting scene/control integration.
Construction Team [c]	Standard installation practices for small offices will need to be expanded to more space types.	Recommend training for construction professionals on how to implement occupancy-based control for both lighting and HVAC systems.
Building Departments [d]	Apply existing plan review and inspection processes to expanded space types.	Updated existing reference materials and guidance documents on new space-type applications.
Verification Testers [e]	Use existing procedures; verify correct operation in newly covered spaces; more time may be needed for each project due to the increased number of tests.	Recommended training for verification testers of lighting and HVAC systems on new space-type requirements, best practices for verifying HVAC coordination, and verifying lighting scene/control integration.
Building Owners, Managers, and Occupants	**Reduced energy bills:** lighting behavior may differ slightly in new spaces. **Potentially much higher costs:** may require replacing single-zone HVAC systems with multizone systems or adding equipment so areas can be controlled separately from zones not using the occupancy sensor.	Additional outreach on cost implications, coordination strategies, and design considerations for retrofits or additions is recommended.

[15] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Market Actor	Impact(s)	Suggested Outreach and Education
Manufacturers and Distributors	**No major changes for lighting:** products are already available to support new space types. **Changes for HVAC:** Changes in how HVAC manufacturers and distributors support equipment choices.	Outreach should include guidance on market trends, equipment capabilities, and best practices for supporting occupancy sensor requirements.

a. Builders include builders and developers.
b. Design professionals include architects, interior designers, engineers (mechanical, electrical, plumbing, structural), specification writers, cost estimators, commissioning agents, lighting designers, and energy consultants.
c. Construction team includes general contractors, design-build contractors, installation contractors (e.g., HVAC, plumbing, electrical), commissioning agents, and tradespeople.
d. Building departments include plans reviewers, building inspectors, specialty inspectors, permit counter technicians, and sustainability department staff.
e. Verification testers include commissioning agents, ECC Raters, and Acceptance Test Technicians.

The 2028 CASE Methodology Report presents a quantitative assessment of how changes to the California building code impact builders, building designers and energy consultants, and building owners and occupants. The analysis in the methodology report is not specific to the code change presented in this report. The following provides a qualitative description of how this specific code change affects various market actors and additional quantitative analyses of its potential impacts on building industry subsectors.

Builders. The proposed change would affect commercial builders; however, it would likely not impact firms focused on the construction or retrofitting of industrial buildings, utility systems, public infrastructure, or other heavy construction. The proposed change would not affect all firms and workers in the commercial building industries equally; instead, it would primarily affect specific subsectors within the industry. Table 18 shows the commercial building subsectors that the Statewide CASE Team expects to be impacted by the changes proposed in this report.

The values in the table below are preliminary estimates and may be updated as the Statewide CASE Team continues data collection ***on impact to the commercial building industry in California. Finalized values will be included in the Final CASE Report.***

Table 18: Specific Subsectors of the California Commercial Building Industry Impacted by Proposed Change to Code/Standard by Subsector in 2025 (Estimated)[16]

Construction Subsector	Establishments*	Employment	Annual Payroll (Billions $)
Commercial Building Construction	5,491	87,450	$10.6
Nonresidential Poured Foundation Contractors	497	15,884	$1.4
Nonresidential Structural Steel Contractors	365	11,899	$1.1
Nonresidential Framing Contractors	137	3,037	$0.2
Nonresidential Masonry Contractors	217	4,028	$0.3
Nonresidential Glass and Glazing Contractors	307	5,079	$0.5
Nonresidential Roofing Contractors	385	11,413	$1.0
Nonresidential Siding Contractors	32	735	$0.1
Other Nonresidential Exterior Contractors	234	2,259	$0.1
Nonresidential Electrical Contractors	3,245	72,794	$7.8
Nonresidential Plumbing & HVAC Contractors	2,270	55,182	$5.8
Other Nonresidential Equipment Contractors	580	9,749	$1.1
Nonresidential Drywall Contractors	593	19,328	$1.8
Nonresidential Painting Contractors	501	9,225	$0.7
Nonresidential Flooring Contractors	286	4,011	$0.4
Nonresidential Tile and Terrazzo Contractors	151	2,223	$0.2
Nonresidential Finish Carpentry Contractors	313	3,697	$0.3
Other Nonresidential Finishing Contractors	492	7,241	$0.6
Nonresidential Site Preparation Contractors	1,147	19,273	$1.9
All Other Nonresidential Trade Contractors	948	17,084	$1.7

Source: Analysis by the Title 24 CASE Team of QCEW data from the California Employment Development Department https://labormarketinfo.edd.ca.gov/cgi/dataanalysis/areaselection.asp?tablename=industry

*An establishment is single economic unit, typically at one physical location, that engages in one, or predominantly one, type of economic activity for which a single industrial classification may be applied. Many businesses are composed of multiple establishments. US Bureau of Labor Statistics, Handbook of Methods. https://www.bls.gov/opub/hom/cew/concepts.htm

Manufacturers. Major manufacturers offering occupancy-sensor and lighting control solutions include Legrand (WattStopper), Lutron, Acuity Brands, Signify (Philips), Leviton, and Hubbell Control Solutions. These companies supply a full range of sensor technologies—including ceiling-mounted, wall-mounted, and integrated luminaire-based sensors—along with compatible control hardware and commissioning tools. Many of

[16] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

these manufacturers maintain distribution centers, technical support staff, and commissioning resources within California.

3.2.3 Compliance Software Updates

If the proposal is adopted, only minor updates to CBECC are expected. The measure relies on occupancy-sensor strategies—full-OFF and partial-OFF—that are already supported within existing CBECC rulesets and EnergyPlus objects. Accordingly:

- **Scope of updates:** An adjustment to the current lighting and HVAC controls schedules would be required to reflect the proposed mandatory occupancy sensor requirements and associated savings assumptions.
- **Software functionality:** No new functionality is expected to be needed. Existing EnergyPlus objects can model the measure without modification.
- **Additional data needs:** Only updated schedule assumptions would need to be incorporated. No new datasets are required.

If ongoing coordination with the CBECC development team indicates that broader updates are necessary, the Statewide CASE Team will provide detailed recommendations on software enhancements in Summer 2026.

3.2.4 Cost of Enforcement

The Statewide CASE Team acknowledges that changes to the code will impact enforcement costs. This report is an evaluation of specific measures, and the collective impact of all proposed changes for the 2028 Title 24, Part 6 may represent an increase in training and/or workload for enforcement personnel. The proposed measure leverages existing compliance infrastructure and acceptance testing protocols. While this approach generally results in minimal incremental enforcement costs for the state or local governments, it will likely increase costs for acceptance testing of lighting and mechanical systems.

No new programs, technology platforms, or staff positions are required to implement or enforce this measure. Any additional training or guidance would be delivered through existing, ongoing education channels at a small marginal cost relative to overall code enforcement budgets.

3.3 Require Occupant Sensing Controls in More Spaces - Market and Economic Analysis

3.3.1 Market Structure and Availability

3.3.1.1 Current Market Structure and Availability

The market for occupant sensing lighting controls in California is mature and supported by a well-established network of manufacturers, distributors, lighting designers, electrical contractors, and commissioning professionals. In addition, California has a mature mechanical controls market, including HVAC manufacturers, controls vendors, building automation system (BAS) providers, mechanical engineers, and mechanical contractors with experience integrating occupancy-based control strategies. Expanding the application of these controls to additional space types—such as computer room, exercise/fitness and gymnasium area, financial transaction area, laboratory, lobby, main entry, and lounge, breakroom, or waiting areas—will influence how mechanical systems are designed, zoned, and controlled, particularly where occupancy signals are used to initiate HVAC standby or ventilation reduction sequences. The proposed measure builds on existing technologies and practices already in common use for other space types covered by the Energy Code.

Leading manufacturers of occupant sensing controls include Lutron Electronics, Leviton Manufacturing, Acuity Brands, Signify (Genlyte Solutions and Cooper Lighting Solutions), Wattstopper (Legrand), and Current Lighting. Several of these companies have regional headquarters or major operations in California, including Acuity Brands Lighting (West Coast operations in Irvine) and Legrand North America (regional distribution in San Jose). These manufacturers supply a wide range of ceiling-mounted, wall-mounted, and integrated fixture sensors that support both partial- and full-OFF operation and can communicate via wired or wireless protocols. On the mechanical side, major HVAC and controls manufacturers—such as Carrier, Trane, Daikin, Johnson Controls, and Honeywell—offer equipment and control platforms capable of supporting occupancy-based setback, ventilation reduction, and zone-level airflow modulation. Many systems already support BACnet-based integration and can receive occupancy signals through BAS programming when properly configured.

The proposed measure does not rely on proprietary or patented technologies. Occupant sensors that meet the functional requirements for time-out duration, partial-OFF operation, and multi-level control are available from multiple manufacturers. Competing products are interoperable with a variety of lighting control systems, reducing the risk of vendor lock-in. For spaces that require networked lighting control, open communication protocols such as BACnet, DALI, and Bluetooth Mesh are already supported by most major manufacturers. Similarly, most modern commercial HVAC systems support open-protocol communication (e.g., BACnet) that enables integration with occupancy-based

control sequences without requiring proprietary platforms. However, implementation may require additional BAS programming, zone controllers, or commissioning effort in some alteration projects.

Design, installation, and commissioning of occupant sensing controls are typically performed by lighting designers, electrical engineers, and licensed electrical contractors, all of whom have significant experience with these systems due to existing Energy Code requirements. California's strong base of lighting professionals routinely specifies occupant sensors in Title 24-compliant designs. Mechanical engineers and controls contractors likewise have experience implementing temperature setback, VAV minimum airflow reduction, and demand-controlled ventilation strategies, which provide a technical foundation for occupancy-based HVAC standby where applicable.

Electrical contractors regularly install occupant sensing and networked lighting control systems. Commissioning agents and Acceptance Test Technicians (ATTs) already perform verification of occupant sensing control functionality under current acceptance test procedures, which are sufficient to support this measure without modification.

Based on the expanded space types in the proposed measure, mechanical ATTs and commissioning providers will experience increased testing scope when occupancy signals interface with HVAC systems, resulting in increased time and cost for verifying standby sequences and airflow reduction strategies. As discussed in Section 3.2.2, existing training infrastructure—such as the California Advanced Lighting Controls Training Program (CALCTP) and National Lighting Contractors Association of America (NLCAA)—provides a strong foundation for any additional training that might be needed to address new space types or integrated lighting-HVAC control strategies. Comparable mechanical training and certification programs for acceptance testing and BAS programming would support implementation on the HVAC side.

The proposed regulation supports and accelerates several existing market trends:

- **Integration of lighting and HVAC controls** through shared occupancy data to reduce both lighting and ventilation energy use.
- **Increased deployment of networked and wireless sensors**, which simplify installation in retrofits and enable more granular control.
- **Growth in data-driven building performance analytics**, leveraging occupancy data to optimize comfort and energy use.

By expanding the required use of occupant sensors, the proposal encourages manufacturers to further develop interoperable devices that communicate across building systems. This is expected to spur innovation in both sensor technology and integrated control algorithms. It may also encourage HVAC manufacturers and BAS

providers to standardize occupancy-based standby sequences and improve factory-supported integration pathways.

Absent regulation, occupant sensing controls are commonly used in offices, classrooms, restrooms, and conference rooms where code already mandates them, but adoption in other space types such as lounges, waiting areas, and lobbies remains inconsistent. Voluntary adoption in these spaces is estimated at 15 percent of new construction projects, typically driven by corporate energy management policies or LEED certification. On the mechanical side, occupancy-based HVAC standby is less consistently implemented in addition and alteration projects unless a BAS upgrade or major HVAC replacement occurs. This limited baseline adoption will be discounted from statewide savings calculations to ensure that estimated energy impacts reflect only incremental effects of the proposed code change.

3.3.1.2 Market Challenges and Solutions

Stakeholder engagement throughout the development of this proposal was central to identifying and resolving market challenges. The project team conducted targeted discussions with manufacturers, lighting designers, and facility maintenance teams to assess feasibility, field readiness, and market capability. Participants included representatives from two lighting designers and UC Davis Facilities Management. Two main challenges emerged from these discussions: (1) the appropriateness of occupant sensing controls in certain space types, and (2) the integration of lighting and HVAC control systems to support coordinated operation (Statewide Utility Codes and Standards Team 2025).

During stakeholder discussions, lighting designers highlighted that applying automatic occupancy sensing in complex space types—such as auditoriums, theaters, and large assembly areas—poses significant operational risks during performances. Automatic-on occupancy sensors could unintentionally disrupt performances by activating lighting scenes, conflicting with the primary theatrical control system. In response to this feedback, the Statewide CASE Team refined the proposal to remove these space types from the measure, thereby eliminating the identified operational risks and avoiding conflicts with theatrical lighting control systems.

During stakeholder discussions, concerns about the complexity of integrating HVAC and lighting occupancy controls were raised, especially in complex space types such as laboratories. Additional technical issues were noted, including mismatched zoning between HVAC and lighting systems, communication delays, and challenges with troubleshooting and maintenance when systems are coupled at the building level rather than locally. In response to this, the Statewide CASE Team will continue gathering information on laboratory space types and will determine whether to remove this space

type from consideration for the measure based on findings that will be documented in the final report.

See Section 3.2.2 for a description of workforce training that may be needed to ensure effective design, installation, and commissioning.

3.3.2 Design and Construction Practices

3.3.2.1 Current Design and Construction Practices

Occupancy-based lighting control systems are well established in nonresidential building design. Current best practices focus on aligning sensor selection, placement, zoning, and control logic with space function and occupant behavior. Designers typically select between occupancy (auto-on/auto-off) and vacancy (manual-on/auto-off) modes based on expected usage patterns, activity types, and potential for false triggering.

Best-practice sensor layout is guided by manufacturer specifications and room geometry, with ceiling- or wall-mounted sensors providing line-of-sight coverage. For larger or more complex spaces—such as auditoriums or museums—zones are subdivided to maintain sensor accuracy and ease of commissioning.

Overall, the proposed measure reinforces and clarifies existing best practices rather than introducing major design or construction impacts. The main change lies in emphasizing functional zoning, control coordination, and programmable flexibility across a wider range of space types. The measure aligns with standard design workflows for lighting control, with minimal implications for electrical infrastructure or physical layout. It does, however, encourage earlier coordination between lighting and mechanical design disciplines to ensure that both systems respond appropriately to occupancy signals without compromising usability or reliability.

3.3.2.2 Health and Safety Considerations

The proposed code change does not alter any existing federal, state, or local regulations pertaining to safety and health, including rules enforced by the California Division of Occupational Safety and Health (DOSH). All existing health and safety rules would remain in place. Complying with the proposed code change is not anticipated to have adverse impacts on the safety or health of occupants or those involved with the construction, commissioning, and maintenance of the building.

Where systems affected by this code change control critical functions—such as lighting in laboratories or ventilation serving hazardous processes—existing safety protocols, overrides, and minimum operational requirements must continue to be implemented. The code change does not supersede these requirements, and any adjustments must ensure that occupant safety and process integrity are maintained at all times.

3.3.2.3 Design and Construction Challenges and Solutions

The proposed expansion of occupancy sensing to more space types in nonresidential buildings, in coordination with additional HVAC occupied standby operation in appropriate spaces, represents a natural extension of established control practices first advanced under the 2022 Title 24 Lighting CASE Report (The Statewide CASE Team 2020). Table 19 summarizes technical challenges and proposed solutions identified by the Statewide CASE Team that were in progress at the time of this report.

Table 19: Technical Challenges & Proposed Solutions for Expanding Space Types for Full or Partial-OFF Occupancy Sensors

Technical Challenge	Description	Proposed Solutions
Implementing HVAC systems for occupied standby controls in more space types	Feasible in systems with digital controls but may not be practical for standalone HVAC equipment without communication capabilities.	Identify specific space types that should be exempted from occupied standby controls.
Conflicts with existing control strategies (e.g., demand ventilation, fume hood, or process controls)	Not feasible where performance based, life-safety, or process-critical ventilation requirements must take precedence.	Remove requirements for performance spaces and consider removing laboratory spaces from consideration for this measure at the time of the Draft Report.

By overcoming the identified challenges through targeted design guidance, California's design, construction, and enforcement community will continue to advance its technical capabilities, supporting modern, grid-responsive, and energy-efficient building operation statewide. See Table 17 in Section 3.2.2 for a description of workforce training that could support effective design, installation, and commissioning.

3.3.3 Energy Equity and Environmental Justice

The Statewide CASE Team evaluated the potential impact on environmental and social justice (ESJ) communities,[17] including impacts related to race, class, and gender via

[17] The CPUC refers to ESJ communities as "low-income or communities of color that have been underrepresented in the policy setting or decision-making process, are subject to a disproportionate impact from one or more environmental hazards, and likely to experience disparate implementation of environmental regulations and socio-economic investments in their communities" (CPUC 2022). ESJ communities also include the CPUC definition for Disadvantaged Communities, which comprises "(1) Census tracts receiving the highest 25 percent of overall scores in CalEnviroScreen 4.0 (1,984 tracts); (2) Census tracts lacking overall scores in CalEnviroScreen 4.0 due to data gaps, but receiving the highest 5 percent of CalEnviroScreen 4.0 cumulative pollution burden scores (19 tracts); (3) Census tracts identified in the 2017 DAC designation as disadvantaged, regardless of their scores in CalEnviroScreen 4.0 (307 tracts); and (4) Lands under the control of federally recognized Tribes (OEHHA 2022).

research and stakeholder input. While the listed potential impacts should be comprehensive, they may not yet be exhaustive.

Specific impacts identified to date include the following:

- **Cost and Affordability:** Initial equipment and installation costs may disproportionately affect small or independent nonresidential building operators serving local markets, particularly in rural or low-income regions.
- **Health and Safety:** Improved nonresidential indoor lighting control standards may reduce waste heat and worker comfort, providing long-term health and safety benefits.
- **Economic Participation:** Over time, energy savings can improve the financial viability of operations, creating more sustainable employment opportunities in ESJ communities.

Recognizing the importance of engaging ESJ communities and gathering their input to inform the code change process and proposed measures, the Statewide CASE Team is working to build relationships with community-based organizations (CBOs) to facilitate meaningful engagement. Any stakeholders with input on how this proposal may impact ESJ communities or who would like to offer their perspective should reach out to Yao-Jung Wen (ywen@energy-solution.com).

3.3.4 Impacts on Jobs and Businesses

This section will be completed for the Final CASE Report.

3.3.5 Economic and Fiscal Impacts

This section will be completed for the Final CASE Report.

3.4 Require Occupant Sensing Controls in More Spaces - Cost Effectiveness

3.4.1 Cost Effectiveness Methodology

The Statewide CASE Team collaborated with the CEC staff to confirm that the cost-effectiveness methodology aligns with the CEC guidelines, including cost inclusion parameters. The 2028 CASE Methodology Report and Appendix A provide reproducibility details.

Per California Law (Public Resources Code 25000), a measure is considered cost-effective if its Benefit-Cost Ratio (BCR) is 1.0 or greater, amortized over the economic life of the structure. The Statewide CASE Team calculates BCR by dividing total dollar benefits by total dollar costs over a 30-year analysis period.

Benefits are based on Long-term System Cost (LSC), which assigns an hourly dollar value to energy use. LSC hourly factors weigh the long-term value of each hour differently, where times of peak demand are valued more than off-peak hours. These factors are not utility rates, forecasts, or bill estimates. The CEC develops and publishes LSC hourly conversion factors for each code cycle.

Costs include first costs and ongoing maintenance costs assessed over the 30-year period. Benefits and costs are evaluated incrementally, relative to the most recently adopted Energy Code. The analysis excludes design costs and incremental code compliance verification costs.

3.4.2 Energy and Energy Cost Savings Results

The Statewide CASE Team completed a preliminary energy savings analysis using nonresidential prototype buildings representative of typical California building operations. Because the measure affects lighting and HVAC controls in common nonresidential space types, the analysis uses two complementary modeling approaches: (1) a spreadsheet-based method for occupancy-sensor lighting savings, and (2) CBECC for HVAC occupied-standby impacts.

CBECC was not used for lighting energy savings because Title 24 compliance software does not currently calculate occupancy-sensor lighting reductions for each space type at the granularity needed for this analysis. Instead, the spreadsheet model applies to published occupancy-sensor savings factors and prototype-specific schedules. CBECC is used for HVAC occupied-standby analysis because this functionality is already embedded within the software's HVAC framework.

For the draft analysis, the CASE Team modeled occupancy-sensor impacts using the Small Office prototype only. For the Final CASE Report, the analysis will be expanded to include all nonresidential prototypes containing space types covered by the proposed measure (i.e., large office, medium office, small office and small/primary school). Key assumptions are provided in Appendix A. Before the final report is published, all assumptions will continue to be updated as new information becomes available through stakeholder engagement with controls manufacturers, lighting designers, HVAC engineers, energy modelers, and commercial building owners/operators. Stakeholders will be asked to review the savings methodology, key assumptions, and modeling framework.

Energy savings and peak demand reductions per square foot are presented in Table 20 through Table 23. Based on preliminary results for the Small Office prototype, first-year electricity savings range from 0.12 to 0.14 kWh per square foot (kWh/ft²), depending on climate zone. First-year peak demand reductions range from 6.45 to 7.97 watts per square foot (W/ft²) across climate zones.

Preliminary natural gas impacts for the Small Office prototype indicate slight increases in natural gas use, ranging from -0.03 to -0.13 kBtu/ft², depending on climate zone. This increase occurs because the proposed lighting schedule reduces internal heat gains from lighting fixtures and occupants. As a result, space heating loads increase slightly in some climate zones.

First-year source energy savings for the Small Office prototype range from -0.02 to 0.07 kBtu/ft², depending on climate zone. In most climate zones, reduced electricity consumption outweighs the small increase in natural gas use, resulting in positive source energy savings. In Climate Zone 16, source energy savings are slightly negative (-0.02 kBtu/ft²); however, the magnitude of this impact is very small and considered effectively neutral for the measure.

LSC results indicate positive net savings across all climate zones for the Small Office prototype. Total 30-year LSC savings range from $0.62 to $0.80 per square foot (2029 PV$), depending on climate zone (Table 24). As shown in Table 25, 30-year electricity LSC savings range from $0.70 to $0.83 per square foot, while 30-year natural gas LSC impacts range from -$0.02 to -$0.12 per square foot, resulting in total net savings of $0.62 to $0.80 per square foot (2029 PV$). Positive electricity savings more than offset the small negative natural gas impacts in all climate zones.

Results for Large Office, Medium Office, and Small School prototypes remain under development and are currently shown as TBD. The Statewide CASE Team is continuing data collection, energy modeling, and cost analysis. Finalized values will be included in the Final CASE Report.

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on first year savings. Finalized values will be included in the Final CASE Report.

Table 20: First Year Electricity Savings (kWh) Per Square Foot – Occupancy Sensor[18]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Medium Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Small Office	0.12	0.13	0.12	0.13	0.13	0.13	0.13	0.14	0.13	0.14	0.13	0.13	0.13	0.13	0.14	0.12
Small School (Primary)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on first year savings. Finalized values will be included in the Final CASE Report.

Table 21: First Year Peak Demand Reduction (W) Per Square Foot – Occupancy Sensor[19]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Medium Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Small Office	6.83	7.40	7.12	7.68	7.31	7.87	7.12	7.87	7.40	7.87	6.45	7.87	7.68	7.97	7.68	7.68
Small School (Primary)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on first year savings. Finalized values will be included in the Final CASE Report.

[18] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

[19] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Table 22: First Year Natural Gas Savings (kBtu) Per Square Foot – Occupancy Sensor[20]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Medium Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Small Office	-0.08	-0.07	-0.06	-0.06	-0.05	-0.03	-0.04	-0.03	-0.03	-0.03	-0.07	-0.05	-0.05	-0.05	-0.03	-0.13
Small School (Primary)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

The Statewide CASE Team is still conducting data collection and analysis. Finalized values will be included in the Final CASE Report.

Table 23: First Year Source Energy Savings (kBtu) Per Square Foot – Occupancy Sensor[21]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Medium Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Small Office	0.01	0.03	0.04	0.04	0.05	0.07	0.06	0.07	0.07	0.07	0.03	0.05	0.05	0.05	0.07	-0.02
Small School (Primary)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

The Statewide CASE Team is still collecting data on LSC costs and savings, and the results will be presented in the Final CASE Report.

[20] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

[21] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Table 24: Total 30-Year LSC Savings (2029 PV$) Per Square Foot – Occupancy Sensor[22]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Medium Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Small Office	0.63	0.70	0.67	0.73	0.73	0.75	0.75	0.78	0.77	0.80	0.70	0.73	0.74	0.72	0.80	0.62
Small School (Primary)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

[22] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The Statewide CASE Team is still collecting data on LSC costs and savings, and the results will be presented in the Final CASE Report.

Table 25: 2029 PV LSC Savings Over 30-Year Period of Analysis – Per Square Foot – New Construction, Additions & Alterations – Occupancy Sensors[23]

Climate Zone	30-Year LSC Electricity Savings, per SF (2029 PV$)	30-Year LSC Natural Gas Savings, per SF (2029 PV$)	Total 30-Year LSC Savings, per SF (2029 PV$)
1	0.70	-0.07	0.63
2	0.76	-0.06	0.70
3	0.73	-0.05	0.67
4	0.78	-0.05	0.73
5	0.77	-0.04	0.73
6	0.79	-0.03	0.75
7	0.79	-0.03	0.75
8	0.81	-0.03	0.78
9	0.79	-0.02	0.77
10	0.82	-0.02	0.80
11	0.77	-0.07	0.70
12	0.78	-0.05	0.73
13	0.78	-0.04	0.74
14	0.77	-0.04	0.72
15	0.83	-0.03	0.80
16	0.74	-0.12	0.62

3.4.3 Incremental First Cost

The baseline for this analysis is indoor lighting control systems that meet the 2025 Title 24, Part 6 requirements for general lighting control, with luminaires for the space types under consideration controlled only by time-based scheduling. Because both the baseline and proposed systems rely on the same lighting equipment and electrical infrastructure, incremental first costs are assumed to arise solely from adding occupancy sensors and performing the associated commissioning.

First cost estimates will be collected through February 2026 using manufacturer quotes, distributor pricing, lighting control and mechanical system acceptance testing, and stakeholder interviews. The Statewide CASE Team will interview key market actors,

[23] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

targeting lighting control manufacturers, acceptance testers, and design professionals. All costs will reflect pricing available at the time of data collection.

Incremental first costs will be calculated as the difference between the proposed and baseline systems and include the following components:

- **Baseline Control Costs:** Timeclock on/off control per lighting zone ($/zone).
- **Proposed Control Costs:** Occupancy sensors with integrated or panel-based control logic ($/zone).
- **Installation:** Incremental wiring, sensor mounting, and commissioning required to verify sensor coverage, time-out settings, and functional operation.

First Costs

First cost data were derived from projects led by a lighting design firm on the Statewide CASE Team. The team compiled average distributor net costs for 36 occupancy sensors, including direct-wired, indirect-wired, and wireless infrared, ultrasonic, and dual technology sensors. A 50% markup was applied to account for supply chain costs such as shipping and freight, and the statewide average sales tax of 8.84% (effective October 1, 2025) was applied to calculate after-tax costs. Based on this approach, the average first cost is $254 per occupancy sensor.

The number of occupancy sensors per building was determined using each building prototype's typical square footage for the applicable space types, as defined in Appendix A. A representative coverage area of 400 square feet per sensor was assumed to estimate the total number of sensors required to implement this measure in each prototype building.

At the time of this Draft Report, the Statewide CASE Team is evaluating and compiling incremental costs associated with enabling HVAC occupied standby control through lighting system occupancy signals. This review includes potential integration devices, installation labor, and commissioning labor. Updated cost findings will be presented in the Final Report and incorporated into the revised cost-effectiveness analysis.

For purposes of the Draft Report, no significant differences in first cost are assumed between new construction and alterations.

Labor Costs

To estimate incremental labor costs, the Statewide CASE Team compiled typical installation and programming times for each device from real-world projects and multiplied these by the projected 2029 electrician labor rate (see below). On average, the reviewed projects showed that each occupancy sensor requires 3.6 minutes for installation and 4.2 minutes for programming.

The labor rate was developed using multiple sources. The 2025 RSMeans national average electrician rates (including overhead and profit) are $85.95/hr for non-union and $109.10/hr for union labor. Applying the 2025 RSMeans City Cost Index for California (132.6%) adjusts these rates to $113.97/hr (non-union) and $144.67/hr (union). The Statewide CASE Team also reviewed California prevailing wage data for the inside wireman classification, resulting in a weighted average rate of $98.02/hr across all counties and climate zones based on the CEC 2029 construction forecast. Averaging these three sources provides the 2025 labor rate, which was then escalated to 2029 dollars, assuming a three percent annual inflation rate, for a final labor rate of $133.80/hr.

Finally, the estimated labor hours for the number of occupancy sensors to cover the building were converted to total labor costs for the representative building prototypes using this projected 2029 rate. Results are provided in Table 26.

The Statewide CASE Team is still collecting data on incremental costs, and the results will be presented in the Final CASE Report.

Table 26: Baseline, Proposed, and Incremental Cost for Equipment and Installation, Per Zone – Require Occupant Sensing in More Spaces ($/zone)[24]

Baseline Equip. Cost	Proposed Equip. Cost	Incremental Equipment Cost	Baseline Install Cost	Proposed Install Cost	Incremental Installation Cost	Total Incremental First Cost
$0.00	$253.71	**$253.71**	$0.00	$18.19	**$18.19**	**$271.90**

3.4.4 Incremental Maintenance and Replacement Costs

The proposed occupancy-sensor measure for additional nonresidential space types is expected to deliver long-term, persistent energy savings due to the reliability and durability of modern control hardware and sensor technologies. For control hardware, the Statewide CASE Team did not find any documented lifetime information in the product literature. The manufacturer stakeholders the Statewide CASE Team consulted with also have not observed or estimated any systematic time-dependent failure patterns for control hardware in indoor applications. As an alternative, the Statewide CASE Team used the estimated luminaire lifetime as a proxy for the lifetime of control hardware. This is a conservative assumption, since control hardware typically outlasts luminaires.

According to the lighting schedule provided in the 2025 Alternative Calculation Method Reference Manual (ACM), the annual lighting operating hours range from 1,687 hours (warehouse) to 4,754 hours (restaurant). Assuming a 50,000-hour nominal rated lifetime

[24] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

for commercial-grade LED luminaires, the luminaire would last 10.5 to 29.7 years, based on the annual lighting operating hours in the ACM. The average lifetime, weighted by the square footage of different non-residential building types estimated in the Energy Commission's 2029 construction forecast, is 20.3 years. This estimate excludes parking garage lighting, which, although treated as an indoor application in Title 24, Part 6, is considered to operate in a harsher environment exposed to outdoor conditions and to have significantly longer operating hours. Also, parking garages are not expected to be impacted by this proposed code change. The Statewide CASE Team conservatively assumed a 15-year lifetime for luminaire and control hardware, resulting in one replacement during the 30-year analysis period.

Routine maintenance for occupancy-based lighting control systems typically includes periodic cleaning of sensors, functional testing, and verification of time-out settings. These tasks are commonly performed during standard facility maintenance cycles and are expected to have minimal impact on overall maintenance costs. Occupancy sensors are solid-state devices without moving parts and generally require little servicing. Routine maintenance requirements are therefore anticipated to be similar between the baseline and proposed cases. Although occasional recalibration or reprogramming may be required to optimize sensor performance, these activities are generally integrated into ongoing lighting and building controls maintenance and were not added as incremental costs.

3.4.5 Cost Effectiveness

The cost-effectiveness analysis evaluates incremental first, labor, maintenance, and replacement costs relative to the baseline. It quantifies the present value (PV) of benefits over a 30-year analysis period using a three percent real discount rate. All values are expressed in 2029 PV dollars to align with the expected code implementation year. Incremental maintenance costs were estimated using the sensor's useful life and replacement assumptions described in Section 49. The analysis assumes the proposed occupancy-sensor control hardware has an expected useful life of 15 years.

Energy and cost savings were modeled using nonresidential prototype buildings that the DEER database (CPUC 2022) cited as having the considered space types for this measure as typical. Each prototype incorporates representative operating schedules, space-applicable lighting power densities from 2025 Title 24 Table 140.6-B (California Energy Commission 2022), and published savings estimates for full- and partial-OFF occupancy sensing strategies from ANSI/ASHRAE/IES Addendum bd to ANSI/ASHRAE/IES Standard 90.1-2022, which establishes select lighting requirements in the forthcoming ASHRAE 90.1-2025 (ASHRAE 2022, ASHRAE 90.1 Addendum bd 2025). Savings were calculated as the difference in lighting and HVAC energy use and annual energy cost between baseline timeclock-only controls and the proposed occupancy-sensor strategies for each prototype, scaled by the square footage of the

applicable space types being considered and applied across all California climate zones.

Results of the per-unit cost-effectiveness analysis are presented in Table 27 and Table 28 for new construction/additions and alterations.

The Statewide CASE Team is still collecting data on cost effectiveness, and the results will be presented in the Final CASE Report.

Table 27: 30-Year Cost-Effectiveness Summary Per Square Foot – New Construction and Additions[25]

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	0.63	0.30	2.07
2	0.70	0.30	2.30
3	0.67	0.30	2.20
4	0.73	0.30	2.41
5	0.73	0.30	2.40
6	0.75	0.30	2.48
7	0.75	0.30	2.47
8	0.78	0.30	2.56
9	0.77	0.30	2.52
10	0.80	0.30	2.61
11	0.70	0.30	2.30
12	0.73	0.30	2.40
13	0.74	0.30	2.42
14	0.72	0.30	2.38
15	0.80	0.30	2.64
16	0.62	0.30	2.03

The Statewide CASE Team is still working on energy modeling and cost analysis, and the results will be included in the Final CASE Report.

[25] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Table 28: 30-Year Cost-Effectiveness Summary Per Square Foot – Alterations[26]

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	0.63	0.30	2.07
2	0.70	0.30	2.30
3	0.67	0.30	2.20
4	0.73	0.30	2.41
5	0.73	0.30	2.40
6	0.75	0.30	2.48
7	0.75	0.30	2.47
8	0.78	0.30	2.56
9	0.77	0.30	2.52
10	0.80	0.30	2.61
11	0.70	0.30	2.30
12	0.73	0.30	2.40
13	0.74	0.30	2.42
14	0.72	0.30	2.38
15	0.80	0.30	2.64
16	0.62	0.30	2.03

3.5 Require Occupant Sensing Controls in More Spaces - Statewide Impacts

3.5.1 Statewide Energy and Energy Cost Savings

Statewide savings for both new construction and alterations were estimated using a bottom-up approach consistent with the 2028 CASE Methodology Report. The per-unit energy impacts were extrapolated to statewide impacts using the Statewide Construction Forecasts provided by the CEC. These forecasts estimate new construction and additions anticipated in 2029, the first year the 2028 Title 24, Part 6 requirements are in effect, as well as the total existing building stock forecasted for 2029, which was used to approximate savings from building alterations. See the 2028 CASE Methodology Report for details on how statewide savings are calculated. Appendix C presents the assumptions on the percentage of the total construction forecast that the proposed measure would impact.

[26] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The tables below present the first-year statewide energy and LSC savings from newly constructed buildings and additions (Table 29) and alterations (Table 30) by climate zone. Table 31 presents first-year statewide savings from new construction, additions, and alterations. These statewide impacts are based on the preliminary per-unit savings in the section above and will be updated in the Final CASE Report as the Statewide CASE Team continues to collect data and refine the estimates.

The Statewide CASE Team is still working on energy modeling and analysis to determine statewide savings. Finalized values will be included in Final CASE Report.

Table 29: Statewide Energy and LSC Impacts – New Construction and Additions[27]

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2026 (Million Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction	First-Year Natural Gas Savings (Million Therms)	First-Year Natural Gas Savings (Million Therms) First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	11,001	0.00	0.00	0.00	0.00	$0.01
2	368,023	0.05	0.00	0.00	0.01	$0.26
3	157,435	0.02	0.00	0.00	0.01	$0.11
4	17,007	0.00	0.00	0.00	0.00	$0.01
5	54,104	0.01	0.00	0.00	0.00	$0.04
6	124,752	0.02	0.00	0.00	0.01	$0.09
7	197,026	0.03	0.00	0.00	0.01	$0.15
8	134,271	0.02	0.00	0.00	0.01	$0.10
9	303,246	0.04	0.00	0.00	0.02	$0.23
10	351,007	0.05	0.00	0.00	0.03	$0.28
11	78,591	0.01	0.00	0.00	0.00	$0.06
12	458,491	0.06	0.00	0.00	0.02	$0.33
13	324,473	0.04	0.00	0.00	0.02	$0.24
14	37,097	0.00	0.00	0.00	0.00	$0.03
15	88,531	0.01	0.00	0.00	0.01	$0.07
16	27,907	0.00	0.00	0.00	0.00	$0.02
Total	**2,732,962**	**0.36**	**0.02**	**0.00**	**0.15**	**$2.03**

[27] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The Statewide CASE Team is still working on energy modeling and analysis to determine statewide savings. Finalized values will be included in Final CASE Report.

Table 30: Statewide Energy and LSC Impacts – Alterations[28]

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2026 (Million Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (Million Therms)	First-Year Natural Gas Savings (Million Therms) First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	272,963	0.03	0.00	0.00	0.00	$0.17
2	833,000	0.11	0.01	0.00	0.03	$0.58
3	1,449,747	0.17	0.01	0.00	0.05	$0.97
4	740,227	0.10	0.01	0.00	0.03	$0.54
5	490,261	0.06	0.00	0.00	0.02	$0.36
6	863,707	0.11	0.01	0.00	0.06	$0.65
7	556,379	0.07	0.00	0.00	0.04	$0.42
8	867,627	0.12	0.01	0.00	0.06	$0.68
9	1,364,160	0.18	0.01	0.00	0.10	$1.05
10	1,596,093	0.22	0.01	0.00	0.12	$1.27
11	692,533	0.09	0.00	0.00	0.02	$0.49
12	2,870,747	0.37	0.02	0.00	0.14	$2.10
13	1,402,707	0.18	0.01	0.00	0.08	$1.04
14	325,817	0.04	0.00	0.00	0.02	$0.24
15	403,825	0.06	0.00	0.00	0.03	$0.32
16	174,832	0.02	0.00	0.00	0.00	$0.11
Total	**14,904,624**	**1.94**	**0.11**	**-0.01**	**0.78**	**$10.98**

[28] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The Statewide CASE Team is still working on energy modeling and analysis to determine statewide savings. Finalized values will be included in Final CASE Report.

Table 31: Statewide Energy and LSC Impacts – New Construction, Additions, and Alterations[29]

Construction Type	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First -Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million Therms)	30-Year Present Valued LSC Savings (Million 2029 PV$)
New Construction & Additions	0.4	0.0	0.0	0.1	2
Alterations	1.9	0.1	0.0	0.8	11
Total	**2.3**	**0.1**	**0.0**	**0.9**	**13**

[29] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

3.5.2 Statewide Greenhouse Gas Emissions Reductions

The Statewide CASE Team is still working on energy modeling and analysis to determine statewide impacts to GHG emissions. Finalized values will be included in Final CASE Report.

Table 32 presents the estimated first-year reduction in GHG emissions resulting from the proposed code change in the Small Office prototype only. Additional prototypes will be included in the Final CASE Report. In this initial year, the Statewide CASE Team expects to avoid 44 metric tons of carbon dioxide equivalent (CO_2e) emissions. These reductions, along with their associated monetary value, were calculated using hourly GHG emissions factors published alongside the LSC hourly factors and source energy hourly factors in the research versions of CBECC, as well as data from the CEC's 2028 Metrics Report. See the 2028 CASE Methodology Report for additional information.

The Statewide CASE Team is still working on energy modeling and analysis to determine statewide impacts to GHG emissions. Finalized values will be included in Final CASE Report.

Table 32: First-Year Statewide GHG Emissions Impacts[30]

Construction Type	Reduced GHG Emissions from Electricity Savings (Metric Tons CO2e)	Reduced GHG Emissions from Natural Gas Savings (Metric Tons CO2e)	Total Reduced GHG Emissions (Metric Ton CO2e)	Total Monetary Value of Reduced GHG Emissions ($)
New Construction, Additions & Alterations	87	-43	44	$5,403

3.5.3 Statewide Water Use Impacts

The proposed code change will not result in water use impacts.

3.5.4 Statewide Material Impacts

The proposed code change does not introduce new types of equipment or products, as all required components are already widely used in the nonresidential lighting industry. However, adoption of the proposed requirement is expected to increase the use of occupancy sensors, associated control hardware, and, in some cases, additional cabling or low-voltage wiring. A corresponding reduction in the use of time-switch

[30] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

controls may occur. Refer to the 2022 Title 24 Indoor Lighting CASE Report for detailed analysis (The Statewide CASE Team 2020).

3.5.5 Environmental Impacts

Integration of occupancy sensors in more spaces with both lighting and HVAC occupied standby modes will decrease unnecessary lighting, ventilation, and conditioning during unoccupied periods, resulting in direct environmental benefits, including lower electricity consumption and reduced GHG emissions from power generation. The Statewide CASE Team has not identified any indirect environmental benefits or any direct or indirect adverse environmental impacts. The Statewide CASE Team also did not identify any other reasonable alternatives that would achieve the same goal of reducing lighting and HVAC energy consumption while maintaining occupant comfort and system performance.

3.5.6 Other Non-Energy Impacts

In addition to energy-related benefits, the proposed code change is expected to result in several non-energy impacts that may be relevant to the California Environmental Quality Act (CEQA) analysis. Enhanced occupancy sensor requirements are expected to improve lighting control effectiveness and HVAC occupied standby implementation across nonresidential building types, reducing unnecessary lighting operation, ventilation, and associated waste heat. These improvements may contribute to improved occupant comfort.

Reduced lighting and ventilation energy use and peak demand may also enhance grid reliability and resilience, particularly during periods of high system stress. While initial equipment and installation costs may be higher for some building owners or operators—especially small businesses or those in older facilities—the resulting long-term energy savings can improve operational sustainability and reduce ongoing utility expenses. These savings may support more stable business operations, create opportunities for reinvestment, and strengthen economic resilience in disadvantaged or ESJ communities.

No additional impacts beyond those identified have been found that would require further CEQA consideration at this time, though the Statewide CASE Team acknowledges that the list of impacts may evolve with continued stakeholder engagement and data collection.

3.6 Require Occupant Sensing Controls in More Spaces - Proposed Language Code

The proposed code language in this section includes only changes relevant to this measure. The intent is to clearly illustrate the scope of this measure. The proposed

code language that encompasses the changes resulting from all the measures in this CASE Report can be found in Appendix F.

3.6.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents should be marked with dark blue underlining (new language) and ~~strikethroughs~~ (deletions). Administrative Code (Title 24, Part 1)

3.6.2 Administrative Code (Title 24, Part 1)

There are no proposed changes to the Administrative Code (Title 24, Part 1).

3.6.3 Energy Code (Title 24, Part 6)

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

(c) **Shut-OFF Controls.** All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is typically unoccupied.

…

6. **Full or partial-OFF occupant sensing controls.** For warehouse aisle ways, warehouse open areas, library book stack aisles, exercise/fitness centers, gymnasium areas, laboratories, lounges, breakrooms, waiting areas, financial transaction areas, computer rooms, main entry lobbies, corridors, stairwells, offices greater than 250 square feet, parking garages, parking areas, loading areas, and unloading areas, the installed lighting shall meet the following requirements:

   A In warehouse and computer room aisle ways and warehouse and computer room open areas, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall independently control lighting in each warehouse and computer room aisle way, and shall not control lighting beyond the aisle way being controlled by the sensor.

…

F. In laboratory spaces, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power to between 50 percent and 20 percent of full power when the space is unoccupied during normally occupied hours and shall turn off lighting when the space is unoccupied during normally unoccupied hours. Where the lighting system occupant sensors are providing the occupancy status of the laboratory space for ventilation control in

accordance with Section 140.9(c)1, the ventilation signal shall be independent of daylighting, manual lighting overrides or manual control of lighting.

…

3.6.4 Reference Appendices

The Statewide CASE Team is still working on identifying the exact changes needed in the Reference Appendices.

3.6.5 Compliance Manuals

The Statewide CASE Team will provide the CEC with recommended revisions to compliance manuals after the 45-Day Language is published.

3.6.6 ACM Reference Manual

The Statewide CASE Team is still working on identifying the exact changes needed in the ACM Reference Manual.

3.6.7 Compliance Forms

As discussed in Section 3.2.1, the nonresidential lighting compliance form NRCC-LTI-E would be updated to reflect the proposed change, as well as the nonresidential performance form NRCC-PRF-01-E. The Statewide CASE Team can support the CEC in implementing these updates if the proposed change is adopted.

4. Reduce Occupant Sensing Control Delay Time

4.1 Reduce Occupant Sensing Control Delay Time - Measure Description

4.1.1 Proposed Code Change

This proposed measure reduces the occupant sensing control delay time for lighting systems from 20 minutes to 15 minutes, which would increase energy savings in affected lighting systems and space types.

The proposed measure would affect new construction, additions, and alterations and require an update to the acceptance test procedure, revising the current 20-minute delay time to 15 minutes.

To align with the Standards, the Statewide CASE Team has also provided potential updated code language that reduces the delay time for HVAC occupied standby requirements. This alignment would provide consistency for systems and space types that use the same sensor for both lighting occupancy control and HVAC occupied standby. However, the Statewide CASE Team has not conducted analysis on any potential changes to the HVAC occupied standby control delay time.

Table 33 summarizes the scope of the proposed code change.

Table 33: Scope of Proposed Code Change[31]

A ☑ indicates the proposed code change is relevant.

Building Type(s)	Construction Type(s)	Type of Change
☑ Single Family	☑ New Construction	☑ Mandatory
☑ Multifamily	☑ Additions	☑ Prescriptive
☑ Nonresidential (Not Group R uses)	☑ Alterations	☑ Performance

Application Climate Zones	Energy Code Sections	Compliance Forms	Sections of ACM Reference Manuals
Climate Zones 1-16	Lighting controls: Part 6, Section 130.1 HVAC controls: Part 6, Sections 120.1(d)5 and 140.9(c)1	N/A	Mandatory

[31] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Third Party Verification)	Updates to Compliance Software
☑ No changes to third party verification	☐ No updates
☑ Update existing verification requirements	☑ Update existing feature
☐ Add new verification requirements	☐ Add new feature

4.1.2 Benefits of Proposed Change

The proposed measure would provide energy savings by reducing the amount of time that lighting remains ON when a space is unoccupied. Because the measure only requires a change in setting to currently required equipment, there would be no incremental cost.

ANSI/ASHRAE/IES 90.1-2022 addendum bd estimates that reducing the shutoff time from 20 minutes to 15 minutes will provide lighting energy savings from 2 to 5 percent (ASHRAE 90.1 Addendum bd 2025). Reducing occupancy delay time could also extend the life expectancy of the lighting system or of individual components incrementally as well, reducing overall life cycle operating and maintenance cost.

The savings associated with the proposed measure depend on occupancy patterns in a space that include periods of no occupancy when the delay time is being employed by the occupancy controller. The greater number of unoccupied periods that occur in a day, the greater the energy savings from turning off the lights with a shorter delay time.

In high-activity spaces with brief periods shorter than the occupancy sensor delay, lights may remain ON or at a 50-percent light-level reduction, limiting energy savings. A shorter delay time can create savings where longer delays, like 20 minutes, would not. While shorter delays will not reduce savings, the impact may be minimal depending on the space's occupancy patterns.

4.1.3 Background Information

If a space becomes unoccupied, an occupancy sensor will detect that condition and start a countdown timer, referred to as the sensor delay time. Occupancy sensors use the delay time because they cannot precisely determine the moment the space becomes unoccupied. The sensor may not detect a hidden occupant or one that may be stationary for a period of time. To reduce false OFF triggers, the delay time keeps the lights ON while observing the space for new activity. When that occurs, the occupancy sensor determines if the space is occupied and waits until it senses that the space is unoccupied to reset the delay timer. If the programmed delay time elapses without detecting a new occupancy event, the occupancy sensor will turn the lights OFF.

The current Energy Code requires lighting controls capable of reducing lighting power or shutting off all lighting within 20 minutes of a space becoming unoccupied.

Several other national and state energy codes have adopted or are considering 15-minute delay times for occupancy controls, as section 4.1.5.1 details. The proposed measure would make the California Energy Code consistent with those other codes.

4.1.4 Modifications to Energy Code Documents

This section provides descriptions of how the proposed code change will affect each Energy Code document. See Section 4.6 - Reduce Occupant Sensing Control Delay - Proposed Language Code of this report for detailed revisions to code language.

4.1.4.1 Energy Code Change Summary

Lighting Controls

130.1 – MANDATORY INDOOR LIGHTING CONTROLS

Subsection 130.1(c): The proposed measure would modify subsection (c) of section 130.1, revising all references to occupancy sensor delay time from 20 minutes to 15 minutes in nonresidential buildings.

HVAC Occupied Standby Controls

120.1 – REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY

Subsection 120.1(d)5: For alignment, the Energy Code could modify the time delay for occupied standby zone controls from 20 minutes to 15 minutes.

140.9 – PRESCRIPTIVE REQUIREMENTS FOR COVERED PROCESSES

Subsection 140.9(c)1: For alignment, the Energy Code could modify the time delay for minimum unoccupied exhaust airflow in laboratory and factory exhaust systems from 20 minutes to 15 minutes.

4.1.4.2 Reference Appendices Change Summary

The proposed measure would update references to occupancy control time delay in reference appendices from a 20-minute delay time to 15 minutes.

4.1.4.3 Compliance Manuals Change Summary

The proposed measure would require compliance manuals to update references of a 20 minute occupancy sensor time delay to 15 minutes.

4.1.4.4 Alternative Calculation Method Reference Manual Change Summary

The proposed measure will impact the ACM Manual baseline assumptions for reducing lighting energy use. “Lighting control zones are typically smaller than HVAC zones, making their zone-level sensors more than capable of detecting occupancy in typical HVAC zones. Lighting systems with sensors integrated into every luminaire can serve

even the smallest HVAC zone sizes. In principle, such systems can even be configured to support reduced HVAC zone sizes that might result from retrofits targeting the greater energy savings that temperature setpoint-widening control schemes can deliver with smaller zones" (Poplawski 2024).

4.1.4.5 Compliance Forms Change Summary

The proposed measure would require revisions to the SHUT-OFF LIGHTING CONTROL 2025-CEC-NRCA-LTI-02-A compliance form to reflect the change in required occupancy control delay time from 20 minutes to 15 minutes.

Any modifications to HVAC occupied standby delay time would require revisions to the associated compliance forms to reflect the change in delay time from 20 minutes to 15 minutes. Associated compliance forms include NRCA-MCH-19-A Occupied Standby and NRCA-PRC14b-F Lab Exhaust – Test and Balance.

4.1.5 Measure Context

4.1.5.1 Comparable Model Codes or Standards

ANSI/ASHRAE/IES 90.1-2022 addendum bd and IECC proposal CE101-24 both propose decreasing the delay time to 15 minutes to achieve energy savings. The ASHRAE committees confirmed with manufacturer stakeholders that this is a common delay in time setting and would not add cost. ASHRAE 90.1-2022 addendum bd states: “Change the occupancy sensor delay time from 20 minutes to 15 minutes in base prescriptive requirements utilizing occupancy sensor technologies to regulate lighting. This provides an additional 2 percent to 5 percent lighting energy savings for spaces required to use occupancy sensor control without additional costs” (ASHRAE 90.1 Addendum bd 2025). This presents an opportunity for the Statewide CASE Team to propose this measure to adopt the same requirements into Title 24.

In New York state, a minimum of 80 percent of all lighting must be automatically turned off within 15 minutes of all occupants leaving the space (open office plans, cafeteria, and fast-food dining areas greater or equal to 300 square feet (NYC Buildings 2020).

4.1.5.2 Interactions with Other Regulations

The proposed measure is not duplicative of, and not in conflict with, applicable federal, state, or local regulations. There are no known federal, state, or local regulatory requirements that address or conflict with the proposed measure.

4.2 Reduce Occupant Sensing Control Delay time - Compliance and Enforcement

4.2.1 Compliance Considerations

The Statewide CASE Team worked with stakeholders to develop a recommended compliance and enforcement process and to identify how this process would affect various market actors.

While developing this proposal, the Statewide CASE Team considered ways to streamline the compliance and enforcement process and how to reduce negative impacts on market actors involved in it.

Below are the activities that need to occur during each phase of the project:

- **Design Phase:** Designers would need to specify occupancy sensors that can comply with the proposed delay time requirement.
- **Permit Application Phase:** No changes.
- **Construction Phase:** No changes, except programming the occupancy sensor delay time to 15 minutes or less instead of 20 minutes or less, and acceptance testing will confirm the revised delay time.
- **Inspection Phase:** No changes, except verifying the occupancy sensor delay time is 15 minutes or less instead of 20 minutes or less.

The Statewide CASE Team does not anticipate significant changes to the compliance process because of this proposed measure. This proposed measure does not modify the spaces that require an occupancy sensor, and no changes to the occupancy sensor delay time verification process other than the change in the delay time. If the Energy Code adopts the same modifications to delay times for HVAC occupied standby, there would be similar minor changes to the compliance process for those controls to reflect the change.

4.2.2 Impact on Market Actors

The proposed measure would slightly change the process for market actors to implement and verify the correct occupancy sensor delay time but would not create additional work compared to the existing compliance processes. Designers will need to specify occupancy sensors capable of meeting the updated delay time requirement. Builders and ATTs will need to commission and verify that the controls meet the delay time requirement, but the processes themselves remain unchanged.

Table 34 summarizes impacts on market actors and suggests outreach and education that might be helpful to support market actors as they prepare for the effective date of the requirements.

Table 34: Impacts on Market Actors and Suggested Training and Education Opportunities[32]

Market Actor	Impact(s)	Suggested Outreach and Education
Builders [a]	Need to specify occupancy sensors capable of a delay time of 15 minutes or less.	Provide educational materials to increase awareness of delay time requirement.
Design Professionals [b]	Need to specify occupancy sensors capable of a delay time of 15 minutes or less.	Provide educational materials to raise awareness of the time-delay requirement and highlight products capable of meeting the required delay time.
Construction Team [c]	Need to program occupancy sensors delay time to 15 minutes or less. They possibly have been doing this already (but with 20 minutes)	None identified.
Building Departments [d]	The workflow remains the same; however, the occupancy sensor delay time will be set to 15 minutes or less instead of 20 minutes or less.	None identified. The proposed changes do not require inspectors to acquire new information/knowledge or modify their practice if the required controls are clearly specified in the design documents.
Verification Testers [e]	• The general workflow remains unchanged by the proposed changes. • For the occupant sensing control functional test, the ATT will now have to verify the delay time to be 15 minutes or less, instead of 20 minutes or less.	Provide educational materials to increase awareness of delay time requirement.
Building Owners, Managers, and Occupants	Reduced energy bills.	None identified.
Manufacturers and Distributors	Occupancy sensors must be capable of a delay time of 15 minutes or less.	Provide educational materials to increase awareness of delay time requirement.

a. Builders include builders and developers.

b. Design professionals include architects, interior designers, engineers (mechanical, electrical, plumbing, structural), specification writers, cost estimators, commissioning agents, lighting designers, and energy consultants.

c. Construction team includes general contractors, design-build contractors, installation contractors (e.g., HVAC, plumbing, electrical), commissioning agents, and tradespeople.

[32] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

d. Building departments include plans reviewers, building inspectors, specialty inspectors, permit counter technicians, and sustainability department staff.
e. Verification testers include commissioning agents, ECC Raters, and Acceptance Test Technicians.

The 2028 CASE Methodology Report presents a quantitative assessment of how changes to the California building code impact builders, building designers and energy consultants, and building owners and occupants. The analysis in the methodology report is not specific to the code change presented in this report. The following provides a qualitative description of how this specific code change affects various market actors and additional quantitative analyses of its potential impacts on building industry subsectors.

Builders. The proposed change would affect commercial builders; however, it would likely not impact firms focused on the construction or retrofitting of industrial buildings, utility systems, public infrastructure, or other heavy construction. The proposed change would not affect all firms and workers in the commercial building industries equally; instead, it would primarily affect specific subsectors within the industry. Table 35 lists the commercial building subsectors the Statewide CASE Team expects will be impacted by the changes proposed in this report.

The proposed measure primarily impacts nonresidential electrical contractors, who will be responsible for installing control systems that comply with the updated occupancy delay time.

The values in the table below are preliminary estimates and may be updated as the Statewide CASE Team continues data collection ***on impact to the commercial building industry in California. Finalized values will be included in the Final CASE Report.***

Table 35: Specific Subsectors of the California Commercial Building Industry Impacted by Proposed Change to Code/Standard by Subsector in 2025 (Estimated)[33]

Construction Subsector	Establishments*	Employment	Annual Payroll (Billions $)
Commercial Building Construction	5,491	87,450	$10.6
Nonresidential Poured Foundation Contractors	497	15,884	$1.4
Nonresidential Structural Steel Contractors	365	11,899	$1.1
Nonresidential Framing Contractors	137	3,037	$0.2

[33] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Construction Subsector	Establishments*	Employment	Annual Payroll (Billions $)
Nonresidential Masonry Contractors	217	4,028	$0.3
Nonresidential Glass and Glazing Contractors	307	5,079	$0.5
Nonresidential Roofing Contractors	385	11,413	$1.0
Nonresidential Siding Contractors	32	735	$0.1
Other Nonresidential Exterior Contractors	234	2,259	$0.1
Nonresidential Electrical Contractors	3,245	72,794	$7.8
Nonresidential Plumbing & HVAC Contractors	2,270	55,182	$5.8
Other Nonresidential Equipment Contractors	580	9,749	$1.1
Nonresidential Drywall Contractors	593	19,328	$1.8
Nonresidential Painting Contractors	501	9,225	$0.7
Nonresidential Flooring Contractors	286	4,011	$0.4
Nonresidential Tile and Terrazzo Contractors	151	2,223	$0.2
Nonresidential Finish Carpentry Contractors	313	3,697	$0.3
Other Nonresidential Finishing Contractors	492	7,241	$0.6
Nonresidential Site Preparation Contractors	1,147	19,273	$1.9
All Other Nonresidential Trade Contractors	948	17,084	$1.7

Source: Analysis by the Title 24 CASE Team of QCEW data from the California Employment Development Department https://labormarketinfo.edd.ca.gov/cgi/dataanalysis/areaselection.asp?tablename=industry

*An establishment is single economic unit, typically at one physical location, that engages in one, or predominantly one, type of economic activity for which a single industrial classification may be applied. Many businesses are composed of multiple establishments. US Bureau of Labor Statistics, Handbook of Methods. https://www.bls.gov/opub/hom/cew/concepts.htm

The current code requires nonresidential buildings to install occupancy sensors. Since this is already a requirement, the proposed measure would have no impact on manufacturers.

4.2.3 Compliance Software Updates

The proposed measure would require a minor update to the CBECC ruleset to change the occupancy sensor delay time from 20 minutes to 15 minutes in the standard design.

4.2.4 Cost of Enforcement

The Statewide CASE Team acknowledges that changes to the code will impact enforcement costs. This report is an evaluation of specific measures, and the collective impact of all proposed changes for the 2028 Title 24, Part 6 may represent an increase in training and/or workload for enforcement personnel. The Statewide CASE Team believes there would be no additional cost to ensure compliance with or enforce the proposed measure in the field. The commissioning and verification procedure would remain the same, except the occupancy sensors would be set with a 15-minute delay time instead of a 20-minute delay time. There would be minor additional costs for training on the new measure. There may be a minimal associated cost with updating CBECC to the proposed 15-minute sensor delay time.

The Statewide CASE Team will be researching and documenting the projected impact on plan checkers and building inspectors as well as additional administrative costs to manage and properly enforce the measure, including contacting AHJs and other stakeholders for estimates of additional staff time and training costs.

4.3 Reduce Occupant Sensing Control Delay time - Market and Economic Analysis

4.3.1 Market Structure and Availability

4.3.1.1 Current Market Structure and Availability

The Statewide CASE Team's market research into existing sensor time setpoint capabilities indicates that the proposed measure would not cause any designer or manufacturer challenges due to reducing the sensor delay time to 15 minutes. All available products are capable of meeting the sensor delay time decrease to 15 minutes.

4.3.1.2 Market Challenges and Solutions

There are not any anticipated market challenges for this proposed measure.

4.3.2 Design and Construction Practices

4.3.2.1 Current Design and Construction Practices

Setting or confirming the occupancy sensor delay time is a standard part of current lighting system initial commissioning at installation. The proposed measure would not require a change to the overall installation process, only a change to the delay time the installer selects. Manufacturers ship occupancy sensor and lighting controls products with default delay times. These default time delays for occupancy control vary between 15 and 30 minutes. For sensors with a default of 15 minutes, the controls would meet

the requirements out of the box and would need no further adjustments to meet the proposed requirements.

4.3.2.2 Health and Safety Considerations

The proposed code change does not alter any existing federal, state, or local regulations pertaining to safety and health, including rules enforced by the California Division of Occupational Safety and Health (DOSH). All existing health and safety rules would remain in place. The Statewide CASE Team does not anticipate that complying with the proposed code change will have adverse impacts on the safety or health of occupants or those involved with the construction, commissioning, and maintenance of the building.

If the Energy Code adopts the same modifications to delay times for HVAC occupied standby, the Statewide CASE Team does not anticipate any negative impacts on indoor air quality, because HVAC occupied standby is only required for space types that the Energy Code allows to have ventilation air reduced to zero. Similarly, the laboratory and factory exhaust system unoccupied minimum exhaust airflow requirements established minimum criteria to protect indoor air quality. The Statewide CASE Team reviewed this measure with HVAC design engineers and confirmed that there are no known impacts to health and safety associated with shortening the delay time for the signal to activate the occupied standby setting in the HVAC system for the impacted room.

4.3.2.3 Design and Construction Challenges and Solutions

The Statewide CASE Team is not aware of any significant barriers to implementing this measure within the construction industry, as it represents an incremental reduction to an existing occupancy sensor requirement.

Prior to the use of LEDs in commercial buildings, the main light source technology employed in nonresidential construction was linear fluorescent. That technology was sensitive to cycling ON and OFF and doing so would result in degradation of the cathode and anode, leading to decreased performance and shorter lamp life. This led to favoring longer sensor delay time settings to avoid these problems. Since LEDs are now the standard light source technology for interior lighting in California nonresidential buildings, this is no longer a concern because LED technology is not susceptible to frequent switching.

4.3.3 Energy Equity and Environmental Justice

The Statewide CASE Team assessed the potential impacts of the proposed measure, and based on a preliminary review, the measure is unlikely to have significant impacts on energy equity or environmental justice.

This section is still in progress. The Statewide CASE Team is continuing to engage with stakeholders to determine potential impacts on environmental and social justice (ESJ) communities and will update this section with any additional findings.

4.3.4 Impacts on Jobs and Businesses

This section will be completed for the Final CASE Report.

4.3.5 Economic and Fiscal Impacts

This section will be completed for the Final CASE Report.

4.4 Reduce Occupant Sensing Control Delay time - Cost Effectiveness

Cost effectiveness results in the section only consider the proposed changes to the lighting controls requirements. The Statewide CASE Team has not analyzed potential cost effectiveness of reducing the HVAC occupied standby delay to match the proposed lighting control requirement.

4.4.1 Cost Effectiveness Methodology

The Statewide CASE Team collaborated with the CEC staff to confirm that the cost-effectiveness methodology aligns with the CEC guidelines, including cost inclusion parameters. The 2028 CASE Methodology Report and Appendix A provide reproducibility details.

Per California Law (Public Resources Code 25000), a measure is considered cost effective if its Benefit-Cost Ratio (BCR) is 1.0 or greater, amortized over the economic life of the structure. The Statewide CASE Team calculates BCR by dividing total dollar benefits by total dollar costs over a 30-year analysis period.

Benefits are based on Long-term System Cost (LSC), which assigns an hourly dollar value to energy use. LSC hourly factors weigh the long-term value of each hour differently, with peak-demand hours valued more than off-peak hours. These factors are not utility rates, forecasts, or bill estimates. The CEC develops and publishes LSC hourly conversion factors for each code cycle.

Costs include first costs and ongoing maintenance costs assessed over the 30-year period. Benefits and costs are evaluated incrementally, relative to the most recently adopted Energy Code. The analysis excludes design costs and incremental code compliance verification costs.

4.4.2 Energy and Energy Cost Savings Results

The Statewide CASE Team created spreadsheet models to assess the potential reduction in energy and energy costs resulting from the proposed measure. These models simulated space vacancy patterns and identified the typical number of savings events occurring within a 24-hour period in the space types where the proposed measure would apply.

Savings events represent the frequency with which the space becomes unoccupied for more than 15 minutes, presenting an opportunity to save energy by transitioning from a 20-minute occupancy sensor to a 15-minute occupancy sensor. For example, in a private office, there may be five savings events (trigger points) per day, such as when the space becomes unoccupied during lunch, breaks, and at the end of the workday. The model distributes these events throughout each weekday and similarly through weekend days to create a simulated occupancy profile for the weekdays (Monday through Friday, excluding major holidays) and weekends (including holidays) when sparsely occupied.

The representative day the Statewide CASE Team used to model the weekday and weekend day is the Equinox, with 12 hours of sunlight and 12 hours of night, so the simulation includes a representative amount of daylight dimming to reduce the potential savings opportunity during times when daylighting is abundant.

The space types that the Statewide CASE Team chose to model represent the spectrum of occupancy patterns that are likely to occur in most building types in the state, including:

- Office – represents typical private and open office spaces.
- Entry/Lobby – represents entries, corridors, restrooms, and other spaces that have a high transient occupancy pattern.fWarehouse – represents typical non-refrigerated warehouse space occupancy patterns, considering the “aisle” lighting controls approach employed in most of these spaces.fClassroom – represents typical classroom conditions, with lower annual hours of occupancy and much more vacancy during the summer months.fParking garage – represents the high annual hours of occupancy and very low lighting power allowance found in parking garage spaces.fThe Statewide CASE Team created a yearly energy consumption model that projects the daily values into an 8760-hour profile to incorporate 365 days per year. In all cases, the Team adjusted the 8760 hours of operation of the lighting system to reflect the “full load equivalent” (FLE) hours of operation of the lighting system, considering the occupancy patterns and the daylight dimming potential.

The Statewide CASE Team simulation developed calculations on a per-square-foot basis to scale the savings potential up to building-construction prototype forecasts and

to perform calculations for several representative space types that cover the spectrum of potential occupancy patterns and lighting power allowances. With the space-type simulations completed, the Statewide CASE Team collected information on the building prototypes in the CBECC calculations to simulate statewide climate zone impacts of various measures. Lighting systems are not inherently climate zone dependent for the direct energy savings related to the measure, but the LSC value and building construction forecasts are dependent on climate zone, so the results that the Statewide CASE Team compiled were then scaled up through area weighted projections from the individual spaces to the building prototypes and then imported into the MeasureSET calculation tool to derive the first year and other savings outputs.

Table 36 through Table 38 present energy savings (electricity, natural gas, and source energy) and peak demand reductions per-unit. The expected per-unit savings for the first year range from 0.01 to 0.08 kWh/yr. The proposed measure would not result in any gas savings.

Table 39 presents total energy cost savings per unit for newly constructed buildings and additions in terms of LSC savings realized over a 30-year period, in 2029 PV$. The LSC methodology values peak electricity savings more than electricity savings during non-peak periods. Peak electricity savings depend on the occupancy patterns of the space and building types.

Occupancy shifts throughout the day and differs on weekdays and weekends, while non-occupancy periods occur at various times during the day. For example, in an office building, weekday lunch times around noon to 1:00 PM are assumed to be non-occupied periods. Most buildings that have normal daytime higher use and lower nighttime use will always be a portion of energy savings which occurs as the occupancy shifts toward lower occupancy, and this will likely occurr during peak evening hours.

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on first year electricity savings. Finalized values will be included in the Final CASE Report.

Table 36: First Year Electricity Savings (kWh) Per Square Foot – Occupancy Sensor[34]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Medium Office	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Small Office	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Large Retail	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Medium Retail	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Strip Mall	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Mixed-use Retail	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Large School	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Small School	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Non-refrigerated Warehouse	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Assembly	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Hospital	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Laboratory	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Restaurant	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Enclosed Parking Garage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Open Parking Garage	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Grocery	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Refrigerated Warehouse	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Controlled Environment Horticulture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vehicle Service	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manufacturing	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

[34] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on first year peak demand savings. Finalized values will be included in the Final CASE Report.

Table 37: First Year Peak Demand Reduction (kW) Per Square Foot – Occupancy Sensor[35]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medium Office	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Small Office	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Large Retail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medium Retail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Strip Mall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed-use Retail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Large School	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Small School	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-refrigerated Warehouse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Assembly	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hospital	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Laboratory	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restaurant	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Enclosed Parking Garage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Open Parking Garage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grocery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Refrigerated Warehouse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[35] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Controlled Environment Horticulture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vehicle Service	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacturing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on first year source energy savings. Finalized values will be included in the Final CASE Report.

Table 38: First Year Source Energy Savings (kBtu) Per Square Foot – Occupancy Sensor[36]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Medium Office	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Small Office	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Large Retail	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Medium Retail	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Strip Mall	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Mixed-use Retail	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Large School	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Small School	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Non-refrigerated Warehouse	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Assembly	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Hospital	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Laboratory	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Restaurant	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

[36] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Enclosed Parking Garage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Open Parking Garage	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Grocery	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Refrigerated Warehouse	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Controlled Environment Horticulture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vehicle Service	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Manufacturing	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on first year LSC savings. Finalized values will be included in the Final CASE Report.

Table 39: Total 30-Year LSC Savings (2029 PV$) Per Square Foot – Occupancy Sensor[37]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Large Office	2.54	2.52	2.52	2.53	2.54	2.47	2.51	2.55	2.55	2.56	2.53	2.54	2.52	2.53	2.52	2.55
Medium Office	2.54	2.52	2.52	2.53	2.54	2.47	2.51	2.55	2.55	2.56	2.53	2.54	2.52	2.53	2.52	2.55
Small Office	2.54	2.52	2.52	2.53	2.54	2.47	2.51	2.55	2.55	2.56	2.53	2.54	2.52	2.53	2.52	2.55
Large Retail	0.57	0.56	0.56	0.56	0.57	0.55	0.56	0.56	0.57	0.57	0.56	0.57	0.56	0.56	0.56	0.57
Medium Retail	0.75	0.75	0.75	0.75	0.75	0.73	0.74	0.75	0.75	0.76	0.75	0.75	0.75	0.75	0.75	0.75
Strip Mall	0.71	0.70	0.70	0.70	0.71	0.69	0.70	0.70	0.71	0.71	0.70	0.71	0.70	0.70	0.70	0.71
Mixed-use Retail	0.75	0.75	0.75	0.75	0.75	0.73	0.74	0.75	0.75	0.76	0.75	0.75	0.75	0.75	0.75	0.75
Large School	1.85	1.84	1.84	1.83	1.83	1.80	1.82	1.84	1.82	1.85	1.83	1.83	1.82	1.84	1.82	1.83
Small School	2.10	2.08	2.09	2.08	2.07	2.04	2.06	2.09	2.07	2.09	2.07	2.08	2.07	2.09	2.06	2.07
Non-refrigerated Warehouse	1.65	1.63	1.63	1.63	1.65	1.60	1.62	1.63	1.64	1.64	1.63	1.65	1.63	1.61	1.63	1.64
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Assembly	2.33	2.32	2.31	2.32	2.32	2.27	2.30	2.35	2.34	2.35	2.32	2.33	2.32	2.34	2.31	2.35
Hospital	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Laboratory	2.26	2.25	2.24	2.25	2.26	2.20	2.23	2.27	2.27	2.28	2.25	2.26	2.25	2.25	2.24	2.27
Restaurant	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.24	0.24	0.24	0.25	0.24	0.25
Enclosed Parking Garage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Open Parking Garage	0.98	0.98	0.98	0.98	0.98	0.99	0.98	0.97	0.98	0.97	0.97	0.98	0.98	0.96	0.99	0.97
Grocery	0.78	0.78	0.78	0.78	0.78	0.76	0.77	0.78	0.78	0.78	0.78	0.78	0.78	0.77	0.77	0.78
Refrigerated Warehouse	1.57	1.56	1.56	1.56	1.57	1.52	1.54	1.56	1.57	1.57	1.56	1.57	1.56	1.54	1.55	1.57
Controlled Environment Horticulture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vehicle Service	0.40	0.40	0.40	0.40	0.40	0.39	0.40	0.40	0.40	0.41	0.40	0.40	0.40	0.40	0.40	0.40
Manufacturing	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.38	0.39	0.38	0.39	0.38	0.39

[37] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

4.4.3 Incremental First Cost

The proposed measure has no incremental first costs. The proposed case does not require different equipment or materials, nor different installation procedures than the base case. This is an incremental improvement to the existing lighting controls requirement in the code. Verification testing costs could decrease as ATTs spend time on acceptance testing overall; instead of waiting 20 minutes to confirm performance for functional tests, they now only need to wait 15 minutes per test.

4.4.4 Incremental Maintenance and Replacement Costs

There are no associated incremental maintenance and replacement costs for the proposed measure because the measure is an incremental improvement (reduction) in the existing lighting controls requirements in the code.

The Statewide CASE Team feels that since the proposed measure is likely to very slightly reduce actual operating hours for the lighting system (by approximately 4% of FLE hours), there is a chance that the lighting system life will be slightly lengthened, but since this is a no-cost code change, the calculations do not include this.

4.4.5 Cost Effectiveness

Results of the per-unit cost-effectiveness analyses are presented in Table 40 and Table 41 for new construction/additions and alterations, respectively.

In the tables below, all values are presented in 2026 present value dollars (2029 PV$). Benefits represent 15-year LSC savings and other savings, including incremental first-cost savings if the proposed first cost is less than the current first cost, incremental maintenance cost savings if the proposed maintenance costs are less than the current maintenance costs, and incremental residual value if proposed residual value is greater than current residual value at the end of the 15-year period of analysis. Costs represent the total incremental PV cost, including incremental equipment, replacement, and maintenance costs over the period of analysis. The analysis treats a negative incremental maintenance cost as a positive benefit. If total incremental costs are zero, the benefit-cost ratio (BCR) is considered infinite. Costs and other savings are discounted at a real (inflation-adjusted) three percent rate. If there are no total incremental PV costs, the BCR is infinite.

The values in the table below are preliminary estimates may be updated as the Statewide CASE Team continues data collection and analysis on cost effectiveness. Finalized values will be included in the Final CASE Report.

Table 40: 15-Year Cost-Effectiveness Summary Per Square Foot – New Construction and Additions[38]

Building Prototype	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
Large Office	$4.60	$0	infinite
Medium Office	$4.60	$0	infinite
Small Office	$4.60	$0	infinite
Large Retail	$1.02	$0	infinite
Medium Retail	$1.36	$0	infinite
Strip Mall	$1.28	$0	infinite
Mixed-use Retail	$0	$0	0
Large School	$3.35	$0	infinite
Small School	$3.80	$0	infinite
Non-refrigerated Warehouse	$2.98	$0	infinite
Hotel	N/A	N/A	N/A
Assembly	$4.23	$0	infinite
Hospital	N/A	N/A	N/A
Laboratory	$4.09	$0	infinite
Restaurant	$0.45	$0	infinite
Enclosed Parking Garage	N/A	N/A	N/A
Open Parking Garage	$1.78	$0	infinite
Grocery	$1.41	$0	infinite
Refrigerated Warehouse	$2.84	$0	infinite
Controlled Environment Horticulture	N/A	N/A	N/A
Vehicle Service	$0.73	$0	infinite
Manufacturing	$0	$0	0

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on cost effectiveness. Finalized values will be included in the Final CASE Report.

[38] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Table 41: 15-Year Cost-Effectiveness Summary Per Square Foot – Alterations[39]

Building Prototype	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
Large Office	$4.60	$0	infinite
Medium Office	$4.60	$0	infinite
Small Office	$4.60	$0	infinite
Large Retail	$1.02	$0	infinite
Medium Retail	$1.36	$0	infinite
Strip Mall	$1.28	$0	infinite
Mixed-use Retail	$0	$0	0
Large School	$3.35	$0	infinite
Small School	$3.80	$0	infinite
Non-refrigerated Warehouse	$2.98	$0	infinite
Hotel	N/A	N/A	N/A
Assembly	$4.23	$0	infinite
Hospital	N/A	N/A	N/A
Laboratory	$4.09	$0	infinite
Restaurant	$0.45	$0	infinite
Enclosed Parking Garage	N/A	N/A	N/A
Open Parking Garage	$1.78	$0	infinite
Grocery	$1.41	$0	infinite
Refrigerated Warehouse	$2.84	$0	infinite
Controlled Environment Horticulture	N/A	N/A	N/A
Vehicle Service	$0.73	$0	infinite
Manufacturing	$0	$0	0

[39] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

4.5 Reduce Occupant Sensing Control Delay time - Statewide Impacts

Statewide impacts result in the section only considering the proposed changes to the lighting controls requirements. The Statewide CASE Team has not analyzed the potential statewide impacts of reducing the HVAC occupied standby delay to match the proposed lighting control requirement.

4.5.1 Statewide Energy and Energy Cost Savings

See the 2028 CASE Methodology Report for details on how statewide savings are calculated. Appendix C presents the assumptions on the percentage of the total construction forecast that the proposed measure would impact.

For more details on the methodology and context about estimating the current market share rate, as well as statewide energy and energy cost savings, see the 2028 CASE Methodology Report.

The tables below present the first-year statewide energy and LSC savings from newly constructed buildings and additions (Table 42) and alterations (Table 43) by climate zone. Table 44 presents first-year statewide savings from new construction, additions, and alterations.

The proposed measure incrementally reduces the time unoccupied spaces remain illuminated, resulting in small statewide energy and LSC savings

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on statewide impacts. Finalized values will be included in the Final CASE Report.

Table 42: Statewide Energy and LSC Impacts – New Construction and Additions[40]

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2026 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (Million Therms)	First-Year Natural Gas Savings (Million Therms) First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	405,097	0.02	0.00	-	0.03	$1.33
2	3,069,224	0.18	0.01	-	0.28	$10.16
3	16,631,224	1.02	0.04	-	1.62	$51.24
4	8,727,514	0.54	0.02	-	0.86	$25.79
5	1,305,258	0.07	0.00	-	0.11	$4.20
6	12,496,124	0.78	0.03	-	1.29	$32.90
7	7,296,259	0.44	0.01	-	0.71	$21.37
8	16,074,677	0.95	0.04	-	1.54	$45.61
9	23,892,276	1.33	0.06	-	2.08	$71.39
10	10,419,693	0.51	0.03	-	0.81	$28.78
11	2,431,106	0.12	0.01	-	0.18	$7.31
12	14,202,608	0.77	0.05	-	1.20	$45.08
13	4,681,463	0.22	0.02	-	0.35	$13.56
14	2,669,147	0.13	0.01	-	0.21	$7.33
15	1,588,369	0.08	0.01	-	0.12	$4.52
16	918,698	0.05	0.00	-	0.08	$2.59
Total	**126,808,736**	**7.22**	**0.34**	**-**	**11.47**	**$373.18**

[40] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on statewide impacts. Finalized values will be included in the Final CASE Report.

Table 43: Statewide Energy and LSC Impacts – Alterations[41]

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2026 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (Million Therms)	First-Year Natural Gas Savings (Million Therms) First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	1,706,734	0.09	0.00	-	0.15	$5.54
2	10,493,908	0.59	0.03	-	0.91	$32.98
3	52,044,260	3.01	0.14	-	4.69	$163.85
4	27,494,234	1.64	0.07	-	2.57	$86.29
5	4,815,466	0.27	0.01	-	0.42	$15.07
6	38,658,286	2.09	0.11	-	3.27	$112.41
7	28,481,728	1.60	0.07	-	2.50	$84.97
8	57,525,554	3.19	0.16	-	5.03	$171.83
9	90,774,255	4.99	0.26	-	7.80	$274.94
10	55,387,867	2.64	0.22	-	4.11	$155.41
11	10,146,979	0.50	0.04	-	0.78	$29.87
12	53,988,858	2.87	0.18	-	4.45	$164.33
13	19,790,958	0.96	0.07	-	1.49	$56.64
14	12,852,543	0.63	0.05	-	0.98	$35.63
15	7,483,839	0.35	0.03	-	0.53	$20.94
16	4,080,754	0.21	0.01	-	0.33	$11.49
Total	**475,726,221**	**25.61**	**1.46**	**-**	**40.03**	**$1,422.20**

[41] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis on statewide impacts. Finalized values will be included in the Final CASE Report.

Table 44: Statewide Energy and LSC Impacts – New Construction, Additions, and Alterations[42]

Construction Type	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First -Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
New Construction & Additions	7.2	0.3	-	11.5	373
Alterations	25.6	1.5	-	40.0	1,422
Total	**32.8**	**1.8**	**-**	**51.5**	**1,795**

[42] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

4.5.2 Statewide Greenhouse Gas Emissions Reductions

Table 45 presents the estimated first-year reduction in GHG emissions resulting from the proposed code change. In this initial year, the Statewide CASE Team expects to avoid 49,105 metric tons of carbon dioxide equivalent (CO_2e) emissions. These reductions, along with their associated monetary value, were calculated using hourly GHG emissions factors published alongside the LSC hourly factors and source energy hourly factors in the research versions of CBECC, as well as data from the CEC's 2028 Metrics Report. See the 2028 CASE Methodology Report for additional information.

These GHG emission reduction estimates are based on the preliminary per-unit savings in the section above and the Statewide CASE Team will update them in the Final CASE Report as they continue to collect data and refine the estimates.

Table 45: First-Year Statewide GHG Emissions Impacts[43]

Construction Type	Reduced GHG Emissions from Electricity Savings (Metric Tons CO_2e)	Reduced GHG Emissions from Natural Gas Savings (Metric Tons CO_2e)	Total Reduced GHG Emissions (Metric Ton CO_2e)	Total Monetary Value of Reduced GHG Emissions ($)
New Construction & Additions	607	0	607	$74,752
Alterations	2,118	0	2,118	$260,794
Total	**2,725**	**0**	**2,725**	**$335,546**

4.5.3 Statewide Water Use Impacts

The proposed code change will not result in water use impacts.

4.5.4 Statewide Material Impacts

The proposed measure would not result in any material impacts.

4.5.5 Environmental Impacts

The proposed measure would not have any significant environmental impacts.

4.5.6 Other Non-Energy Impacts

The proposed measure would not have other non-energy impacts.

[43] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

4.6 Reduce Occupant Sensing Control Delay time - Proposed Language Code

The proposed code language in this section includes only changes relevant to this measure. The intent is to clearly illustrate the scope of this measure. The proposed code language that encompasses the changes resulting from all the measures in this CASE Report can be found in Appendix F.

4.6.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents should be marked with dark blue underlining (new language) and ~~strikethroughs~~ (deletions).

4.6.2 Administrative Code (Title 24, Part 1)

There are no proposed changes to Title 24, Part 1.

4.6.3 Energy Code (Title 24, Part 6)

4.6.3.1 Proposed Lighting Controls Code Language

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

(c) **Shut-OFF Controls.** All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is typically unoccupied.

1. All installed indoor lighting shall be equipped with controls that meet the following requirements:

A. Shall be controlled with an occupant sensing control set to no more than a ~~20~~15-minute delay time, automatic time-switch control, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and

…

5. **Occupant sensing controls.** In offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, classrooms of any size, conference rooms, and restrooms, lighting shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting in ~~20~~15 minutes or less after the control zone is unoccupied.

…

6. **Full or partial-OFF occupant sensing controls.**

…

D. In office spaces greater than 250 square feet, general lighting shall be controlled with occupant sensing controls that meet all of the following:

…

ii. In ~~20~~15 minutes or less after the control zone is unoccupied, the occupant sensing controls shall uniformly reduce lighting power in the control zone to no more than 20 percent of full power. Control functions that switch control zone lights completely off when the zone is vacant meet this requirement; and

iii. In ~~20~~15 minutes or less after the entire office space is unoccupied, the occupant sensing controls shall automatically turn off lighting in all control zones in the space; and

…

4.6.3.2 Potential HVAC Controls Code Language for Alignment with Proposed Lighting Controls Code Language

SECTION 120.1 – REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY

(d) **Operation and control requirements for minimum quantities of outdoor air.**

…

5. **Occupied Standby Zone Controls.**

…

B. Occupied-standby zone controls shall comply with the following:

i. Occupant sensors shall have suitable coverage and placement to detect occupants in the entire space. In ~~20~~15 minutes or less after no occupancy is detected by any sensors covering the room, occupant sensing controls shall indicate a room is vacant.

SECTION 140.9 – REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY

(c) **Prescriptive requirements for laboratory and factory exhaust systems.**

…

1. **Airflow reduction requirements.** Building laboratory exhaust systems shall be able to reduce zone exhaust and makeup airflow rates to the occupied and unoccupied minimum exhaust airflow rates based on demand and sensed occupancy as follows:
   …

C. Unoccupied minimum exhaust airflow. Within ~~20~~15 minutes of no occupancy being detected by occupant sensors covering the space, the minimum exhaust and makeup airflow rates shall be the greater of:

i. User defined airflow not to exceed 0.67 cfm/ft2 (equivalent to 4 air changes per hours for a 10-foot high ceiling), or

ii. The regulated minimum unoccupied circulation rate documented to comply with code, accreditation, or facility environmental health and safety department requirements, or

iii. The minimum needed to maintain unoccupied pressurization.

4.6.4 Reference Appendices

4.6.4.1 Proposed Modifications to Reference Appendices for Lighting Controls

NA7.6.2.3 Occupant Sensing Lighting Controls Functional Testing

This requirement applies to areas where occupant sensing controls are required to comply with Section 130.1(c) with the exception of Section 130.1(c)6D.

For each sensor to be tested do the following:

(a) Unoccupied Test. Simulate an unoccupied condition in the controlled space. Verify and document the following:

1. The occupant sensing control turn the controlled lighting off or partially-off in ~~20~~15 minutes or less from the start of an unoccupied condition. In addition:

   a. For partial-on occupant sensing controls, occupant sensing controls and vacancy sensing controls, the controlled lighting is turned off in unoccupied condition.

…

4.6.4.2 Potential Modifications to Reference Appendices for HVAC Controls

NA7.5.17 Occupied Standby

…

NA7.5.17.2 Functional Testing

…

Step 7: For space conditioning systems that also provide ventilation to the zone, confirm that within 5 minutes of occupant sensing controls indicating that the zone is unoccupied the setpoint is setup or setback and the zone is within the occupied standby

deadband. Occupant sensing controls may have a time delay of up to ~~20~~15 minutes before indicating the space is unoccupied and occupant sensing zone controls may allow up to an additional 5 minute time delay after occupant sensing controls have indicated all rooms served by the zone are unoccupied before resetting zone temperature setpoints and shutting off zone ventilation air).

…

NA7.16.2 Functional Testing for VAV Lab Exhaust System with Occupancy Controls

…

Step 3: Simulate minimum flowrate under unoccupied conditions by adjusting fume hoods and other exhaust devices and vacate all lab spaces served by the exhaust fan system for at least ~~20~~15 minutes so occupant control treats lab spaces as unoccupied. Adjust the thermostatic control so that the space temperature is within the dead band.

…

4.6.5 Compliance Manuals

The Statewide CASE Team will provide the CEC with recommended revisions to compliance manuals after the 45-Day Language is published.

4.6.6 ACM Reference Manual

There are no proposed changes to the ACM Reference Manual. Since this measure applies to the mandatory lighting controls sections, there is no alternate pathway for the controls in the modeling software.

4.6.7 Compliance Forms

As discussed in Section 4.1.4.5, the proposed measure would require updates to the SHUT-OFF LIGHTING CONTROL 2025-CEC-NRCA-LTI-02-A compliance form to reflect the updated sensor delay time. The Statewide CASE Team can support the CEC in implementing these updates if the proposed change is adopted.

Any modifications to HVAC occupied standby delay time would require revisions to the associated compliance forms to reflect the change in delay time from 20 minutes to 15 minutes. Associated compliance forms include NRCA-MCH-19-A Occupied Standby and NRCA-PRC14b-F Lab Exhaust – Test and Balance.

5. Update Multilevel Lighting Controls Requirements

5.1 Update Multilevel Lighting Controls Requirements

5.1.1 Proposed Code Change

The proposed code change aims to clarify the current code requirements on multilevel lighting controls and update the trigger to the requirement. The proposal would improve the code language in specifying manual dimmer requirements and the continuous dimming capability required for other control strategies, such as daylight responsive controls and demand responsive lighting controls. The proposal would also revise the trigger to the requirements, which were previously determined based on traditional light sources, to reflect LED lighting technologies, as well as align the trigger specification with other mandatory control requirements.

The proposal would result in the following changes:

- Requirements that pertain to manual dimmers would be moved to the Manual Controls section, Section 130.1(a). In addition to the original on/off switching requirements, Section 130.1(a) would have additional requirements specifying spaces and conditions where manual dimmers are required. The functional requirements for manual dimmers would also be specified in this section.
- The trigger for requiring manual dimmers would be specified in wattage of the connected general lighting load, instead of in lighting power density for the current multilevel lighting controls requirements.
- Any reference to multilevel lighting controls in other mandatory control sections, including occupant sensing controls in Section 130.1(c), daylight responsive controls in Section 130.1(d), and demand responsive lighting controls in Section 110.12(c), would be removed. The dimming capability required for those control strategies would be directly specified in each respective section.

As a result, the current multilevel lighting controls section, Section 130.1(b), would be removed in its entirety, except for Group R occupancies and common or public use areas. References to multilevel lighting controls in the prescriptive requirements sections would be updated accordingly.

Table 46 summarizes the scope of the proposed code change.

Table 46: Scope of Proposed Code Change[44]

A ☑ indicates the proposed code change is relevant.

Building Type(s)	Construction Type(s)	Type of Change
☐ Single Family	☑ New Construction	☑ Mandatory
☐ Multifamily	☑ Additions	☐ Prescriptive
☑ Nonresidential (Not Group R uses)	☑ Alterations	☐ Performance

Application Climate Zones	Energy Code Sections	Compliance Forms	Sections of ACM Reference Manuals
Climate Zones 1-16	Part 6, Section 130.1 Nonresidential Reference Appendix Section NA7.6.1	NRCC-LTI-E LMCC-LTI-E NRCC-PRF-E NRCI-LTI-E LMCI-LTI-E NRCA-LTI-03-A	Mandatory

Third Party Verification)	Updates to Compliance Software
☐ No changes to third party verification	☐ No updates
☑ Update existing verification requirements	☑ Update existing feature
☐ Add new verification requirements	☐ Add new feature

5.1.2 Benefits of Proposed Change

The proposed code changes aim to clarify when manual dimmers are required, using dedicated language to avoid confusion. It also revises the code language to explicitly describe when continuous dimming is required for each mandatory control requirement, without cross-referencing between code sections. Specifying the requirement trigger in general lighting wattage also aligns the trigger specification with other mandatory lighting controls requirements, avoiding multiple metrics for determining the required controls.

In addition, the proposed changes align with industry's best practices to increase occupant satisfaction and avoid lighting control actions (e.g., sudden switching off from full-power level due to daylighting controls) that could confuse and potentially upset occupants.

[44] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

5.1.3 Background Information

The 0.5 watts per square foot threshold for requiring multilevel lighting controls has been in place since the pre-LED era and was based on legacy light sources such as fluorescent and incandescent. Since the code transitioned to the LED baseline during the 2019 code cycle, this threshold has not been updated accordingly. With LEDs' high efficacy and being continuously dimmable with no or minimal additional cost, this threshold should be recalibrated and revised based on current technologies. At the beginning of this code cycle, the California Energy Alliance (CEA) also recommended revising the current threshold for triggering the multilevel lighting controls requirement. Rather than creating a second CASE report, the topic was absorbed in this effort and the CEA remained engaged in the process.

Furthermore, the code language does not clearly stipulate the intent of multilevel lighting controls. It could be interpreted as requiring the capability of continuous dimming that other controls can utilize, or as a physical dimmer for manual dimming. The Compliance Manual also does not elaborate on the requirements. This ambiguity can cascade and needs clarification, as several other mandatory control sections, including demand responsive lighting controls, occupant sensing controls, and daylight responsive controls, reference multilevel lighting controls since the 2025 code cycle. For example, if interpreted as requiring manual dimmers, referencing multilevel lighting controls in daylight responsive controls could be interpreted as allowing the use of manual dimmers as a means for daylighting controls. The 0.5 watts per square foot trigger for multilevel lighting controls could also result in daylit spaces having to implement daylight responsive controls (i.e., with a connected lighting load of 75 watts or greater) without multilevel lighting controls (i.e., with a lighting power density of 0.5 watts per square foot or less). In this case, daylight responsive controls may be implemented with on/off switching; the lights would stay at full power until daylight illuminance exceeds 150 percent of the design illuminance, at which the lights would be turned off. This sudden change in electric light level would be noticeable and could cause confusion and frustration for occupants.

Specifying the trigger for multilevel lighting controls based on lighting power density results in multiple metrics being used to determine the required lighting controls, complicating the workflow for market actors. For example, the trigger for requiring daylight responsive controls and demand responsive lighting controls are both specified in wattages, leading to the need for separately evaluating lighting power density to determine whether multilevel lighting controls are required.

5.1.4 Modifications to Energy Code Documents

This section provides descriptions of how the proposed code change will affect each Energy Code document. See Section 5.6 of this report for detailed revisions to code language.

5.1.4.1 Energy Code Change Summary

The changes to the code sections are summarized in order of significance and interrelationship with other code sections, instead of in sequential order. The proposed changes apply to all nonresidential occupancies, except Group R occupancies and common or public use areas. The requirements would remain unchanged from 2025 Title 24, Part 6, for Group R occupancies and common or public use areas.

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

Subsection 130.1(b): For all spaces in nonresidential buildings, the proposed regulations remove subsection 130.1(b) Multilevel Lighting Controls and move the requirements related to manual dimmers and continuous dimming into other mandatory controls subsections for clarity. For Group R occupancies and common or public use areas, subsection 130.1(b) remains applicable; however, the proposed regulations convert the trigger for multilevel lighting controls to be based on general lighting wattage. The value of this wattage trigger has the same stringency as the original trigger specified in lighting power density.

Subsection 130.1(a): The proposed regulations move the manual dimmer requirements in subsection 130.1(b) Multilevel Lighting Controls to this section as part of the Manual Controls requirements. The proposed regulations also specify the trigger for requiring manual dimmers in general lighting wattage.

Subsection 130.1(d): The proposed regulations remove references to subsection 130.1(b) Multilevel Lighting Controls in this subsection and directly require continuous dimming for daylight responsive controls. This removes the ability to use on/off switching to meet the daylight responsive controls requirements if the space is exempt from multilevel lighting controls. The proposed regulations also mandate that daylight responsive controls regain control of the light level after being overridden by the manual dimmer to temporarily raise the electric light level.

Subsection 130.1(c): The proposed regulations remove references to subsection 130.1(b) Multilevel Lighting Controls in this subsection and directly specify the criteria for meeting the partial-on requirement.

SECTION 110.12 – MANDATORY REQUIREMENTS FOR DEMAND MANAGEMENT

Subsection 110.12(c): The proposed regulations remove references to subsection 130.1(b) Multilevel Lighting Controls in this subsection and directly require continuous dimming for demand responsive lighting controls.

SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

Subsection 120.6(h): The proposed regulations remove references to subsection 130.1(b) Multilevel Lighting Controls and directly require manual dimmers for horticultural lighting that meets the original criteria.

SECTION 140.6 – PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

Subsection 140.6(a): The proposed regulations remove references to subsection 130.1(b) Multilevel Lighting Controls and directly require continuous dimming for utilizing the PAF related to demand responsive lighting controls.

Subsection 140.6(c): The proposed regulations remove references to subsection 130.1(b) Multilevel Lighting Controls and directly require manual dimmers for controlling additional lighting in videoconferencing studios.

SECTION 141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINAIRED SIGNS

Table 141.0-F: The proposed regulations remove references to subsection 130.1(b) Multilevel Lighting Controls in the table.

5.1.4.2 Reference Appendices Change Summary

Nonresidential Appendix (NA) 7.6.1 – Daylight Responsive Controls Acceptance Test: The proposed changes would update NA7.6.1.5 Stepped Switching or Stepped Dimming Control Systems Functional Testing and remove the test method for on/off stepped switching and any relevant references.

5.1.4.3 Compliance Manuals Change Summary

The section on Mandatory Lighting Controls would be updated to remove the Multilevel Lighting Controls subsection as well as any reference to multilevel lighting controls and its code section number, 130.1(b). Manual dimmer requirements would be added to the Manual Controls subsection. The partial-off and partial-on requirements in the Shut-Off Controls subsection would be explained without referencing multilevel lighting controls. The Daylight Responsive Controls and Demand Responsive Lighting Controls subsections would be updated to remove any reference to multilevel lighting controls and explain the continuous dimming requirements for these controls.

The subsection on Lighting Control Interactions – Considerations for Spaces with Daylight Responsive Controls and Multilevel Lighting Controls would be updated to

remove any references to on/off stepped switching controls for daylight responsive controls in spaces exempted from multilevel lighting controls requirements.

Overall, references to Code Section 130.1(b) will be removed throughout the compliance manuals, and appropriate edits will be made to ensure the document's coherence and accurate interpretation of the code.

5.1.4.4 Alternative Calculation Method Reference Manual Change Summary

The proposed change does not modify any modeling assumptions or parameters in the ACM Reference Manual.

5.1.4.5 Compliance Forms Change Summary

The Certificates of Compliance (NRCC-LTI-E, LMCC-LTI-E and NRCC-PRF-E) forms would need to be updated to remove the fields related to multilevel lighting controls and mentions of the 130.1(b) code section.

The Certificates of Installation (NRCI-LTI-E and LMCI-LTI-E) form would need to be updated to remove the fields related to multilevel lighting controls.

The Certificates of Acceptance (NRCA-LTI-03-A) form would need to be updated to remove the test and verification steps for controls that have zero dimming step between on and off, i.e., daylight responsive controls using on/off switching.

5.1.5 Measure Context

5.1.5.1 Comparable Model Codes or Standards

ASHRAE 90.1-2022 has multilevel lighting control requirements (Section 9.4.1.1.d). However, unlike Title 24 code language, the section is clear about its intention of requiring manual dimmers by stipulating that general lighting be manually controlled with continuous dimming to 10 percent or less of full lighting power. Determining whether multilevel lighting control is required is based on space type, and no other exceptions were provided.

ASHRAE 90.1-2022 (Sections 9.4.1.1.e and 9.4.1.1.f) requires photocontrols to reduce electric lighting power in response to available daylight using continuous dimming for both sidelighting and toplighting areas. It does not provide any exceptions to allow the use of on/off switching, stepped switching, or stepped dimming with automatic daylight responsive controls.

IECC-2024 (Section C405.2.5.3) required dimming controls in a list of space types. Dimming control is a manual dimmer requirement, as it clearly stipulates that the controls be manual controls allowing lights to be dimmed from full output to 10 percent of full power or lower with continuous dimming.

IECC-2024 (Section C405.2.4.1) requires daylight responsive controls to dim the lights continuously and does not provide any exceptions for the use of on/off switching, stepped switching, or stepped dimming.

The proposed change brings the Title 24 requirements more in line with the national standards and model codes.

5.1.5.2 Interactions with Other Regulations

The proposed code change is not duplicative of or in conflict with any applicable federal, state, or local regulations.

5.2 Update Multilevel Lighting Controls Requirements - Compliance and Enforcement

5.2.1 Compliance Considerations

The proposed code change would slightly modify and simplify the compliance process. Multilevel lighting controls are no longer required to be separately identified on the compliance forms. Instead, manual dimmers, where required or specified, would need to be identified on the plans and compliance forms. Identifying manual dimmers on the plans has been a common practice, and the proposed change codifies the manual dimmer requirement in a dedicated subsection.

The proposed code change would require the use of continuous dimming for all daylight-responsive controls. This eliminates the decision-making complication for specifiers—including designers, engineers, energy consultants, electrical contractors/installers, commissioning providers, and Acceptance Test Technicians (ATTs)—who previously had to determine between on/off switching and continuous dimming for daylight responsive controls, depending on whether multilevel lighting controls exceptions are met. The proposed code change would not alter the enforcement workflow or modify the existing testing and verification procedures. The number of tests and verifications may increase slightly due to increased continuous dimming for daylight-responsive controls.

5.2.2 Impact on Market Actors

Table 47 **summarizes impacts on market actors and suggests outreach and education that might be helpful to support market actors as they prepare for the effective date of the requirements.**

Table 47: Impacts on Market Actors and Suggested Training and Education Opportunities[45]

Market Actor	Impact(s)	Suggested Outreach and Education
Builders [a]	Minimal impact, if any.	
Design Professionals [b]	Lighting designers and electrical engineers would need: • Specify manual dimmers and continuously dimmable lighting in the impacted spaces and correctly reflect the manual dimmers on the drawings. • Specify continuously dimmable lighting in all daylit zones where daylight responsive controls are required. Energy consultants would need to advise and confirm with the design team that the impacted spaces have manual dimmers and continuous dimmable lighting.	• Provide informational references to help identify spaces that require manual dimmers. • Provide informational references to highlight that continuous dimming is required in all daylit zones where daylight responsive controls are required. • Include the code changes in any compliance tool to better support the updated requirements. • Included the code changes in the NRCC forms that support the impacted control requirements.
Construction Team [c]	Electrical contractors and installers would need to expect that: • The total number of manual dimmers would increase due to the code change. • Photocontrols will always need to be wired and programmed with continuous dimming due to the code change. • The overall time required to install, wire, and program the lighting control systems may increase. Commissioning providers would need to expect that: • More spaces will have manual dimmers, which will need to be programmed appropriately to allow continuous dimming of the lights. In daylit spaces where manual dimmers are not required, continuous dimming still needs to be	• Provide materials to educate electrical contractors and installers on the updated control requirements and their impacts on the control products used on the jobs. • Provide informational references to help clearly identify spaces where manual dimmers are required. • Provide informational references to increase awareness that continuous dimming is required for daylight responsive controls in daylit zones, with the exception of HID and induction light sources, where step dimming is still allowed. • Confirm the NRCC forms support the required acceptance testing triggers for the commissioning providers to coordinate with.

[45] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Market Actor	Impact(s)	Suggested Outreach and Education
	programmed for daylight responsive controls.	
Building Departments [d]	Plans examiners would need to confirm: • Manual dimmers are reflected on the drawings for spaces required by code. • Luminaires in daylit zones, where daylight responsive controls are required, are capable of continuous dimming. Building inspectors would need to: • Expect more spaces will now have manual dimmers. • Verify that all daylight responsive controls are implemented with continuous dimming, except for HID and induction light sources.	• Provide training and reference materials to help clearly identify the spaces where manual dimmers are required. • Update the NRCC forms to clearly support the updated control requirements. • Update the NRCI forms to clearly support the updated control requirements so they can be used as an inspection tool for building inspectors to follow and educate the contractors on how to comply with these new requirements.
Verification Testers [e]	Commissioning providers would need to: • Program the manual dimmers in the impacted spaces to allow continuous dimming of the lights. • Program daylight responsive controls with continuous dimming in all daylit zones where daylight responsive controls are required. Acceptance Test Technicians (ATTs) would need to: • Only perform the Stepped Switching or Stepped Dimming Control System Functional Test on HID and induction light sources and perform Continuous Dimming Control System Functional Test on all other light sources. • Expect an increase in overall time for the acceptance test, as it typically takes longer to perform the Continuous Dimming Control System Functional Test than the Stepped Switching or Stepped Dimming Control System Functional Test.	• Provide informational references to help clearly identify spaces where manual dimmers are required. • Provide informational references to increase awareness that continuous dimming is required for daylight responsive controls in daylit zones, with the exception of HID and induction light sources, where step dimming is still allowed. • Confirm the NRCC forms support the required acceptance testing triggers for the commissioning providers to coordinate with. • Confirm the NRCA forms are updated to clearly specify the use of the Continuous Dimming Control System Function Test, except for HID and induction light sources.

Market Actor	Impact(s)	Suggested Outreach and Education
Building Owners, Managers, and Occupants	• Reduced energy bills. • More control flexibility and light level options for the occupants enabled by the manual dimmers. • Better occupant experiences with daylight responsive controls implemented with continuous dimming.	• Provide informational references to highlight benefits of adding manual dimmers and implementing daylight responsive controls with continuous dimming.
Manufacturers and Distributors	• Sell more continuous dimming products.	• Provide references that highlight the impacts of the code change on the products used on the job, so manufacturers and distributors can recommend appropriate products and solutions to their customers.

a. Builders include builders and developers.
b. Design professionals include architects, interior designers, engineers (mechanical, electrical, plumbing, structural), specification writers, cost estimators, commissioning agents, lighting designers, and energy consultants.
c. Construction team includes general contractors, design-build contractors, installation contractors (e.g., HVAC, plumbing, electrical), commissioning agents, and tradespeople.
d. Building departments include plan reviewers, building inspectors, specialty inspectors, permit counter technicians, and sustainability department staff.
e. Verification testers include commissioning agents, ECC Raters, and Acceptance Test Technicians.

The 2028 CASE Methodology Report presents a quantitative assessment of how changes to the California building code impact builders, building designers and energy consultants, and building owners and occupants. The analysis in the methodology report is not specific to the code change presented in this report. The following provides a qualitative description of how this specific code change affects various market actors and additional quantitative analyses of its potential impacts on building industry subsectors.

Builders. The proposed change would likely affect commercial builders; however, it would likely not impact firms focused on the construction or retrofitting of industrial buildings, utility systems, public infrastructure, or other heavy construction. The proposed change would not affect all firms and workers in the commercial building industries equally; instead, it would primarily affect specific subsectors within the industry. Table 48 shows the commercial building subsectors that the Statewide CASE Team expects to be impacted by the changes proposed in this report.

The values in the table below are preliminary estimates and may be updated as the Statewide CASE Team continues data collection ***on impact to the commercial***

building industry in California. Finalized values will be included in the Final CASE Report.

Table 48: Specific Subsectors of the California Commercial Building Industry Impacted by Proposed Change to Code/Standard by Subsector in 2022 (Estimated)[46]

Construction Subsector	Establishments*	Employment	Annual Payroll (Billions $)
Commercial Building Construction	5,491	87,450	$10.6
Nonresidential Poured Foundation Contractors	497	15,884	$1.4
Nonresidential Structural Steel Contractors	365	11,899	$1.1
Nonresidential Framing Contractors	137	3,037	$0.2
Nonresidential Masonry Contractors	217	4,028	$0.3
Nonresidential Glass and Glazing Contractors	307	5,079	$0.5
Nonresidential Roofing Contractors	385	11,413	$1.0
Nonresidential Siding Contractors	32	735	$0.1
Other Nonresidential Exterior Contractors	234	2,259	$0.1
Nonresidential Electrical Contractors	3,245	72,794	$7.8
Nonresidential Plumbing & HVAC Contractors	2,270	55,182	$5.8
Other Nonresidential Equipment Contractors	580	9,749	$1.1
Nonresidential Drywall Contractors	593	19,328	$1.8
Nonresidential Painting Contractors	501	9,225	$0.7
Nonresidential Flooring Contractors	286	4,011	$0.4
Nonresidential Tile and Terrazzo Contractors	151	2,223	$0.2
Nonresidential Finish Carpentry Contractors	313	3,697	$0.3
Other Nonresidential Finishing Contractors	492	7,241	$0.6
Nonresidential Site Preparation Contractors	1,147	19,273	$1.9
All Other Nonresidential Trade Contractors	948	17,084	$1.7

Source: Analysis by the Title 24 CASE Team of QCEW data from the California Employment Development Department https://labormarketinfo.edd.ca.gov/cgi/dataanalysis/areaselection.asp?tablename=industry

*An establishment is single economic unit, typically at one physical location, that engages in one, or predominantly one, type of economic activity for which a single industrial classification may be applied. Many businesses are composed of multiple establishments. US Bureau of Labor Statistics, Handbook of Methods. https://www.bls.gov/opub/hom/cew/concepts.htm

Manufacturers. Manufacturers would be selling different types of equipment as a result of this proposed code change. Specifically, for the impacted spaces, they would sell

[46] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

dimmer keypads instead of switch keypads. Similarly, they would sell lamps and luminaires with continuously dimmable drivers rather than non-dimmable drivers. These shifts are not expected to necessitate the creation of new products, as manufacturers already have these products for meeting existing code requirements. Many of these manufacturers maintain distribution centers and technical support staff within California. Other manufacturers maintain their presence in California through independent sales representative agencies, who provides technical, engineering, and commissioning expertise on behalf of the manufacturers to serve California customers.

5.2.3 Compliance Software Updates

The compliance software would need to be updated to support the proposed changes to the mandatory controls.

5.2.4 Cost of Enforcement

The Statewide CASE Team acknowledges that changes to the code will impact enforcement costs. This report is an evaluation of specific measures, and the collective impact of all proposed changes for the 2028 Title 24, Part 6 may represent an increase in training and/or workload for enforcement personnel. The proposed code change is not expected to impact the state's cost of enforcement. The increased number of manual dimmers, as a result of this code change, will be identified on the plans, but they would just replace the on/off switches showing on the plans. Continuous dimming, now required for all daylight-responsive controls, would replace on/off or stepped switching that was previously allowed for implementing daylight responsive controls when meeting the multilevel lighting controls exceptions.

5.3 Update Multilevel Lighting Controls Requirements - Market and Economic Analysis

5.3.1 Market Structure and Availability

5.3.1.1 Current Market Structure and Availability

Dimming drivers are widely available and are typically the default option for lamps and luminaires, especially those used in commercial applications. The most common dimming protocol for commercial applications in the U.S. is 0-10V dimming. Other dimming protocols include phase dimming, DALI (Digitally Addressable Lighting Interface), and DMX. With 0-10V dimming, two additional low-voltage control wires will need to be wired to the controller for continuous dimming controls. The controller may be a room controller, power pack, sensor, or wall control panel. Therefore, installers can still forego wiring the dimming control wires and treat the lamps and luminaires with dimming drivers as non-dimmable if the space is exempt from multilevel lighting

controls. For systems using other dimming protocols, the wall keypads may still be programmed to provide only on/off switching rather than functioning as manual dimmers. Similarly, daylight responsive controls, if currently exempted from multilevel lighting controls, may still be programmed to only turn on/off the electric lights in response to the available daylight instead of using continuous dimming.

5.3.1.2 Market Challenges and Solutions

Market challenges are not expected with the proposed change. Manual dimmers are already available in lighting control systems of all designs and configurations. Requiring manual dimmers in more spaces is not expected to introduce additional concerns; instead, it could empower occupants to adjust the light level to better meet their task needs. Daylight responsive controls are a mandatory lighting control requirement for many code cycles. In most cases, daylight responsive controls are already required by code to be implemented with continuous dimming. Removing the ability to meet daylight responsive controls requirements with on/off or stepped switching would not cause implementation issues. It would potentially eliminate confusion and frustration as occupants are less familiar with the expected daylighting control behavior when implemented with on/off or stepped switching.

See Section 5.2.2 for a description of workforce training that may be needed to ensure effective design, installation, and commissioning.

5.3.2 Design and Construction Practices

5.3.2.1 Current Design and Construction Practices

Whether the manual controls should provide on/off switching, manual dimming, or scene selection (and if so, the number of scenes needed) is typically specified in the design documents, specifically, the control intent narrative (CIN). The expected behavior of the manual controls and scene settings are prescribed in the sequence of operation (SOO). Similarly, if daylight responsive controls are implemented using continuous dimming, on/off switching, stepped switching, or stepped dimming (based on code requirements and exceptions as well as the space's functional needs) is specified in the CIN and SOO. The electrical contractors would procure the lighting control system from lighting or electrical distributors in accordance with the design documents and install and start up the system. Depending on the lighting control systems and the system purchase agreement, system startup and programming may be performed by the manufacturers or the manufacturer's sales representative agency's field engineers. The commissioning providers would then review the design documents and confirm that manual controls and daylight responsive controls are programmed as intended. The Acceptance Test Technicians (ATTs) would test and verify that the performance of daylight responsive controls meets code requirements.

5.3.2.2 Health and Safety Considerations

There are no known health and safety considerations.

5.3.2.3 Design and Construction Challenges and Solutions

Continuous dimming has been required and used for both multilevel lighting controls and daylight responsive controls for many code cycles. Manual dimmers have been interpreted as part of the multilevel lighting controls requirement that exposes continuous dimming capability to manual controls. The understanding, availability, and implementation of the technologies are very well-established. The proposed code change would require more spaces to use manual dimmers, rather than on/off switches. Additionally, the proposed code change would require spaces with lower general lighting power to use continuous dimming for daylight responsive controls, which would be implemented in the exact same way as spaces that already need to meet the requirement. Therefore, no design and construction challenges are expected for the proposed code change.

See Table 47 in Section 5.2.2 for a description of workforce training that could support effective design, installation, and commissioning.

5.3.3 Energy Equity and Environmental Justice

The Statewide CASE Team evaluated the potential impact on environmental and social justice (ESJ) communities, including impacts related to race, class, and gender.

Based on a preliminary review, this proposed code change is unlikely to have significant negative or positive impacts on the ESJ communities. The slightly increased costs associated with the measure are expected to be modest and outweighed by the benefits. Energy costs would decrease, which would result in lower utility bills for the ESJ communities.

The Statewide CASE Team does not expect impacts on the health and safety of ESJ communities or on their disaster preparedness. The comfort of ESJ communities is unlikely to be impacted by the proposed code change.

Recognizing the importance of engaging ESJ communities and gathering their input to inform the code change process and proposed measures, the Statewide CASE Team is working to build relationships with community-based organizations (CBOs) to facilitate meaningful engagement. Please reach out to Yao-Jung Wen (ywen@energy-solution.com) if you have input on how this proposal may impact ESJ communities or if you would like to offer your perspective.

5.3.4 Impacts on Jobs and Businesses

This section will be completed for the Final CASE Report.

5.3.5 Economic and Fiscal Impacts

This section will be completed for the Final CASE Report.

5.4 Update Multilevel Lighting Controls Requirements - Cost Effectiveness

5.4.1 Cost Effectiveness Methodology

The Statewide CASE Team collaborated with the CEC staff to confirm that the cost-effectiveness methodology aligns with the CEC guidelines, including cost inclusion parameters. The 2028 CASE Methodology Report and Appendix A provide reproducibility details.

Per California Law (Public Resources Code 25000), a measure is considered cost effective if its Benefit-Cost Ratio (BCR) is 1.0 or greater, amortized over the economic life of the structure. The Statewide CASE Team calculates BCR by dividing total dollar benefits by total dollar costs over a 30-year analysis period.

Benefits are based on Long-term System Cost (LSC), which assigns an hourly dollar value to energy use. LSC hourly factors weigh the long-term value of each hour differently, where times of peak demand are valued more than off-peak hours. These factors are not utility rates, forecasts, or bill estimates. The CEC develops and publishes LSC hourly conversion factors for each code cycle.

Costs include first costs and ongoing maintenance costs assessed over the 30-year period. Benefits and costs are evaluated incrementally, relative to the most recently adopted Energy Code. The analysis excludes design costs and incremental code compliance verification costs.

5.4.2 Energy and Energy Cost Savings Results

5.4.2.1 Convert to Wattage-based Trigger

The Statewide CASE Team proposes to specify the trigger for the requirements to be based on general lighting wattage, instead of general lighting power density (LPD) currently specified for multilevel lighting controls. This change is intended to unify the metric used to determine the required controls, so that all mandatory lighting control requirements are triggered by wattage, improving ease of compliance. The change will impact spaces in nonresidential buildings as well as Group R occupancies and common or public use areas. The impact on Group R occupancies and common or public use areas would be limited to improving ease of compliance and does not change the stringency of the 2025 code requirements as mandated by AB130.

An equivalent wattage-based trigger, with the same stringency as the current LPD trigger (greater than 0.5 watts per square foot), was first derived. This wattage trigger was determined to be 75 watts. The equivalency is established based on equal longer-term system costs (LSC) between the LPD trigger and the converted wattage trigger for spaces impacted by the current multilevel lighting controls requirement. A detailed description of the methodology is provided in Appendix G. The Statewide CASE Team will continue to examine this wattage trigger and verify that the converted wattage-based trigger imposes the same stringency as the current LPD-based trigger for Group R occupancies and common or public use areas. Any further updates will be reflected in the Final CASE Report, incorporating most up-to-date and accurate data.

For Group R occupancies and common or public use areas, 75 watts would be the wattage-based trigger for the 2028 requirement in the current proposal, maintaining the same stringency as the 2025 multilevel lighting controls requirement. In other words, multilevel lighting controls are required for spaces with a connected general lighting load greater than 75 watts.

For spaces in all other nonresidential buildings, the Statewide CASE Team proposes a lower wattage trigger for requiring manual dimmers to better reflect the current LED technology. The resulting savings are estimated in the following section.

5.4.2.2 Energy Savings from Space in Nonresidential Buildings

Energy savings are expected from spaces for nonresidential occupancies through the following two distinct components of the proposed code change:

- Requiring manual dimmers in spaces with a general lighting load greater than 50 watts.
- Requiring continuous dimming for all daylight responsive controls.

Energy Savings from Requiring Manual Dimmers

The current requirement for multilevel lighting controls applies to spaces with an LPD greater than 0.5 watts per square foot. Based on section 5.4.2.1, this is equivalent to a general lighting load greater than 75 watts. The proposed code changes require manual dimmer in spaces with a general lighting load greater than 50 watts. Therefore, for spaces with a general lighting load greater than 50 watts and less than or equal to 75 watts, energy savings from manual dimmers are expected, as shown in Table 49. Note that, under the current code requirements, multilevel lighting controls are already required in many spaces listed in Table 49. However, lowering the threshold to 50 watts would trigger additional spaces, typically smaller ones, to require manual dimmers, and the per-unit savings in Table 49 would still apply. Per-unit savings from manual dimmers, presented in per-watt controlled by manual dimmers, for the first year are expected to range from 0.091 and 0.583 kWh/yr, depending on the space type. Demand

reductions are expected to range from 0.006 to 0.066 W, also depending on the space type. The measure applies to both new construction/additions and alterations, and no difference in the per-unit savings are expected between new construction/additions and alterations. Electricity and source energy savings as well as peak demand reductions per unit (per-watt controlled by manual dimmers) from requiring manual dimmers are presented in Table 49 through Table 50 by space type. There are no natural gas savings from this proposed change. Table 51 presents total per-unit (per-watt controlled by manual dimmers) energy cost savings by space type for newly constructed buildings and additions as well as alterations to existing buildings in terms of LSC savings realized over a 30-year period, in 2029 present value dollars (2029 PV$). The LSC methodology allows peak electricity savings to be valued more than electricity savings during non-peak periods.

The values in the table below are preliminary estimates and may be updated as the Statewide CASE Team continues data collection and analysis on first year electricity savings. Finalized values will be included in the Final CASE Report.

Table 49: First Year Electricity Savings (kWh) and Demand Reductions Per Watt Controlled from Requiring Manual Dimmers[47]

Space Type (Area Category)	First Year Electricity Savings (kWh/W)	First Year Peak Demand Reduction (kW/W)
Aging Eye/Low-vision: Dining	0.388	0.038
Aging Eye/Low-vision: Main Entry Lobby	0.145	0.013
Aging Eye/Low-vision: Lounge/Waiting Area	0.583	0.066
Aging Eye/Low-vision: Multipurpose Room	0.583	0.066
Aging Eye/Low-vision: Religious Worship Area	0.261	0.024
Audience Seating Area	0.261	0.024
Auditorium Area	0.261	0.024
Auto Repair / Maintenance Area	0.115	0.008
Barber, Beauty Salon, and Spa Area	0.211	0.016
Civic Meeting Place Area	0.203	0.019
Classroom, Lecture, Training, Vocational Area	0.145	0.011
Concourse and Atria Area	0.151	0.011
Convention, Conference, Multipurpose and Meeting Area	0.261	0.024

[47] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Space Type (Area Category)	First Year Electricity Savings (kWh/W)	First Year Peak Demand Reduction (kW/W)
Dining Area: Bar/Lounge and Fine Dining	0.388	0.038
Dining Area: Cafeteria/Fast Food	0.216	0.021
Exercise/Fitness Center and Gymnasium Area	0.211	0.016
Financial Transaction Area	0.091	0.006
Library : Reading Area	0.091	0.006
Library : Stacks Area	0.091	0.006
Main Entry Lobby	0.145	0.013
Lounge, Breakroom, or Waiting Area	0.261	0.024
Museum Area: Exhibition/Display	0.203	0.019
Museum Area: Restoration Room	0.203	0.019
Office Area: > 250 square feet	0.091	0.006
Office Area: ≤ 250 square feet	0.163	0.011
Pharmacy Area	0.151	0.011
Retail Sales Area: Grocery Sales	0.151	0.011
Retail Sales Area: Retail Merchandise Sales	0.211	0.016
Retail Sales Area: Fitting Room	0.151	0.011
Religious Worship Area	0.261	0.024
Sports Arena – Playing Area: Class I Facility	0.151	0.011
Sports Arena – Playing Area: Class II Facility	0.151	0.011
Sports Arena – Playing Area: Class III Facility	0.151	0.011
Sports Arena – Playing Area: Class IV Facility	0.151	0.011
Theater Area: Motion picture	0.261	0.024
Theater Area: Performance	0.261	0.024
Videoconferencing Studio	0.091	0.006

The values are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis for first year source energy savings. The values may be updated and finalized in the Final CASE Report.

Table 50: First Year Source Energy Savings (kBtu) Per Watt Controlled – Requiring Manual Dimmers[48]

Space Type (Area Category)	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Aging Eye/Low-vision: Dining	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529
Aging Eye/Low-vision: Main Entry Lobby	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181
Aging Eye/Low-vision: Lounge/Waiting Area	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992
Aging Eye/Low-vision: Multipurpose Room	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992
Aging Eye/Low-vision: Religious Worship Area	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327
Audience Seating Area	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327
Auditorium Area	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327
Auto Repair / Maintenance Area	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091
Barber, Beauty Salon, and Spa Area	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185
Civic Meeting Place Area	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254

[48] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Space Type (Area Category)	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Classroom, Lecture, Training, Vocational Area	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135	0.135
Concourse and Atria Area	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Convention, Conference, Multipurpose and Meeting Area	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327
Dining Area: Bar/Lounge and Fine Dining	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529	0.529
Dining Area: Cafeteria/Fast Food	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294
Exercise/Fitness Center and Gymnasium Area	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185
Financial Transaction Area	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Library: Reading Area	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Library: Stacks Area	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Main Entry Lobby	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181	0.181
Lounge, Breakroom, or Waiting Area	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327
Museum Area: Exhibition/Display	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254
Museum Area: Restoration Room	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254	0.254

Space Type (Area Category)	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Office Area: > 250 square feet	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Office Area: ≤ 250 square feet	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.139
Pharmacy Area	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Retail Sales Area: Grocery Sales	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Retail Sales Area: Retail Merchandise Sales	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185	0.185
Retail Sales Area: Fitting Room	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Religious Worship Area	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327
Sports Arena – Playing Area: Class I Facility	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Sports Arena – Playing Area: Class II Facility	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Sports Arena – Playing Area: Class III Facility	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Sports Arena – Playing Area: Class IV Facility	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132	0.132
Theater Area: Motion picture	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327

Space Type (Area Category)	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Theater Area: Performance	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327	0.327
Videoconferencing Studio	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077

The values are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis for 30-year LSC savings. Finalized results will be included in the Final CASE Report.

Table 51: Total 30-Year LSC Savings (2029 PV$) Per Watt Controlled – Requiring Manual Dimmers[49]

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Aging Eye/Low-vision: Dining	$3.15	$3.16	$3.16	$3.16	$3.18	$3.09	$3.12	$3.18	$3.21	$3.19	$3.16	$3.18	$3.16	$3.13	$3.15	$3.20
Aging Eye/Low-vision: Main Entry Lobby	$1.15	$1.15	$1.15	$1.15	$1.16	$1.11	$1.13	$1.16	$1.18	$1.16	$1.15	$1.16	$1.15	$1.13	$1.15	$1.17
Aging Eye/Low-vision: Lounge/Waiting Area	$5.09	$5.08	$5.09	$5.08	$5.07	$5.11	$5.08	$5.07	$5.07	$5.07	$5.08	$5.07	$5.08	$5.08	$5.09	$5.07
Aging Eye/Low-vision: Multipurpose Room	$5.09	$5.08	$5.09	$5.08	$5.07	$5.11	$5.08	$5.07	$5.07	$5.07	$5.08	$5.07	$5.08	$5.08	$5.09	$5.07
Aging Eye/Low-vision: Religious Worship Area	$2.07	$2.07	$2.07	$2.07	$2.10	$2.00	$2.04	$2.09	$2.12	$2.09	$2.07	$2.09	$2.07	$2.03	$2.06	$2.11
Audience Seating Area	$2.07	$2.07	$2.07	$2.07	$2.10	$2.00	$2.04	$2.09	$2.12	$2.09	$2.07	$2.09	$2.07	$2.03	$2.06	$2.11
Auditorium Area	$2.07	$2.07	$2.07	$2.07	$2.10	$2.00	$2.04	$2.09	$2.12	$2.09	$2.07	$2.09	$2.07	$2.03	$2.06	$2.11

[49] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Auto Repair / Maintenance Area	$0.81	$0.80	$0.80	$0.79	$0.80	$0.78	$0.79	$0.78	$0.79	$0.78	$0.79	$0.80	$0.79	$0.77	$0.79	$0.78
Barber, Beauty Salon, and Spa Area	$1.50	$1.50	$1.50	$1.49	$1.51	$1.45	$1.47	$1.48	$1.51	$1.48	$1.48	$1.51	$1.49	$1.44	$1.49	$1.49
Civic Meeting Place Area	$1.61	$1.61	$1.61	$1.61	$1.63	$1.56	$1.58	$1.62	$1.65	$1.63	$1.61	$1.62	$1.61	$1.58	$1.60	$1.64
Classroom, Lecture, Training, Vocational Area	$1.07	$1.06	$1.06	$1.05	$1.06	$1.02	$1.04	$1.05	$1.06	$1.05	$1.05	$1.06	$1.05	$1.02	$1.04	$1.05
Concourse and Atria Area	$1.07	$1.07	$1.07	$1.07	$1.08	$1.03	$1.05	$1.06	$1.08	$1.06	$1.06	$1.08	$1.06	$1.03	$1.06	$1.06
Convention, Conference, Multipurpose and Meeting Area	$2.07	$2.07	$2.07	$2.07	$2.10	$2.00	$2.04	$2.09	$2.12	$2.09	$2.07	$2.09	$2.07	$2.03	$2.06	$2.11
Dining Area: Bar/Lounge and Fine Dining	$3.15	$3.16	$3.16	$3.16	$3.18	$3.09	$3.12	$3.18	$3.21	$3.19	$3.16	$3.18	$3.16	$3.13	$3.15	$3.20
Dining Area: Cafeteria/Fast Food	$1.75	$1.76	$1.75	$1.75	$1.77	$1.72	$1.73	$1.77	$1.78	$1.77	$1.75	$1.77	$1.76	$1.74	$1.75	$1.78
Exercise/Fitness Center and Gymnasium Area	$1.50	$1.50	$1.50	$1.49	$1.51	$1.45	$1.47	$1.48	$1.51	$1.48	$1.48	$1.51	$1.49	$1.44	$1.49	$1.49
Financial Transaction Area	$0.65	$0.64	$0.64	$0.64	$0.64	$0.62	$0.63	$0.63	$0.63	$0.63	$0.63	$0.64	$0.63	$0.62	$0.63	$0.63
Library: Reading Area	$0.65	$0.64	$0.64	$0.64	$0.64	$0.62	$0.63	$0.63	$0.63	$0.63	$0.63	$0.64	$0.63	$0.62	$0.63	$0.63
Library: Stacks Area	$0.65	$0.64	$0.64	$0.64	$0.64	$0.62	$0.63	$0.63	$0.63	$0.63	$0.63	$0.64	$0.63	$0.62	$0.63	$0.63
Main Entry Lobby	$1.15	$1.15	$1.15	$1.15	$1.16	$1.11	$1.13	$1.16	$1.18	$1.16	$1.15	$1.16	$1.15	$1.13	$1.15	$1.17
Lounge, Breakroom, or Waiting Area	$2.07	$2.07	$2.07	$2.07	$2.10	$2.00	$2.04	$2.09	$2.12	$2.09	$2.07	$2.09	$2.07	$2.03	$2.06	$2.11

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Museum Area: Exhibition/Display	$1.61	$1.61	$1.61	$1.61	$1.63	$1.56	$1.58	$1.62	$1.65	$1.63	$1.61	$1.62	$1.61	$1.58	$1.60	$1.64
Museum Area: Restoration Room	$1.61	$1.61	$1.61	$1.61	$1.63	$1.56	$1.58	$1.62	$1.65	$1.63	$1.61	$1.62	$1.61	$1.58	$1.60	$1.64
Office Area: > 250 square feet	$0.65	$0.64	$0.64	$0.64	$0.64	$0.62	$0.63	$0.63	$0.63	$0.63	$0.63	$0.64	$0.63	$0.62	$0.63	$0.63
Office Area: ≤ 250 square feet	$1.17	$1.15	$1.16	$1.15	$1.15	$1.12	$1.14	$1.13	$1.14	$1.13	$1.14	$1.15	$1.14	$1.11	$1.14	$1.13
Pharmacy Area	$1.07	$1.07	$1.07	$1.07	$1.08	$1.03	$1.05	$1.06	$1.08	$1.06	$1.06	$1.08	$1.06	$1.03	$1.06	$1.06
Retail Sales Area: Grocery Sales	$1.07	$1.07	$1.07	$1.07	$1.08	$1.03	$1.05	$1.06	$1.08	$1.06	$1.06	$1.08	$1.06	$1.03	$1.06	$1.06
Retail Sales Area: Retail Merchandise Sales	$1.50	$1.50	$1.50	$1.49	$1.51	$1.45	$1.47	$1.48	$1.51	$1.48	$1.48	$1.51	$1.49	$1.44	$1.49	$1.49
Retail Sales Area: Fitting Room	$1.07	$1.07	$1.07	$1.07	$1.08	$1.03	$1.05	$1.06	$1.08	$1.06	$1.06	$1.08	$1.06	$1.03	$1.06	$1.06
Religious Worship Area	$2.07	$2.07	$2.07	$2.07	$2.10	$2.00	$2.04	$2.09	$2.12	$2.09	$2.07	$2.09	$2.07	$2.03	$2.06	$2.11
Sports Arena – Playing Area: Class I Facility	$1.07	$1.07	$1.07	$1.07	$1.08	$1.03	$1.05	$1.06	$1.08	$1.06	$1.06	$1.08	$1.06	$1.03	$1.06	$1.06
Sports Arena – Playing Area: Class II Facility	$1.07	$1.07	$1.07	$1.07	$1.08	$1.03	$1.05	$1.06	$1.08	$1.06	$1.06	$1.08	$1.06	$1.03	$1.06	$1.06
Sports Arena – Playing Area: Class III Facility	$1.07	$1.07	$1.07	$1.07	$1.08	$1.03	$1.05	$1.06	$1.08	$1.06	$1.06	$1.08	$1.06	$1.03	$1.06	$1.06
Sports Arena – Playing Area: Class IV Facility	$1.07	$1.07	$1.07	$1.07	$1.08	$1.03	$1.05	$1.06	$1.08	$1.06	$1.06	$1.08	$1.06	$1.03	$1.06	$1.06

Prototype	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Theater Area: Motion picture	$2.07	$2.07	$2.07	$2.07	$2.10	$2.00	$2.04	$2.09	$2.12	$2.09	$2.07	$2.09	$2.07	$2.03	$2.06	$2.11
Theater Area: Performance	$2.07	$2.07	$2.07	$2.07	$2.10	$2.00	$2.04	$2.09	$2.12	$2.09	$2.07	$2.09	$2.07	$2.03	$2.06	$2.11
Videoconferencing Studio	$0.65	$0.64	$0.64	$0.64	$0.64	$0.62	$0.63	$0.63	$0.63	$0.63	$0.63	$0.64	$0.63	$0.62	$0.63	$0.63

Energy Savings from Daylight Responsive Controls with Continuous Dimming

The current requirement for multilevel lighting controls applies to spaces with an LPD greater than 0.5 watts per square foot, and the current daylight responsive controls only require continuous dimming in daylit zones where multilevel lighting controls are required. As a result, requiring continuous dimming for all daylight responsive controls would result in additional energy savings in daylit zones with an LPD of 0.5 watts per square foot or less and where daylight responsive controls are required, i.e., the general lighting load in the daylit zone is 75 watts or more.

The Statewide CASE Team is still collecting data to model energy savings, considering both skylit and sidelit scenarios, and the results will be presented in the Final CASE Report. The Statewide CASE Team expects that there may not be energy savings in some spaces in certain climate zones, especially those with lower design illuminance. This is because in the base case, when daylight illuminance exceeds 150 percent of daylight illuminance, the light would be turned off and consume no energy, whereas in the proposed case with continuous dimming, the light would be dimmed to 10 percent of its power. During these hours, the proposed case would consume more energy than the base case. In spaces with low design illuminance and in climate zones where the sky condition can more easily result in abundant daylight, this condition would occur more often, causing the proposed case to use more energy than the base case overall. However, the Statewide CASE Team also expects that there would be positive energy savings overall when considered together with the energy savings resulting from the requirement for manual dimmers. Under the proposed new 50-watt trigger for manual dimmers, all spaces where daylight responsive controls are required (i.e., with a general lighting load of 75 watts or greater) would already have continuous dimming capability.

5.4.3 Incremental First Cost

5.4.3.1 Cost Estimate Methodology

First costs were obtained in the current dollar at the writing of the CASE Report and were projected to the 2029 dollar for the cost-effectiveness analyses, assuming a 3 percent year-over-year inflation rate.

For the material costs, the Statewide CASE Team obtained the distributor net price quotes, primarily from independent manufacturers' sales representative agencies. To arrive at the total incremental material cost, state and local sales tax, freight charge, and supply chain markup were applied to the net distributor price quotes. The Statewide CASE Team applied the average sales tax rates of 8.84 percent across the state, effective October 1, 2025, to estimate the after-tax incremental cost.

The additional efforts required to implement the proposed code change, including installation and system programming, were based on practitioner estimates in labor hours. The incremental labor costs were estimated as a product of the incremental labor hours and the hourly labor rate. The Statewide CASE Team assumed an electrician's rate for labor. Two sources were consulted to estimate the labor rates: RSMeans and the prevailing wage published by California Department of Industrial Relations (DIR) (State of California Department of Industrial Relations 2025).

The 2025 RSMeans national average electrician rate is $85.95/hr and $109.10/hr (including overhead and profit) for non-union and union laborers, respectively. The Statewide CASE Team used the 2025 RSMeans City Cost Index for California and decided on a California average scaling factor of 132.6 percent as the scaling factors to arrive at the average California labor rates, as shown in Table 52. The rates included overhead and profit in the cost estimate. Applying the 132.6 percent scaling factor resulted in a labor rate of $113.97/hr and $144.67/hr for non-union and union California labors, respectively. The prevailing wages for workers employed on public works projects are published by the county on the DIR website. The prevailing wages for the inside wireman classification under the electrician craft were used to estimate the labor rates. The average rate across all counties and climate zones, weighted by the CEC 2029 construction forecast, is $98.02/hr. The Statewide CASE Team used the average of the three labor rate categories to represent the 2025 labor rate in estimating labor costs. This average 2025 hourly rates is projected to 2029 dollars, assuming the same 3 percent year-over-year inflation rate. The labor hours estimated in the later sections were then converted into labor costs using the hourly rate in Table 52.

Table 52: Estimated Labor Rates

Labor Rate Category/Source	Estimated Average Labor Rate
RSMeans Non-unionized (2025$/hr)	$113.97
RSMeans Unionized (2025$/hr)	$144.67
DIR Prevailing Wage (2025$/hr)	$98.02
Average (2025$/hr)	$118.89
Average (2029$/hr)	$133.80

The labor required for implementing the proposed code change typically does not involve the full skill set of a licensed electrician and may be largely performed by an electrician's apprentice. Therefore, the estimated labor cost using exclusively the electrician's rates would be on the conservative side.

The proposed code change has two major incremental first cost components: the incremental cost of implementing manual dimmers, and the incremental cost of

implementing daylight responsive controls with continuous dimming in daylit zones. They are separately discussed in the following sections.

5.4.3.2 Incremental First Cost of Manual Dimmers

The four control solution configurations in Table 53 were considered to represent the variety of possible implementations and the associated costs.

Table 53: Control Solutions Considered for Requiring Manual Dimmers

Control Solution Type	Control Solution Description	Base Case Configuration	Proposed Case Configuration
Wired, Line-Voltage	The manual control is powered by the line voltage for on/off switching and dimming control commands are communicated to the luminaires or controllers through low-voltage wires, most commonly, 0-10V.	The manual control is a wall switch keypad that switches the line voltage for on/off controls. No low-voltage control wires.	The manual control is a wall dimmer keypad that switches the line voltage for on/off controls. Low-voltage dimming control wires between the keypad and the luminaire or controller.
Wired, Low-Voltage	The manual control is powered by low voltage, and on/off switching and dimming control commands are also communicated to the luminaires or controllers through low-voltage wires. The most common configuration is that both power and control signals are carried on a multi-conductor cable, such as Cat5 or Cat6 cables.	The manual control is a wall switch keypad wired to the luminaire or controller with a multi-conductor cable. It is programmed for only on/off switching.	The manual control is a wall dimmer keypad wired to the luminaire or controller with a multi-conductor cable. It is programmed for both on/off switching and continuous dimming.
Wireless, Line Powered	The manual control is powered by the line voltage but switching and dimming control commands are communicated to the luminaires or controllers wirelessly.	The manual control is a wall switch keypad wired to the line voltage. It is programmed for only on/off switching.	The manual control is a wall dimmer keypad wired to the line voltage. It is programmed for both on/off switching and continuous dimming.
Wireless, Self Powered	The manual control is powered by batteries or kinetic energy and switching and dimming control commands are communicated to the luminaires or controllers wirelessly.	The manual control is a wall switch keypad with no wiring. It is programmed for only on/off switching.	The manual control is a wall dimmer keypad with no wiring. It is programmed for both on/off switching and continuous dimming.

The first costs of materials and labor associated with the four control solution configurations are listed in Table 54.

Table 54: Incremental First Cost Components Estimated for Requiring Manual Dimmers

Control Solution Type	Base Case Material	Proposed Case Material	Proposed Case Incremental Labor
Wired, Line-Voltage	High-voltage wall switch keypad	High-voltage wall dimmer keypad Low-voltage dimming control wires Wire nuts	Additional wiring of low-voltage dimming control wires between the keypad and the luminaire or controller.
Wired, Low-Voltage	Low-voltage wall switch keypad	Low-voltage wall dimmer keypad	No wiring difference Additional programming for the dimmer
Wireless, Line Powered	Wireless line-powered wall switch keypad	Wireless line-powered wall dimmer keypad	No wiring difference Additional programming for the dimmer
Wireless, Self Powered	Wireless self-powered wall switch keypad	Wireless self-powered wall dimmer keypad	No wiring needed Additional programming for the dimmer

For wireless keypads that are battery-powered, the Statewide CASE Team assumes that batteries are included in the product package, which is largely the case for most products researched. For the low-voltage dimming control wires, the Statewide CASE Team assumes an average length of 16 feet between the keypad and the luminaire or controller, consistent with the assumption used in the 2025 Daylighting Final CASE Report. Other necessary components, including controllers, power packs, and networking devices, are assumed to be in place due to other mandatory control requirements, and requiring manual dimmers would not incur additional related hardware costs.

To arrive at the total incremental material cost, state and local sales tax, delivery charge, and supply chain markup would be applied to the net distributor price quotes. A 50 percent markup throughout the supply chain, including the delivery (shipping and freight) charges, was assumed for the keypads. The costs of cables and connectors necessary to wire the keypads to the luminaires or controllers were also included and subject to the same sales tax rate. The second to fourth columns in Table 56 show the pre-tax base case, proposed case, and incremental material cost in current dollars, respectively. These represent the cost per keypad installation averaged across multiple pricing data points of different makes, models, and systems within each control solution type. The fifth column shows the average incremental material cost after tax and supply

chain markup. The additional efforts required to implement the manual dimmer, including installation and system programming, were based on practitioner estimates, and presented in labor hours as shown in Table 55. The estimate only includes the differences in installation and programming of a wall switch keypad versus a wall dimmer keypad for each control solution type. For simplicity, the Statewide CASE Team used conservative estimates for the hours that would cover the average time required to perform installation and programming in both new construction and alteration. This would avoid the need to separately evaluate cost and cost effectiveness for new construction and alteration, although, in general, such an approach would likely be too conservative for new constructions. Applying the average California labor rates discussed in Section 5.4.3.1, the incremental installation and programming costs per control solution type are shown in the third and fourth columns in Table 57. The total first cost, in both 2025 dollars and projected 2029 dollars are shown in the last two columns of the table.

For control solution types where the material or labor costs for implementing the proposed case are less than the base case, the incremental costs are considered to be zero.

The values in the table below are preliminary estimates and may be updated as the Statewide CASE Team continues data collection to estimate labor hours. Finalized values will be included in the Final CASE Report.

Table 55: Labor Hours Estimated for Requiring Manual Dimmers.

Control Solution Type	Incremental Installation Hours (hr)	Incremental Programming Hours (hr)
Wired, Line-Voltage	0	0
Wired, Low-Voltage	0	0
Wireless, Line Powered	0	0.03
Wireless, Self Powered	0	0.03

The third and fourth columns in Table 57 show the installation and programming labor costs, respectively, for the manual dimmers. The values for each control solution type are the average labor costs across all systems that fall within the same control solution type.

The values in the table below are preliminary estimates and may be updated as the Statewide CASE Team continues data collection to estimate material costs. Finalized values will be included in the Final CASE Report.

Table 56: Incremental Material Costs Estimated for Requiring Manual Dimmers[50]

Control Solution Type	Pre-tax Base Case Material Cost	Pre-tax Proposed Case Material Cost	Pre-tax Incremental Material Cost	Incremental Material Cost after Tax and Supply Chain Markup
Wired, Line-Voltage	$97.71	$110.00	$12.29	$20.06
Wired, Low-Voltage	$146.20	$97.75	$-	$-
Wireless, Line Powered	$88.97	$85.00	$-	$-
Wireless, Self Powered	$76.18	$90.00	$13.82	$22.56

The values in the table below are preliminary estimates and may be updated as the Statewide CASE Team continues data collection to estimate incremental costs. Finalized values will be included in the Final CASE Report.

Table 57: Incremental First Costs Estimated for Requiring Manual Dimmers[51]

Control Solution Type	Incremental Material Cost after Tax and Supply Chain Markup	Incremental Installation Labor Cost	Incremental Programming Labor Cost	Total First Cost (2025$)	Total First Cost (2029$)
Wired, Line-Voltage	$20.06	$-	$-	$20.06	$22.58
Wired, Low-Voltage	$-	$-	$-	$-	$-
Wireless, Line Powered	$-	$-	$3.96	$3.96	$4.46
Wireless, Self Powered	$22.56	$-	$3.96	$26.52	$29.85
Average	$10.65	$-	$1.98	$12.64	$14.22

[50] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

[51] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

5.4.3.3 Incremental First Cost of Daylight Responsive Controls with Continuous Dimming

The five control solution configurations in Table 58 were considered to represent the variety of possible implementations and the associated costs.

For the base case that complies with the current code requirements, the control solutions are assumed to switch the lights off when daylight illuminance exceeds 150 percent of the design illuminance; otherwise, the lights remain on at 100 percent of full power. For the proposed case, the control solutions are assumed to continuously adjust the electric light level based on the available daylight and keep the lights at 10 percent of full power when daylight illuminance exceeds 150 percent of the design illuminance.

The first costs of materials and labor associated with the four control solution configurations are listed in Table 59.

Table 58: Control Solution Types Considered for Requiring Daylight Responsive Controls with Continuous Dimming

Control Solution Type	Control Solution Description	Base Case Configuration	Proposed Case Configuration
Analog Line-Voltage Daylight Sensor	Daylight sensor is powered by line voltage and directly switches the power to the loads, i.e., LED drivers.	Daylight sensor directly switches the loads.	Daylight sensor dims the light through low-voltage dimming signals, e.g., 0-10V.
Analog Low-Voltage Daylight Sensor	Daylight sensor is powered by low voltage provided by the power pack or controller. It switches the power to the loads, i.e., LED drivers, by signaling the power pack or controller, and dims the light through low-voltage signals wired directly to the loads.	Daylight sensor is wired to the power pack or controller and switches the power to the loads by signaling the power pack or controller.	Daylight sensor is wired to the power pack or controller. Additionally, low-voltage control wires, e.g., 0-10V, are directly connected to the loads for dimming.
Digital Wired Daylight Sensor	Daylight sensor is wired to the controller. The cable connecting the sensor and controller serves both to power the sensor and to carry the control commands. The controller controls the loads, i.e., LED drivers, in accordance with commands from the sensor.	Daylight sensor is wired to the controller. The controller switches the lights on and off based on the control commands from the daylight sensor.	Daylight sensor is wired to the controller. The controller adjusts the light level in response to control commands from the daylight sensor.
Digital Wireless Daylight Sensor	Daylight sensor is either wired to the controller for power or	Daylight sensor sends wireless	Daylight sensor sends wireless

Control Solution Type	Control Solution Description	Base Case Configuration	Proposed Case Configuration
	powered by batteries. The controller is wired to the loads, i.e., LED drivers. Control signals are transmitted between the daylight sensor and the controller via wireless communication, such as Bluetooth.	control commands to the controller based on the daylight level it sees. The controller switches the power to the drivers accordingly.	control commands to the controller based on the daylight level it sees. The controller dims the lights accordingly through the control wires between the controller and the drivers.
Luminaire-Integrated Daylighting Controls	Daylight sensors and controllers are built into the luminaire and directly connected to the LED driver.	The controller switches the lights on/off based on the daylight level the daylight sensor sees.	The controller dims the lights in response to the daylight level the daylight sensor sees.

Table 59: Incremental First Cost Components for Requiring Daylight Responsive Controls with Continuous Dimming

Control Solution Type	Base Case Material	Proposed Case Material	Proposed Case Incremental Labor
Analog Line-Voltage Daylight Sensor	• Line-voltage daylight sensor, on/off control only • Non-dimmable driver	• Line-voltage daylight sensor, on/off + dimming • Dimmable driver • Low-voltage dimming control wires • Wire nuts	Additional wiring of low-voltage dimming control wires between the sensor and the driver
Analog Low-Voltage Daylight Sensor	• Line-voltage daylight sensor, on/off control only • Non-dimmable driver	• Low-voltage daylight sensor, on/off + dimming • Dimmable driver • Low-voltage dimming control wires • Wire nuts	Additional wiring of low-voltage dimming control wires between the sensor and the driver
Digital Wired Daylight Sensor	• Digital wired daylight sensor • Non-dimmable driver	• Digital wired daylight sensor • Dimmable driver • Dimming control wires (if 0-10V) • Wire nuts (as needed)	• Additional wiring of dimming control wires between the controller/power pack and the driver • Differences in programming daylight responsive controls

Control Solution Type	Base Case Material	Proposed Case Material	Proposed Case Incremental Labor
			with continuous dimming vs. on/off switching
Digital Wireless Daylight Sensor	• Digital wired daylight sensor (low voltage or battery powered) • Non-dimmable driver	• Digital wired daylight sensor (low voltage or battery powered) • Dimmable driver	• Additional wiring of dimming control wires between the controller and the driver • Differences in programming daylight responsive controls with continuous dimming vs. on/off switching
Luminaire-Integrated Daylighting Controls	Non-dimmable driver with associated wiring to the sensor/control module	Dimmable driver with associated wiring to the sensor/control module	• Differences in programming daylight responsive controls with continuous dimming vs. on/off switching

For battery-powered wireless daylight sensors, the Statewide CASE Team assumes that batteries are included in the product package, which is largely the case for most products researched. For low-voltage dimming control wires, the Statewide CASE Team assumes an average length of 18 feet between the LED driver and the daylight sensor, power pack, or controller, depending on the control solution type. This assumption is consistent with the assumption used in the 2025 Daylighting Final CASE Report. Other necessary components, including controllers, power packs, and networking devices, are assumed to be in place due to other mandatory control requirements and would not incur additional related hardware cost.

To arrive at the total incremental material cost, state and local sales tax, delivery charge, and supply chain markup would be applied to the net distributor price quotes. A 50 percent markup throughout the supply chain, including the delivery (shipping and freight) charges, was assumed for the sensors. The costs of cables and connectors necessary for wiring between daylight sensors, controllers, power packs, and LED drivers were also included and subject to the same sales tax rate. The second to fourth columns in Table 62 show the pre-tax base case, proposed case, and incremental material cost in current dollars, respectively. These represent the cost per sensor installation averaged across multiple pricing data points of different makes, models, and systems within each control solution type. The fifth column shows the average incremental material cost after tax and supply chain markup.

The additional efforts required to implement daylight responsive controls with continuous dimming, including installation and system programming, were based on practitioner estimates and presented in labor hours as shown in Table 60. The estimate only includes the differences in installation and programming between on/off switching and continuous dimming daylight responsive controls. The Statewide CASE Team's survey found no increase in installation and programming efforts between daylight responsive controls with on/off switching and with continuous dimming. The installation efforts were between 0.03 and 0.08 hours, and the programming efforts were between 0.07 and 0.10 hours per sensor, both varying by the control solution type.

The Statewide CASE Team is still collecting data to estimate labor hours. Finalized values will be included in the Final CASE Report.

Table 60: Labor Hours Estimated for Requiring Daylight Responsive Controls with Continuous Dimming

Control Solution Type	Incremental Installation Hours (hr)	Incremental Programming Hours (hr)
Analog Line-Voltage Daylight Sensor	0.00	0.00
Analog Low-Voltage Daylight Sensor	0.00	0.00
Digital Wired Daylight Sensor	0.00	0.00
Digital Wireless Daylight Sensor	0.00	0.00
Luminaire-Integrated Daylighting Controls	0.00	0.00

Applying the average California labor rates discussed in Section 5.4.3.1, the incremental installation and programming costs per control solution type are shown in the third and fourth columns in Table 63.

Additionally, acceptance testing will need to be performed on the daylight responsive controls installed in the impacted spaces, and therefore, the cost of the acceptance test was included as one of the components in the incremental first cost. The Statewide CASE Team assessed the average hourly rate of an acceptance test technician (ATT) at $138, based on the range of $125-$150 surveyed. The research documented in the 2025 Daylighting CASE Report shows that the time required to perform daylight responsive controls functional test was estimated at 1 hour per photocontrol per daylit zone. This time was estimated for Continuous Dimming Control Systems Functional Testing per the test method provided in Title 24, Reference Appendices NA7.6.1.4. The time required to perform Continuous Dimming Control Systems Functional Testing is about twice that of Stepped Switching or Stepped Dimming Control Systems Functional Testing method in NA7.6.1.5, based on information provided by state-certified Acceptance Test Technicians (ATTs). Therefore, performing Stepped Switching or

Stepped Dimming Control Systems Functional Testing was estimated at 0.5 hours per photocontrol per daylit zone.

The code permits sampling of a group of up to five photocontrols when performing daylight responsive controls functional test, as long as all photocontrols within the same sample group have the same characteristics, including cardinal direction, luminaire layout, etc.; if the photocontrol passes the test, all photocontrols within the same sample group pass. Utilizing the sampling approach, not every additional photocontrol would incur acceptance testing cost. In the best-case scenario, only one out of every five photocontrols (20 percent of photocontrols across all daylit zones) needs to be tested when the ATT is able to identify and test the photocontrols in groups of five photocontrols. In this case, one-fifth of the cost of the acceptance test would be attributed to each photocontrol. Similarly, the Statewide CASE Team estimated the worst-case scenario where only one out of two photocontrols on average can be grouped for testing (50 percent of photocontrols across all daylit zones), and therefore, half of the cost of the acceptance test would be attributed to each photocontrol. An ATT is expected to encounter a variety of sampling scenarios spanning from the best case to the worst case, so the midpoint between the best and worst case (35 percent) was used to represent the typical number of photocontrols needed to undergo acceptance testing. To take the sampling approach, the ATT also needs to spend time planning how to sample the photocontrols. The Statewide CASE Team conservatively assumed a planning time of 0.1 to 0.5 hours per photocontrol, with the average of 0.3 hours, given that the overall project-level planning time is distributed to each photocontrol. Table 61 shows the highest, lowest, and midpoint of each cost component considered in estimating the cost associated with acceptance test. The Statewide CASE Team used the midpoint and projected it to 2029 dollars as the incremental cost on acceptance testing, as summarized in the last row in Table 61 for each control solution type.

The values in the table below are preliminary estimates. Statewide CASE Team is still collecting data to refine the ATT labor rates and hours estimates. Finalized values will be included in the Final CASE Report.

Table 61: Incremental Costs for Acceptance Testing[52]

ATT Tasks Average (Surveyed Range)	Base Case: Stepped Switch or Stepped Dimming Testing	Proposed Case: Continuous Dimming Testing
ATT Labor Rate (2025$/hr) [A]	$138 ($125-$150)	$138 ($125-$150)
Sampling Planning Time (hr) [B]	0.3 (0.1-0.5)	0.3 (0.1-0.5)

[52] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

ATT Tasks Average (Surveyed Range)	Base Case: Stepped Switch or Stepped Dimming Testing	Proposed Case: Continuous Dimming Testing
Test Time per Photocontrol per Daylit Zone (hr) [C]	0.5	1.0
Groupable Photocontrols (Fraction of Photocontrols Tested Per Daylit Zone) [D]	0.35 (0.2-0.5)	0.35 (0.2-0.5)
Average Acceptance Test Cost per Photocontrol (2025 $) [A]x([B]+[C]x[D])	$65.31 ($25.00-$112.50)	$89.38 ($37.50-$150.00)
Average Incremental Acceptance Test Cost per Photocontrol (2025$)	N/A	$24.06 (12.50-$37.50)
Average Incremental Acceptance Test Cost per Photocontrol (2029$)	N/A	$27.08 ($14.07-$42.21)

The values in the table below are preliminary estimates. The Statewide CASE Team is still collecting cost data. Finalized values will be included in the Final CASE Report.

Table 62: Incremental Material Costs Estimated for Requiring Daylight Responsive Controls with Continuous Dimming[53]

Control Solution Type	Pre-tax Base Case Material Cost	Pre-tax Proposed Case Material Cost	Pre-tax Incremental Material Cost	Incremental Material Cost after Tax and Supply Chain Markup
Analog Line-Voltage Daylight Sensor	$136.00	$244.67	$108.67	$177.41
Analog Low-Voltage Daylight Sensor	$229.50	$229.50	$-	$-
Digital Wired Daylight Sensor	$174.50	$176.25	$1.75	$2.86
Digital Wireless Daylight Sensor	$158.00	$143.18	$-	$-
Luminaire-Integrated Daylighting Controls	$94.00	$85.36	$-	$-

The values in the table below are preliminary estimates. The Statewide CASE Team is still collecting cost data. Finalized values will be included in the Final CASE Report.

[53] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Table 63: Incremental First Costs Estimated for Requiring Daylight Responsive Controls with Continuous Dimming[54]

Control Solution Type	Incremental Material Cost after Tax and Supply Chain Markup	Incremental Installation Labor Cost	Incremental Programming Labor Cost	Incremental Acceptance Test Labor Cost	Total First Cost (2025$)	Total First Cost (2029$)
Analog Line-Voltage Daylight Sensor	$177.41	$-	$-	$24.06	$201.47	$226.76
Analog Low-Voltage Daylight Sensor	$-	$-	$-	$24.06	$24.06	$27.08
Digital Wired Daylight Sensor	$2.86	$-	$-	$24.06	$26.93	$30.31
Digital Wireless Daylight Sensor	$-	$-	$-	$24.06	$24.06	$27.08
Luminaire-Integrated Daylighting Controls	$-	$-	$-	$24.06	$24.06	$27.08
Average	$36.05	$-	$-	$24.06	$60.12	$67.66

[54] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

5.4.4 Incremental Maintenance and Replacement Costs

Description of the incremental maintenance and replacement costs, as well as estimation of present value of maintenance and replacement costs, are provided in the 2028 CASE Methodology Report.

Replacement and maintenance costs are obtained in current dollars at the writing of the CASE Report and are projected to 2029 dollars for the cost-effectiveness analyses, assuming a 3 percent year-over-year inflation rate.

5.4.4.1 Cost Estimate Methodology

The maintenance and replacement costs over the 30-year analysis period were obtained in current dollars at the time the CASE Report was written and projected to 2029 dollars, assuming a 3 percent year-over-year inflation rate. The present values of these costs were then calculated using a 3 percent discount rate for the years in which maintenance and replacement take place.

For control hardware, the Statewide CASE Team did not find any documented lifetime information in the product literature. The manufacturer stakeholders the Statewide CASE Team consulted with also have not observed or estimated any systematic time-dependent failure patterns for control hardware in indoor applications. As an alternative, the team used the estimated luminaire lifetime as a proxy for the lifetime of control hardware. This is likely a conservative assumption since control hardware typically outlasts luminaires. According to the lighting schedule provided in the 2025 Alternative Calculation Method Reference Manual (ACM), the annual lighting operating hours range from 1,687 hours (warehouse) to 4,754 hours (restaurant). Assuming a 50,000-hour nominal rated lifetime for commercial-grade LED luminaires, the luminaire would last 10.5 to 29.7 years, based on the annual lighting operating hours in the ACM. The average lifetime, weighted by the square footage of different non-residential building types estimated in the Energy Commission's 2029 construction forecast, is 20.3 years. This estimate excludes parking garage lighting, which, although treated as an indoor application in Title 24, Part 6, is considered to operate in a harsher environment exposed to outdoor conditions and to have significantly longer operating hours. Also, parking garages are not expected to be impacted by this proposed code change. The Statewide CASE Team conservatively assumed a 15-year lifetime for luminaire and control hardware, resulting in one replacement during the 30-year analysis period.

For battery-powered devices, including keypads and daylight sensors, used in some of the control solution configurations in the cost analysis, the batteries would need to be replaced every 5 to 10 years, according to the product data sheets. However, no incremental cost would be incurred since battery replacement costs, both material and labor, would be the same for the base case and the proposed case. For requiring

manual dimmers, the batteries and associated replacement efforts for the battery-powered switch keypads in the base case and the battery-powered dimmer keypads in the proposed case would be identical. Similarly, for requiring continuous dimming for daylight responsive controls, the batteries and corresponding replacement efforts would be the same for battery-powered daylight sensors performing on/off switching in the base case and performing continuous dimming in the proposed case. The incremental maintenance and replacement cost is estimated for each control system using the following methodology:

- Estimate the incremental material and labor costs for each maintenance and replacement occurrence.
- Calculate the present value cost for the same type of maintenance and replacement over the 30-year analysis period.
- Add up the present value cost of all types of maintenance and replacement for the system.
- Calculate the average present value cost across all systems of the same control solution type.

5.4.4.2 Incremental Maintenance and Replacement Cost of Manual Dimmers

The average incremental present value cost of maintenance and replacement costs for each manual dimmer control solution type is shown in Table 64. It was assumed that the device being replaced at the 15-year mark of the estimated end of life includes only the keypad and does not include wires and cables connecting the keypads to other system components. For control solution types where the replacement costs in the proposed case are lower than the base case, the incremental replacement costs are considered to be zero.

The values in the table below are preliminary estimates. The Statewide CASE Team is still collecting cost data. Finalized values will be included in the Final CASE Report.

Table 64: Incremental Maintenance and Replacement Cost for Requiring Manual Dimmers

Control Solution Type	30-Year Present Value Maintenance and Replacement Cost
Wired, Line-Voltage	$14.49
Wired, Low-Voltage	$-
Wireless, Line Powered	$2.86
Wireless, Self Powered	$19.16
Average	$9.13

5.4.4.3 Incremental Maintenance and Replacement Cost of Daylight Responsive Controls with Continuous Dimming

The average incremental present value cost of maintenance and replacement costs for each daylight responsive control solution type is shown in Table 65. Except for the Luminaire-Level Lighting Controls (LLLC) solution type, it was assumed that the device being replaced at the 15-year mark of the estimated end of life includes only the daylight sensor and does not include wires and cables connecting the sensor to other system components. For LLLC solution type, the entire luminaires, including the luminaire-integrated sensor, would be replaced at the 15-year end-of-life mark. The incremental replacement cost also includes cost for acceptance test technicians to perform acceptance testing when the replacement daylight sensors and luminaires are installed.

The values in the table below are preliminary estimates. The Statewide CASE Team is still collecting cost data. Finalized values will be included in the Final CASE Report.

Table 65: Incremental First Costs Estimated for Requiring Daylight Responsive Controls with Continuous Dimming

Control Solution Type	30-Year Present Value Maintenance and Replacement Cost
Analog Line-Voltage Daylight Sensor	$145.55
Analog Low-Voltage Daylight Sensor	$17.38
Digital Wired Daylight Sensor	$19.45
Digital Wireless Daylight Sensor	$17.38
Luminaire-Integrated Daylighting Controls	$17.38
Average	$43.43

5.4.5 Cost Effectiveness

Cost effectiveness is assessed separately for the two major savings and cost components of the proposed code change: requiring manual dimmers in spaces with an LPD greater than 0.4 watts per square foot and requiring all daylighting responsive controls to be implemented with continuous dimming.

In the tables in this section, all values are presented in 2026 present value dollars (2029 PV$). Benefits represent 30-year LSC savings and other savings, including incremental first-cost savings if the proposed first cost is less than the current first cost, incremental maintenance cost savings if the proposed maintenance costs are less than the current maintenance costs, and incremental residual value if proposed residual value is greater than current residual value at the end of the 30-year period of analysis. Costs represent the total incremental PV cost, including incremental equipment, replacement, and maintenance costs over the period of analysis. The analysis treats a negative incremental maintenance cost as a positive benefit. If total incremental costs are zero,

the benefit-cost ratio (BCR) is considered infinite. Costs and other savings are discounted at a real (inflation-adjusted) three percent rate. If there are no total incremental PV costs, the BCR is infinite.

5.4.5.1 Cost Effectiveness for Requiring Manual Dimmers

The incremental present value costs for each of the control solution types are summarized in Table 66. The average present value incremental cost across all control solution types is $23.35 per dimmer keypad. Since manual dimmers are only required if the connected general lighting load exceeds 50 watts, the average present value incremental cost is $0.47 per watt controlled by the dimmer keypad. Note that the assumption of each dimmer controlling only 50 watts of general lighting is the most conservative. In most cases, when the manual dimmer requirement is triggered, a single dimmer typically controls the entire space, which may have a general lighting load far exceeding 50 watts.

The values are preliminary estimates. The Statewide CASE Team is still collecting cost data and modeling the cost analysis. Finalized values will be added to the paragraph above and table below in the Final CASE Report.

Table 66: Incremental Cost Components for Requiring Manual Dimmers

Control Solution Type	Incremental First Cost per Dimmer	30-year PV Incremental Maintenance and Replacement Cost per Dimmer	30-year Present Value Incremental Cost Total per Dimmer	30-year Present Value Incremental Cost per Watt Controlled
Wired, Line-Voltage	$22.58	$14.49	$37.07	$0.74
Wired, Low-Voltage	$-	$-	$-	$-
Wireless, Line Powered	$4.46	$2.86	$7.32	$0.15
Wireless, Self Powered	$29.85	$19.16	$49.01	$0.98
Average	$14.22	$9.13	$23.35	$0.47

Table 67 shows the per-unit (per-watt controlled) benefit-to-cost ratio for each of the impacted space types. The per-unit benefits are the total 30-year LSC savings per impacted space type per climate zone as listed in Table 54. The per-unit total incremental costs in 2029 PV$ does not vary by climate zone or space type, and the average 30-year present value incremental cost per watt controlled in Table 66 (the value in the last row of the last column in the table) is used to determine the benefit-to-cost ratios. The benefit-to-cost ratios are all greater than 1.0, ranging from 1.32 to 10.86, depending on space types and climate zones, with space type being the dominating factor.

The values in the table below are preliminary estimates. The Statewide CASE Team is still collecting cost data and modeling the cost analysis. Finalized values will be included in the Final CASE Report.

Table 67: 30-Year Cost-Effectiveness Summary Per Watt Controlled for Requiring Manual Dimmers– New Construction, Additions, and Alterations[55]

Space Type (Area Category)	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Aging Eye/Low-vision: Dining	6.70	6.73	6.71	6.71	6.77	6.58	6.64	6.77	6.83	6.79	6.72	6.76	6.73	6.66	6.70	6.81
Aging Eye/Low-vision: Main Entry Lobby	2.44	2.45	2.45	2.44	2.48	2.37	2.41	2.47	2.50	2.47	2.44	2.47	2.45	2.40	2.44	2.49
Aging Eye/Low-vision: Lounge/Waiting Area	10.82	10.82	10.82	10.81	10.79	10.86	10.81	10.79	10.78	10.79	10.80	10.79	10.80	10.81	10.83	10.78
Aging Eye/Low-vision: Multipurpose Room	10.82	10.82	10.82	10.81	10.79	10.86	10.81	10.79	10.78	10.79	10.80	10.79	10.80	10.81	10.83	10.78
Aging Eye/Low-vision: Religious Worship Area	4.40	4.41	4.40	4.40	4.46	4.26	4.33	4.44	4.50	4.45	4.40	4.44	4.41	4.33	4.39	4.49
Audience Seating Area	4.40	4.41	4.40	4.40	4.46	4.26	4.33	4.44	4.50	4.45	4.40	4.44	4.41	4.33	4.39	4.49
Auditorium Area	4.40	4.41	4.40	4.40	4.46	4.26	4.33	4.44	4.50	4.45	4.40	4.44	4.41	4.33	4.39	4.49
Auto Repair / Maintenance Area	1.72	1.70	1.71	1.68	1.69	1.65	1.67	1.66	1.67	1.66	1.67	1.69	1.67	1.64	1.67	1.66
Barber, Beauty Salon, and Spa Area	3.20	3.19	3.20	3.18	3.22	3.08	3.13	3.15	3.21	3.15	3.16	3.21	3.17	3.07	3.17	3.17
Civic Meeting Place Area	3.42	3.43	3.42	3.42	3.47	3.32	3.37	3.45	3.50	3.46	3.42	3.45	3.43	3.37	3.41	3.49
Classroom, Lecture, Training, Vocational Area	2.27	2.25	2.26	2.24	2.26	2.18	2.21	2.23	2.25	2.23	2.23	2.25	2.23	2.18	2.21	2.24
Concourse and Atria Area	2.28	2.28	2.29	2.27	2.30	2.20	2.24	2.25	2.29	2.25	2.26	2.29	2.26	2.19	2.26	2.26

[55] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Space Type (Area Category)	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Convention, Conference, Multipurpose and Meeting Area	4.40	4.41	4.40	4.40	4.46	4.26	4.33	4.44	4.50	4.45	4.40	4.44	4.41	4.33	4.39	4.49
Dining Area: Bar/Lounge and Fine Dining	6.70	6.73	6.71	6.71	6.77	6.58	6.64	6.77	6.83	6.79	6.72	6.76	6.73	6.66	6.70	6.81
Dining Area: Cafeteria/Fast Food	3.72	3.74	3.73	3.73	3.76	3.66	3.69	3.76	3.79	3.77	3.73	3.76	3.74	3.70	3.72	3.78
Exercise/Fitness Center and Gymnasium Area	3.20	3.19	3.20	3.18	3.22	3.08	3.13	3.15	3.21	3.15	3.16	3.21	3.17	3.07	3.17	3.17
Financial Transaction Area	1.38	1.36	1.37	1.35	1.36	1.33	1.34	1.34	1.35	1.34	1.35	1.36	1.35	1.32	1.34	1.34
Library : Reading Area	1.38	1.36	1.37	1.35	1.36	1.33	1.34	1.34	1.35	1.34	1.35	1.36	1.35	1.32	1.34	1.34
Library : Stacks Area	1.38	1.36	1.37	1.35	1.36	1.33	1.34	1.34	1.35	1.34	1.35	1.36	1.35	1.32	1.34	1.34
Main Entry Lobby	2.44	2.45	2.45	2.44	2.48	2.37	2.41	2.47	2.50	2.47	2.44	2.47	2.45	2.40	2.44	2.49
Lounge, Breakroom, or Waiting Area	4.40	4.41	4.40	4.40	4.46	4.26	4.33	4.44	4.50	4.45	4.40	4.44	4.41	4.33	4.39	4.49
Museum Area: Exhibition/Display	3.42	3.43	3.42	3.42	3.47	3.32	3.37	3.45	3.50	3.46	3.42	3.45	3.43	3.37	3.41	3.49
Museum Area: Restoration Room	3.42	3.43	3.42	3.42	3.47	3.32	3.37	3.45	3.50	3.46	3.42	3.45	3.43	3.37	3.41	3.49
Office Area: > 250 square feet	1.38	1.36	1.37	1.35	1.36	1.33	1.34	1.34	1.35	1.34	1.35	1.36	1.35	1.32	1.34	1.34
Office Area: ≤ 250 square feet	2.48	2.46	2.47	2.44	2.45	2.39	2.42	2.40	2.42	2.41	2.42	2.45	2.42	2.37	2.42	2.41
Pharmacy Area	2.28	2.28	2.29	2.27	2.30	2.20	2.24	2.25	2.29	2.25	2.26	2.29	2.26	2.19	2.26	2.26
Retail Sales Area: Grocery Sales	2.28	2.28	2.29	2.27	2.30	2.20	2.24	2.25	2.29	2.25	2.26	2.29	2.26	2.19	2.26	2.26

Space Type (Area Category)	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Retail Sales Area: Retail Merchandise Sales	3.20	3.19	3.20	3.18	3.22	3.08	3.13	3.15	3.21	3.15	3.16	3.21	3.17	3.07	3.17	3.17
Retail Sales Area: Fitting Room	2.28	2.28	2.29	2.27	2.30	2.20	2.24	2.25	2.29	2.25	2.26	2.29	2.26	2.19	2.26	2.26
Religious Worship Area	4.40	4.41	4.40	4.40	4.46	4.26	4.33	4.44	4.50	4.45	4.40	4.44	4.41	4.33	4.39	4.49
Sports Arena – Playing Area: Class I Facility	2.28	2.28	2.29	2.27	2.30	2.20	2.24	2.25	2.29	2.25	2.26	2.29	2.26	2.19	2.26	2.26
Sports Arena – Playing Area: Class II Facility	2.28	2.28	2.29	2.27	2.30	2.20	2.24	2.25	2.29	2.25	2.26	2.29	2.26	2.19	2.26	2.26
Sports Arena – Playing Area: Class III Facility	2.28	2.28	2.29	2.27	2.30	2.20	2.24	2.25	2.29	2.25	2.26	2.29	2.26	2.19	2.26	2.26
Sports Arena – Playing Area: Class IV Facility	2.28	2.28	2.29	2.27	2.30	2.20	2.24	2.25	2.29	2.25	2.26	2.29	2.26	2.19	2.26	2.26
Theater Area: Motion picture	4.40	4.41	4.40	4.40	4.46	4.26	4.33	4.44	4.50	4.45	4.40	4.44	4.41	4.33	4.39	4.49
Theater Area: Performance	4.40	4.41	4.40	4.40	4.46	4.26	4.33	4.44	4.50	4.45	4.40	4.44	4.41	4.33	4.39	4.49
Videoconferencing Studio	1.38	1.36	1.37	1.35	1.36	1.33	1.34	1.34	1.35	1.34	1.35	1.36	1.35	1.32	1.34	1.34

5.4.5.2 Cost Effectiveness for Requiring Continuous Dimming for All Daylight Responsive Controls

The incremental present value costs for each of the control solution types are summarized in Table 68. The average present value incremental cost across all control solution types is $111.09 per daylight responsive control. Since daylight responsive controls are only required in daylit zones with a general lighting of 75 watts or greater, the average present value incremental cost is $1.48 per watt controlled. Note that this is a conservative assumption since each daylit zone is likely to have more than 75 watts of general lighting load.

The values in the table below are preliminary estimates. The Statewide CASE Team is still collecting cost data and modeling the cost analysis. Finalized values will be included in the Final CASE Report.

Table 68: Incremental Cost Components for Requiring Daylight Responsive Controls with Continuous Dimming

Control Solution Type	Incremental First Cost per Dimmer	30-year PV Incremental Maintenance and Replacement Cost per Dimmer	30-year Present Value Incremental Cost Total per Dimmer	30-year Present Value Incremental Cost per Watt Controlled
Analog Line-Voltage Daylight Sensor	$226.76	$145.55	$372.31	$4.96
Analog Low-Voltage Daylight Sensor	$27.08	$17.38	$44.47	$0.59
Digital Wired Daylight Sensor	$30.31	$19.45	$49.76	$0.66
Digital Wireless Daylight Sensor	$27.08	$17.38	$44.47	$0.59
Luminaire-Integrated Daylighting Controls	$27.08	$17.38	$44.47	$0.59
Average	$67.66	$43.43	$111.09	$1.48

The per-unit benefit-to-cost ratio for each impacted space type will be presented in the Final CASE Report, as the Statewide CASE Team is still collecting data to model energy savings. The per-unit benefits, which is to be determined, would be the total 30-year LSC savings per impacted space type resulted from the energy savings. The average 30-year present value incremental cost per watt controlled in Table 68 (the value in the last row of the last column in the table). As discussed in Section 5.4.1.2, the Statewide CASE Team expects that there may not be energy savings in spaces with

low design illuminance in climate zones where the sky condition would more easily saturate the space with daylight. This may result in non-cost-effectiveness in those spaces when the benefit-to-cost ratio for this requirement is evaluated independently. However, the Statewide CASE Team expects overall cost-effectiveness when considered together with the manual dimmer requirements. Under the proposed new 50-watt trigger for manual dimmers, all spaces where daylight responsive controls are required (i.e., with a general lighting load of 75 watts or greater) would already have continuous dimming capability and the associated energy savings from manual dimmers. Therefore, the combined energy savings, the 30-year LSC savings, and the incremental costs should be cost effective overall.

5.5 Update Multilevel Lighting Controls Requirements - Statewide Impacts

5.5.1 Statewide Energy and Energy Cost Savings

See the 2028 CASE Methodology Report for details on how statewide savings are calculated. Appendix C presents the assumptions on the percentage of the total construction forecast that the proposed measure would impact.

For more details on the methodology and context about estimating the current market share rate, as well as statewide energy and energy cost savings, see the 2028 CASE Methodology Report.

The Statewide CASE Team first made assumptions on the percentage of different nonresidential occupancy space types within each building type included in the CEC construction forecast. Group R occupancies and common or public use areas were excluded from the assumptions and the subsequent analysis. The Statewide CASE Team then estimated, within each space type, the percentage of space that would be impacted by the proposed code changes. Spaces that would be impacted were separately estimated for the two components of the proposed code change: requiring manual dimmers in spaces with a general lighting load greater than 50 watts and requiring continuous dimming for all daylight responsive controls. The first-year statewide savings for new construction and additions were calculated by multiplying the per-unit savings, presented in Section 5.4.2, by the estimated percentage of spaces within newly constructed buildings that would be impacted. The statewide savings for the two components of the proposed changes were added together to represent the total statewide savings.

For alterations, the Statewide CASE Team followed the same approach as for new construction and additions and additionally assumed that the existing building stock would be impacted by the proposed code changes over the span of 15 years. In other

words, one-fifteenth of the existing building stock would be impacted in the first year and each year thereafter. The statewide savings from alterations are thus determined by multiplying the per-unit savings by the estimated existing building stock and by the estimated percentage of spaces within each building type that would be impacted.

The tables below present the first-year statewide energy and LSC savings from newly constructed buildings and additions (Table 69) and alterations (Table 70) by climate zone. Table 71 presents first-year statewide savings from new construction, additions, and alterations.

The values are preliminary estimates and currently include only the statewide impact from requiring manual dimmers. These values need to be updated as the Statewide CASE Team continues data collection and analysis on statewide impacts. Finalized values will be included in the Final CASE Report.

Table 69: Statewide Energy and LSC Impacts – New Construction and Additions[56]

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2029 (Million Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	0.017	0.002	0.000	0.002	$0.02
2	0.174	0.021	0.002	0.025	$0.16
3	0.748	0.090	0.008	0.106	$0.70
4	0.350	0.042	0.004	0.049	$0.32
5	0.052	0.006	0.001	0.007	$0.05
6	0.473	0.057	0.005	0.068	$0.43
7	0.394	0.047	0.004	0.056	$0.36
8	0.745	0.090	0.008	0.108	$0.71
9	1.140	0.137	0.012	0.165	$1.09
10	0.605	0.073	0.007	0.088	$0.58
11	0.126	0.015	0.001	0.017	$0.11
12	0.719	0.086	0.008	0.100	$0.67
13	0.241	0.028	0.003	0.033	$0.22
14	0.139	0.017	0.002	0.020	$0.13
15	0.071	0.008	0.001	0.010	$0.07
16	0.047	0.006	0.001	0.007	$0.04
Total	**6.042**	**0.725**	**0.065**	**0.864**	**$5.65**

[56] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values are preliminary estimates and currently include only the statewide impact from requiring manual dimmers. These values need to be updated as the Statewide CASE Team continues data collection and analysis on statewide impacts. Finalized values will be included in the Final CASE Report.

Table 70: Statewide Energy and LSC Impacts – Alterations[57]

Climate Zone	Statewide Alterations Impacted by Proposed Change in 2026 (Million Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction	First-Year Natural First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	0.112	0.014	0.001	0.016	$0.11
2	0.596	0.071	0.006	0.084	$0.55
3	2.681	0.322	0.029	0.381	$2.50
4	1.367	0.164	0.015	0.195	$1.27
5	0.228	0.027	0.002	0.032	$0.21
6	2.002	0.240	0.022	0.288	$1.82
7	1.426	0.170	0.015	0.203	$1.31
8	3.000	0.361	0.032	0.431	$2.82
9	4.614	0.552	0.050	0.660	$4.37
10	3.187	0.386	0.035	0.466	$3.04
11	0.554	0.066	0.006	0.078	$0.51
12	2.630	0.312	0.028	0.367	$2.43
13	1.115	0.133	0.012	0.156	$1.03
14	0.695	0.084	0.008	0.101	$0.64
15	0.397	0.048	0.004	0.057	$0.37
16	0.224	0.027	0.002	0.032	$0.21
Total	**24.828**	**2.978**	**0.267**	**3.548**	**$23.20**

[57] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values are preliminary estimates and currently include only the statewide impact from requiring manual dimmers. These values need to be updated as the Statewide CASE Team continues data collection and analysis on statewide impacts. Finalized values will be included in the Final CASE Report.

Table 71: Statewide Energy and LSC Impacts – New Construction, Additions, and Alterations[58]

Construction Type	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
New Construction & Additions	0.725	0.065	0.864	$5.65
Alterations	2.978	0.267	3.548	$23.20
Total	**3.703**	**0.331**	**4.411**	**$28.84**

[58] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

5.5.2 Statewide Greenhouse Gas Emissions Reductions

Table 72 presents the estimated first-year reduction in GHG emissions resulting from the proposed code change. In this initial year, the Statewide CASE Team expects to avoid 875.85 metric tons of carbon dioxide equivalent (CO_2e) emissions. These reductions, along with their associated monetary value, were calculated using hourly GHG emissions factors published alongside the LSC hourly factors and source energy hourly factors in the research versions of CBECC, as well as data from the CEC's 2028 Metrics Report. See the 2028 CASE Methodology Report for additional information.

The values in the table below are preliminary estimates and currently include only the statewide impact from requiring manual dimmers. These values need to be updated as the Statewide CASE Team continues data collection and analysis on statewide impacts. Finalized values will be included in the Final CASE Report.

Table 72: First-Year Statewide GHG Emissions Impacts[59]

Construction Type	Reduced GHG Emissions from Electricity Savings (Metric Tons CO2e)	Reduced GHG Emissions from Natural Gas Savings (Metric Tons CO2e)	Total Reduced GHG Emissions (Metric Ton CO2e)	Total Monetary Value of Reduced GHG Emissions ($)
New Construction & Additions	45.70	N/A	45.70	$5,627.79
Alterations	675.58	N/A	187.71	$23,116.08
Total	**233.41**	**N/A**	**233.41**	**$28,743.87**

5.5.3 Statewide Water Use Impacts

The proposed code change will not result in water use impacts.

5.5.4 Statewide Material Impacts

The Statewide CASE Team is still collecting data for material impacts. Finalized values will be included in the Final CASE Report.

5.5.5 Environmental Impacts

The proposed measure is not expected to have any significant environmental impacts. A detailed environmental impact analysis will be included in the Final CASE Report if further evidence shows any meaningful environmental impacts.

[59] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

5.5.6 Other Non-Energy Impacts

The proposed measure is not expected to have any quantifiable positive or negative non-energy impacts. A detailed non-energy impact analysis will be included in the Final CASE Report if further evidence shows any meaningful positive or negative impacts.

5.6 Update Multilevel Lighting Controls Requirements - Proposed Language Code

The proposed code language in this section includes only changes relevant to this measure. The intent is to clearly illustrate the scope of this measure. The proposed code language that encompasses the changes resulting from all the measures in this CASE Report can be found in Appendix F.

5.6.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents should be marked with dark blue underlining (new language) and ~~strikethroughs~~ (deletions).

5.6.2 Administrative Code (Title 24, Part 1)

There are no proposed changes to the Administrative Code (Title 24, Part 1).

5.6.3 Energy Code (Title 24, Part 6)

SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 120.6(a) through 120.6(k), and the applicable requirements of Sections 110.2(a) and 120.3.

…

(h) **Mandatory requirements for Controlled Environment Horticulture (CEH) spaces.**

…

5. **Horticultural lighting.** In a building with CEH spaces or a greenhouse with more than 40 kW of aggregate horticultural lighting load, the electric lighting system used for plant growth and plant maintenance shall meet the following requirements:

   …

   C. ~~Multilevel lighting controls~~Manual dimmers shall be installed and comply

with Section ~~130.1(b)~~130.1(a)4.

…

SECTION 110.12 – MANDATORY REQUIREMENTS FOR DEMAND MANAGEMENT

Buildings, other than healthcare facilities, that install or are required to install demand responsive controls shall comply with the applicable demand responsive control requirements of Sections 110.12(a) through 110.12(e).

…

(c) **Demand Responsive Lighting Controls.** Buildings with nonresidential lighting systems having a total installed lighting power of 4,000 watts or greater that are subject to the requirements of Section 130.1(a)4 ~~130.1(b)~~ or 160.5(b)4B shall install controls that are capable of automatically reducing lighting power in response to a demand response signal.

1. For compliance testing, the lighting controls shall demonstrate a 15-percent or greater reduction in lighting power as described in NA7.6.3. The controls may provide additional demand responsive functions or abilities.
2. For buildings where demand response controls are required, demand responsive controls shall control the general lighting in the spaces required to meet Section ~~130.1(b)~~ 130.1(a)4 or 160.5(b)4B.
3. General lighting power shall be reduced by continuous dimming ~~in a manner consistent with the requirements of Section 130.1(b)~~ or consistent with the requirements of Section 160.5(b)4B.

Exception to Section 110.12(c): Spaces where a health or life safety statute, ordinance, or regulation does not permit the general lighting to be reduced are not required to install demand responsive controls and do not count toward the 4,000-watt threshold.

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.1(a) through 130.1(f), in addition to the applicable requirements of Sections 110.9 and 130.0.

(a) **Manual controls**. Each space shall be provided with lighting controls that allow the lighting in that space to be manually turned on and off. The manual control shall:

…

4. In Group R occupancies and common or public use areas, where the connected general lighting exceeds 75 watts, controls shall be capable of continuous manual dimming to 10 percent or less of full lighting power in addition to full ON and OFF control. In spaces in nonresidential buildings, where the connected general lighting exceeds 50 watts, controls shall be capable of continuous manual dimming to 10 percent or less of full lighting power in addition to full ON and OFF control.

   Exception 1 to Section 130.1(a)4: Lighting in commercial/industrial shipping and receiving areas, copy rooms, corridors, electrical/mechanical/telephone rooms, kitchen/food preparation areas, laboratories, laundry rooms, locker rooms, manufacturing/commercial/industrial work areas, parking garages, restrooms, stairwells, and transportation concourse/baggage/ticketing areas.

   Exception 2 to Section 130.1(a)4: HID (high intensity discharge) and induction lighting with manual controls that have a minimum of one control step between 30 and 70 percent of full rated power in addition to full ON and full OFF.

   Exception 3 to Section 130.1(a)4: Healthcare Facilities.

…

(b) **RESERVED.**~~**Multilevel lighting controls.** The general lighting of any space with a size of 100 square feet or larger and with a connected lighting load greater than 0.5 watts per square foot shall be provided with multilevel lighting controls. The multilevel lighting controls shall provide and enable continuous dimming from 100 percent to 10 percent or lower of lighting power.~~

…

(c) **Shut-OFF** ~~**C**~~**controls.** All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is unoccupied.

…

5. **Occupant sensing controls.** In offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, classrooms, conference rooms, and restrooms, lighting shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting in 20 minutes or less after the control zone is unoccupied.

   ~~In areas required by Section 130.1(b) to have multi-level lighting controls, the~~The occupant sensing controls shall function either as a:

   A. Partial-ON occupant sensing controls capable of automatically activating between 50 and 70 percent of controlled lighting power, or

B. Vacancy sensing controls, where all lighting responds to a manual ON input only.

~~In areas not required by Section 130.1(b) to have multilevel lighting controls, the occupant sensing controls shall function either as:~~

~~A. Automatic full-on occupant sensing controls; or~~

~~B. Partial-ON occupant sensing controls, or~~

~~C. Vacancy sensing controls, where all lighting responds to a manual ON input only.~~

In addition, controls shall be provided that allow the lights to be manually shut OFF in accordance with Section 130.1(a) regardless of the sensor status.

Exception 1 to Section 130.1(c)5: Lighting systems not required to comply with the manual dimmer requirement in Section 130.1(a)4 may comply with this section with automatic full-on occupant sensing controls.

…

(d) **Daylight responsive controls.**

…

2. All daylight responsive controls shall meet the following requirements:

A. All skylit daylit zones, primary sidelit daylit zones, secondary sidelit daylit zones, and the combined primary and secondary sidelit daylit zones in parking garages shall be shown on the plans"; and

…

C. The daylight responsive controls shall control general lighting as follows ~~meet the following~~:

i. For spaces in Group R occupancies and common or public use areas, where the installation of ~~multilevel lighting controls~~manual dimmer is required under Section ~~130.1(b)~~130.1(a)4, ~~allow the multilevel lighting controls to adjust the light level with continuous dimming~~in response to availability of daylight, the daylighting control shall dim the lighting system continuously between 100 percent to 10 percent or lower of lighting power. For spaces in nonresidential buildings, in response to availability of daylight, the daylighting control shall dim the lighting system continuously between 100 percent to 10 percent or lower of lighting power;

Exception to Section 130.1(d)2Ci: Where general lighting is provided by HID or induction light sources, a daylight responsive control shall be permitted that has a minimum of one control step between 30 and 70 percent of full rated power in addition to full ON

and full OFF.

…

F. ~~The automatic daylighting control shall permit the multilevel lighting control to adjust the level of lighting.~~ In spaces where manual controls are required, the manual controls shall be capable of turning off or decreasing light levels below the light level set by the daylight responsive controls. When manual controls are capable of temporarily increasing electric lighting above the light level set by the daylight responsive controls, the controls shall be configured to reset electric lighting controls back to the Section 130.1(d)2C defaults after electric lighting have been turned off or reduced by a manual control, occupancy sensor or timeclock.

SECTION 140.6 – PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

(a) **Calculation of adjusted indoor lighting power.** The adjusted indoor lighting power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through 4 of this subsection, and the requirements of Subdivision 4 of this subsection.

…

2. **Reduction of wattage through controls.** In calculating adjusted indoor lighting power, the installed watts of a luminaire providing general lighting in an area listed in Table 140.6-A may be reduced by the product of (i) the number of watts controlled as described in Table 140.6-A, times (ii) the applicable power adjustment factor (PAF), if all of the following conditions are met:

   …

   K. To qualify for the PAF for a demand responsive control in Table 140.6-A, the general lighting wattage receiving the PAF shall not be within the scope of Section 110.12(c) and a demand responsive control shall meet all of the following requirements:

      i. The controlled lighting shall be capable of being automatically reduced in response to a demand response signal; and

      ii. General lighting power shall be reduced by continuous dimming ~~in a manner consistent with the requirements of~~ Section ~~130.1(b)~~.

…

(c) **Calculation of allowed indoor lighting power: specific methodologies.** The allowed indoor lighting power for each building type, or each primary function area

shall be calculated using only one of the methods in Subsection 1 or 2 below as applicable.

…

2. **Area Category Method.** Requirements for using the Area Category Method include all of the following:

   …

   G. In addition to the allowed indoor lighting power calculated according to Sections 140.6(c)2A through F, the building may add additional lighting power allowances for qualifying lighting systems as specified in the Qualifying Lighting Systems column in TABLE 140.6-C under the following conditions:

      …

      vii. In addition to meeting Sections 140.6(c)2Gi through vi, additional lighting power for videoconferencing as specified in Table 140.6-C shall be allowed in a videoconferencing studio, as defined in Section 100.1, provided the following conditions are met:

         …

         c. General lighting is switched in accordance with the requirements of Section ~~130.1(b)~~130.1(a)4; and

         …

SECTION 141.1 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND THE INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS

Table 141.0-F – Control Requirements for Indoor Lighting System Alterations

Control Specifications	Coded Section	Projects complying with Section 141.0(b)2li	Projects complying with Sections 141.0(b)2lii or 141.0(b)2liii
Manual Area Controls	130.1(a)1	Required	Required
Manual Area Controls	130.1(a)2	Required	Required
Manual Area Controls	130.1(a)3	Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Manual Area Controls	130.1(a)4	Required	Not Required
~~**Multilevel Controls**~~	~~130.1(b)~~	~~Required~~	~~Not Required~~
Automatic Shut-Off Controls	130.1(c)1	Required	Required
Automatic Shut-Off	130.1(c)2	Required	Required

Controls			
Automatic Shut-Off Controls	130.1(c)3	Required	Required
Automatic Shut-Off Controls	130.1(c)4	Required	Required
Automatic Shut-Off Controls	130.1(c)5	Required	Required
Automatic Shut-Off Controls	130.1(c)6	Required	Required; except for 130.1(c)6D
Automatic Shut-Off Controls	130.1(c)8	Required	Required
Daylight Responsive Controls	130.1(d)	Required	Not Required
Demand Responsive Controls	110.12(a) and 110.12(c)	Required	Not Required

5.6.4 Reference Appendices

NA7.6 Indoor Lighting Controls Acceptance Tests

NA7.6.1 ~~Automatic Daylighting~~Daylight Responsive Controls Acceptance Tests

…

***NA7.6.1.5* ~~Stepped Switching or~~ Stepped Dimming Control Systems Functional Testing**

Stepped ~~switching or stepped~~ dimming control systems provide no more than 10 discrete steps of control of light output.

…

(d) **Partial daylight test**. If the control system has one (1) to three (3) steps of control between on and off, test all control steps between on and off. If the control system has more than three (3) steps between on and off, testing three (3) control steps between on and off is sufficient to demonstrate compliance. ~~If the control system has zero (0) steps between on and off, the partial daylight test is not necessary. For stepped switching control systems, steps in a controlled zone are achieved by turning some luminaires or groups of luminaires on or off without any steps between on and off.~~

For each control stage that is tested in this step, the control stages with lower setpoints than the stage tested are left ON and those stages of control with higher setpoints are dimmed or controlled off. Simulate or provide conditions so that each control stage turns on and off or dims. Verify and document the following for each control stage:

1. Measure that the combined daylight and controlled electric lighting illuminance at the Reference Location is no less than the reference illuminance measured at this location during the No Daylight Test.
2. Verify that the combined daylight and controlled electric lighting illuminance at the Reference Location is no greater than 150 percent of the reference illuminance.
3. Light output is stable with no visible flicker. (Note: only luminaires in daylit zones are affected by daylight control)
4. The control stage shall not cycle on and off or cycle between dim and undimmed while daylight illuminance remains constant.

5.6.5 Compliance Manuals

The Statewide CASE Team will provide the CEC with recommended revisions to compliance manuals after the 45-Day Language is published.

5.6.6 ACM Reference Manual

There are no proposed changes to the ACM Reference Manual.

5.6.7 Compliance Forms

As discussed in Section 5.1.4.5, the NRCC-LTI-E, NRCC-PRF-E, NRCI-LTI-E and NRCA-LTI-03-A compliance forms would be updated to reflect the proposed change. The Statewide CASE Team can support the CEC in implementing these updates if the proposed change is adopted.

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Appendix A: Assumptions for Cost-effectiveness Analysis

Parking Garage Daylight Adaptation Zones Nighttime Controls

Key Assumptions for Energy Savings Analysis

The Statewide CASE Team calculated per-unit impacts and statewide impacts associated with both new construction and alterations by comparing the energy use of lighting that is minimally compliant with the 2025 Title 24, Part 6 Standards to lighting that is minimally compliant with the proposed requirements for the 2028 Standards. Savings are based on a comparison between a base case that uses daylight-adaptation zone lighting operating 24 hours per day and a building with daylight-adaptation zone photocell controls that turn the system off between sunset and sunrise at each garage entrance.

The Statewide CASE Team used a spreadsheet-based analysis approach to determine energy savings. The Statewide CASE Team modeled annual energy consumption per garage entrance based on an average garage entrance size. The Statewide CASE Team used an average garage entrance square footage for energy analysis, as these can vary across different garage entrance styles and significantly affect the annual energy consumption of the associated daylight adaptation system.

The analysis used the following assumptions and methodologies:

- The energy and cost analysis presented in this report used the final 2028 LSC factors.
- Since savings do not vary by climate zone, the Statewide CASE Team used the statewide average LSC hourly factors when calculating energy and energy cost impacts.
- The analysis used the same assumption as the 2025 code cycle, that all lighting would use LED technology or another technology with equivalent performance.
- Based on market research and stakeholder input, the Statewide CASE Team modeled the measure case using on/off photocell controls for daylight adaptation zone lighting.
- For the energy and cost analysis, the Statewide CASE Team used an average garage entrance size of 25’ by 45’ to calculate energy savings.
- For the energy and cost analysis, the Statewide CASE Team estimated that parking garages have one entrance per 250 parking spaces to calculate energy savings.

- For the energy and cost analysis, the Statewide CASE Team used the CEBECC Open Parking Garage model to represent the average size of standalone structured parking garages.
- For the energy and cost analysis, the Statewide CASE Team used the size of a single floor of the each analyzed building prototype to estimate the accompanying attached garage size to calculate energy savings.
- For the energy and cost analysis, the Statewide CASE Team used an estimate of the number of new construction commercial buildings that would include attached parking garages to estimate statewide impacts.

Energy Savings Methodology per Prototypical Building

The 2028 CASE Methodology Report provides details on estimating energy savings per prototypical building and unit. The CEC directed the Statewide CASE Team to model energy impacts using specific prototypical building models that represent typical building geometries for different building types. Table 73 presents the prototype buildings used in the analysis.

Table 73: Prototype Buildings Used for Energy, Demand, Cost, and Environmental Impacts Analysis[60]

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
Large Office	12	498,589	12-story + 1 basement. WWR–40%.
Large Retail	1	240,000	Big-box type retail building with WWR–12% and SRR–0.82%
Large School	2	210,866	High school with WWR–35% and SRR–1.4%
Assembly	1	315,339	The main assembly prototype comprises five different assembly buildings i.e., Dodge building types: Religious Worship, Sports & Recreation, Library, Exhibits & Events, and Transportation Terminals.
Hospital	5	241,501	5-story hospital plus basement.
Laboratory	3	53,628	3-story office building with 5 zones and a ceiling plenum on each floor. WWR–33%
Open Parking Garage	3	183,750	Configuration: two-way ramp with one-way floors. 175-foot length and width. 3-story building with 13-foot floor-to-floor height, 5.5-foot wall opening height, 3.5-foot sill height, and 175-foot wall opening width. Concrete wall with 0.30 reflectance.

[60] This proposed change applies to Nonresidential Buildings not Including Group R Occupancies and Common Use or Public Use Areas as mandated by California Assembly Bill 130.

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
			Unconditioned except for 8x5-foot parking attendant space with 8-foot ceiling.
Grocery	1	50,002	6-Zone Grocery Store DEER prototype model provided by Southern California Edison

There is an existing Title 24, Part 6 requirement that covers the building system in question and applies to both new construction/additions and alterations, so the Standard Design is minimally compliant with the 2025 Title 24 requirements, as the previous section describes.

The Proposed Design was identical to the Standard Design in all ways except for the revisions that represent the proposed changes to the code, as the previous section describes. Table 74 presents the parameters modified and the values used in the Standard Design and Proposed Design.

The values are preliminary estimates and need to be updated as the Statewide CASE Team continues data collection and analysis. Finalized values will be included in the Finalized CASE Report.

Table 74: Modifications Made to Standard Design in Each Prototype to Simulate Proposed Code Change[61]

Prototype ID	Climate Zones	Objects Modified	Parameter Name	Standard Design Parameter Value	Proposed Design Parameter Value
Large Office	3, 4, 6-10, 12	Parking Garage daylight adaptation zone lighting	LPD	1.0	0.1
Large Retail	3, 4, 6-10, 12	Parking Garage daylight adaptation zone lighting	LPD	1.0	0.1
Large School	3, 4, 6-10, 12	Parking Garage daylight adaptation zone lighting	LPD	1.0	0.1
Assembly	3, 4, 6-10, 12	Parking Garage daylight adaptation zone lighting	LPD	1.0	0.1
Hospital	3, 4, 6-10, 12	Parking Garage daylight adaptation zone lighting	LPD	1.0	0.1
Laboratory	3, 4, 6-10, 12	Parking Garage daylight adaptation zone lighting	LPD	1.0	0.1

[61] This proposed change applies to Nonresidential Buildings not Including Group R Occupancies and Common Use or Public Use Areas as mandated by California Assembly Bill 130.

Prototype ID	Climate Zones	Objects Modified	Parameter Name	Standard Design Parameter Value	Proposed Design Parameter Value
Open Parking Garage	All	Parking Garage daylight adaptation zone lighting	LPD	1.0	0.1
Grocery	3, 4, 6-10, 12	Parking Garage daylight adaptation zone lighting	LPD	1.0	0.1

The energy impacts of the proposed code change do not vary by CZ. Since savings do not vary by climate zone, the Statewide CASE Team used the statewide LSC hourly factors when calculating energy and LSC impacts.

Require Occupant Sensing Controls in More Spaces

Key Assumptions for Energy Savings Analysis

In the draft analysis, the focus was on the small-office prototype, but the final draft will incorporate all relevant prototypes that include the targeted space types. Two methods were utilized for estimating energy savings with one for energy savings analysis for lighting and one for HVAC. For both methods, the construction forecast assumes:

- 100 percent compliance in new construction; and
- Alterations that gradually convert the existing building stock over a 30-year period, where 15% of existing buildings are assumed to already have this measure implemented due to naturally occurring market adoption (NOMAD).

The analysis assumes that one-fifteenth (6.7 percent) of the existing stock is impacted in the first year and each year thereafter, based on the EUL of 15 for the control devices required to implement this measure. Energy impacts were simulated in each climate zone. Climate-zone-specific LSC hourly factors were applied to calculate energy and energy cost impacts.

The draft CASE Report includes HVAC–lighting interaction effects. The proposed lighting schedules and updated occupancy schedules are applied simultaneously within the CBECC model. The Statewide CASE Team will revisit these interaction effects in the final report, as needed, for additional prototypes and project types.

Lighting Energy Savings Analysis

The first method evaluates the benefit of adding full- or partial-off lighting shutoff controls, depending on space type and occupancy needs. This approach uses a spreadsheet-based model with lighting schedules derived from the 2025 CBECC weekday, Saturday, and Sunday schedules, extrapolated to a full-year 8,760-hour profile (excluding holidays).

The proposed building occupancy schedule was developed by subtracting unoccupied time based on each space type's floor area fraction. Savings from occupancy controls are based on Title 24, Part 6, Table 140.6-C, which specifies lighting power density (LPD) allowances by Lighting Area Category.

The analysis assumes that occupancy reductions apply evenly across all building operating hours when lighting load exceeds five percent. A 25 percent reduction is applied when controls are upgraded to full-off occupancy-based control. This assumption is based on the lesser of:

- The savings identified in an LBNL meta-analysis of 20 peer-reviewed studies, and
- The occupancy sensor reduction defined in ASHRAE 90.1 Table G3.7-1.

An exception is made for break rooms, where the LBNL savings value is applied because these spaces are assumed to have high levels of unoccupied time.

When controls are upgraded from manual to partial-off or from partial-off to full-off, the analysis assumes that 50 percent of the full-off reduction applies. Occupancy-based controls apply only to general lighting. Connected lighting loads are assumed to match the full LPD permitted under the 2025 Title 24, Part 6 Lighting Area Category method. Floor area distributions for each area category are derived from CPUC DEER data. Electricity savings are assumed to apply consistently across climate zones.

HVAC Energy Savings Analysis

The HVAC energy savings analysis method evaluates the benefit of adding full-off ventilation controls (occupied-standby mode). This approach also uses a spreadsheet-based model with building occupancy schedules derived from the 2025 CBECC weekday, Saturday, and Sunday schedules, extrapolated to a full-year 8,760-hour profile (excluding holidays).

The proposed occupancy schedule was developed by subtracting unoccupied time based on floor area fraction. The analysis assumes a 25 percent occupancy reduction applied evenly across building operating hours for each area category, consistent with the lighting occupancy reduction assumption described above.

Baseline HVAC energy use is based on CBECC results for each building type under current code assumptions. Proposed HVAC energy use reflects CBECC results generated using the updated building occupancy schedule.

Energy Savings Methodology per Prototypical Building

The 2028 CASE Methodology Report provides details on estimating energy savings per prototypical building and unit. The CEC directed the Statewide CASE Team to model energy impacts using specific prototypical building models that represent typical building

geometries for different building types. Table 75 presents the prototype buildings used in the analysis.

Table 75: Prototype Buildings Used for Energy, Demand, Cost, and Environmental Impacts Analysis[62]

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
Large Office	12	498,589	12-story + 1 basement office building with 5 zones and a ceiling plenum on each floor. WWR–40%. Because CBECC will model single-zone heat pumps in the Large School prototype's Standard Design, results from measures applied to the prototype should be compared to the Proposed Design prototype model, not the Standard Design. For example, as with the Assembly prototype, if a U-factor measure is applied to the Large School windows, that measure should be applied to a copy of the original Proposed Design. The results from that analysis should then be compared to the results of the original prototype's Proposed Design.
Medium Office	3	53,628	3-story office building with 5 zones and a ceiling plenum on each floor. WWR–33%
Small Office	1	5,502	1-story, 5-zone office building with pitched roof and unconditioned attic. WWR–24%
Small School	1	24,413	Elementary school with WWR–36%

The Statewide CASE Team is still modeling the energy analysis, and the detailed assumptions will be included in the Final CASE Report.

Reduce Occupant Sensing Controls Delay time

Key Assumptions for Energy Savings Analysis

To determine the energy savings for this proposal, the Statewide CASE Team compared the proposed code change to a base case with an occupant sensing control delay time set at 20 minutes, which is minimally compliant with the current Energy Code requirements. The proposed measure will set the delay time to 15 minutes. The Statewide CASE Team applied this comparison in several typical building space types with likely traffic patterns to model the amount of time during a typical day that the

[62] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

lighting system is dimmed or turned OFF. The difference between the base case and the proposed measure case represents the typical energy savings in the scenario.

The Statewide CASE Team used a spreadsheet-based analysis approach to determine energy savings. The first step was to develop a prototype scenario that reflects a typical load profile for a seven-day week, with a 40-hour work week in small, medium, and large office building types. Within these building types, the calculation estimates the proportion of space types, such as open office, private office, and reception area. Each space type has a different load shape based on the occupancy of the space. The model uses values per space type based on statewide averages of full load hours and extrapolated to the building level to incorporate multiple space types within the building. The Statewide CASE Team modeled a lighting scenario with the base case of 20-minute delay times and compared it to a model of the proposed 15-minute delay time to determine the reduction of Wh/day. The model multiplied full-load hours by the reduction time (percentage), then multiplied by the LPD.

The Statewide CASE Team is sensitive to the variability in delay times across different activities within buildings and is evaluating where longer delay times may lead to increased safety and security. In industrial building types, for instance, there may be a fall risk factor involved. The Statewide CASE Team also considered occupancy sensors for restrooms, because of the bathroom stalls where the lights may turn off while occupied.

The Statewide CASE Team simulated a 24-hour period in typical spaces and applied the full load equivalent hours based on normal occupancy patterns.

The Statewide CASE Team will use values based on engineering expertise instead of a full dataset to determine potential energy savings. The model assigned energy savings expectations to the prototype building based on the predominant use types. The Statewide CASE Team defined the overall building type allowance in Wh/f^2 using the complete building category method. The model compiles each simulation area use category to determine the energy savings at the complete building level. The Statewide CASE Team then extrapolated across other building types, depending on the space type level to the prototype savings. The full-load hour reduction will result in statewide energy savings.

Since the lighting energy savings do not vary by climate zone, the Statewide CASE Team used the statewide average LSC hourly factors when calculating energy and energy cost impacts.

Energy Savings Methodology per Prototypical Building

The 2028 CASE Methodology Report provides details on estimating energy savings per prototypical building and unit. The CEC directed the Statewide CASE Team to model

energy impacts using specific prototypical building models that represent typical building geometries for different building types. Table 76 presents the prototype buildings used in the analysis.

Table 76: Prototype Buildings Used for Energy, Demand, Cost, and Environmental Impacts Analysis[63]

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
Assembly	1	315,339	The main assembly prototype comprises five different assembly buildings i.e., Dodge building types: Religious Worship, Sports & Recreation, Library, Exhibits & Events, and Transportation Terminals. The CBECC model is separated into individual building files before using the Standard design. The CBECC standard design is modeled with SZVAVHP for Library and all other assembly building types are modeled with SZVAVAC systems. Gas hot water system is used as the Standard design SWH.
Non-refrigerated Warehouse	1	52,045	Single story high ceiling warehouse. Includes one office space. WWR–0.7% ,SRR–5%
Hospital	5	241,501	5-story hospital plus basement. Source: DOE Standard 90.1 Hospital prototype and scorecard. The prototype contains Title 24, Part 6, minimally compliant envelope features, and lighting. For HVAC systems, the AIA guidelines recommended using VAV systems wherever possible.
Hotel	4	42,554	4-story hotel with 77 guest rooms. WWR–11%
Large Office	12	498,589	12-story + 1 basement office building with 5 zones and a ceiling plenum on each floor. WWR–40%. Because CBECC will model single-zone heat pumps in the Large School prototype's Standard Design, results from measures applied to the prototype should be compared to the Proposed Design prototype model, not the Standard Design. For example, as with the Assembly prototype, if a U-factor measure is applied to the Large School windows, that measure should be applied to a copy of the original Proposed Design. The results from that analysis should then be compared to the results of the original prototype's Proposed Design.

[63] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
Medium Office	3	53,628	3-story office building with 5 zones and a ceiling plenum on each floor. WWR–33%
Laboratory	3	53,628	3-story office building with 5 zones and a ceiling plenum on each floor. WWR–33%
Small Office	1	5,502	1-story, 5-zone office building with pitched roof and unconditioned attic. WWR–24%
Restaurant	1	2,501	Fast food restaurant with a small kitchen and dining areas. WWR–14%. Pitched roof with an unconditioned attic.
Large Retail	1	240,000	Big-box type retail building with WWR–12% and SRR–0.82%
Mixed-use Retail	1	9,375	Retail building with WWR–10%. Roof is adiabatic
Medium Retail	1	24,563	Similar to a Target or Walgreens, 7% WWR on the front façade, none on other sides. SRR–2.1%.
Strip Mall	1	9,375	Strip mall building with WWR–10%
Small School	1	24,413	Elementary school with WWR–36%
Large School	2	210,866	High school with WWR–35% and SRR–1.4%
Open Parking Garage	3	183,750	Configuration: two-way ramp with one-way floors. 175-foot length and width. 3-story building with 13-foot floor-to-floor height, 5.5-foot wall opening height, 3.5-foot sill height, and 175-foot wall opening width. Concrete wall with 0.30 reflectance. Unconditioned except for 8x5-foot parking attendant space with 8-foot ceiling.
Enclosed Parking Garage	1	12,540	Part of the Mid- and High-rise Multifamily building prototype models (see UGGarage in the .idf files)
Grocery	1	50,002	6-Zone Grocery Store DEER prototype model provided by Southern California Edison
Refrigerated Warehouse	1	100,000	-
Controlled-environment Horticulture	1	100,000	-
Vehicle Service	1	100,000	-
Manufacturing	1	100,000	-
Unassigned	-	-	-

There is an existing Title 24, Part 6 requirement that covers the building system in question and applies to both new construction/additions and alterations, so the Standard Design is minimally compliant with the 2025 Title 24 requirements. The current occupancy sensor delay time is 15 minutes for relevant space types in both new construction/additions and alterations.

The Proposed Design was identical to the Standard Design in all ways except for the revisions that represent the proposed changes to the code. presents the parameters modified and the values used in the Standard Design and Proposed Design. Specifically, the proposed conditions assume an occupancy sensor delay time of 15 minutes.

CBECC was not used to model energy impacts. The Statewide CASE Team calculated energy savings using a spreadsheet model that simulates typical hours of a week in certain space types and applies a distribution of full load equivalent hours based on occupancy. The calculation considers the distribution of space types within each prototype and identifies the gaps in occupancy that are long enough to have the lights go off with the proposed code change for the measure's savings opportunity.

The energy impacts of the proposed code change do not vary by CZ. Since savings do not vary by climate zone, the Statewide CASE Team used the statewide LSC hourly factors when calculating energy and LSC impacts.

Update Multilevel Lighting Controls Requirements

Key Assumptions for Energy Savings Analysis

Energy savings are expected from the following two distinct components of the proposed code change:

- Requiring manual dimmers in spaces with a lighting power density (LPD) greater than 0.4 watts per square foot.
- Requiring continuous dimming for all daylight responsive controls.

Requiring manual dimmers in spaces with a lighting power density (LPD) greater than 0.4 watts per square foot

The savings from manual dimmers do not vary by climate zone. However, because LSC varies by climate zone, the Statewide CASE Team applied climate-zone-specific LSC hourly factors when calculating energy and energy cost impacts.

The current multilevel lighting controls requirements exempt spaces with an LPD of 0.5 watts per square foot or less, and the proposed change requires manual dimmers in spaces with an LPD greater than 0.4 watts per square foot. Therefore, energy savings

for this proposed change are generated in spaces with an LPD greater than 0.4 watts per square foot but less than or equal to 0.5 watts per square foot. Consequently, the energy savings analysis focused only on spaces with an LPD meeting this criterion. The base case assumes that no manual dimmer is installed in the space. The lights in the space are either full ON when occupied or full OFF when unoccupied. The proposed case assumes the lights are full OFF when unoccupied, same as the base case. However, when occupied, it assumes the lights are manually dimmed from the full ON level by the occupants.

The lighting schedules provided in the 2025 Nonresidential and Multifamily Alternative Calculation Method (ACM) Reference Manual that best match the impacted space types were used as the base case schedules. Based on professional judgement by the practitioners on the Statewide CASE Team staff, each impacted space type was assigned a likelihood of dimmers being used by occupants on a three-point scale: low, medium, or high. The potential savings from manual dimming reported as percentages in a meta-analysis study were mapped to the three scale points, with “medium” corresponding to the average. These percentage savings were applied uniformly to the base case lighting schedules to form the proposed case lighting schedules.

The differences in full-load hours (FLH) between the base case and the proposed case for the full-year 8760 hours were calculated for each impacted space type as FLH per year. The per-unit savings were then determined by multiplying the FLH by the allowed LPD for each impacted space type, presented in kilowatt-hours per square foot.

Requiring continuous dimming for all daylight responsive controls

The savings from requiring continuous dimming for all daylight responsive controls vary by climate zone because daylight availability throughout the day is correlated with climate zones. Therefore, the Statewide CASE Team applied climate-zone-specific LSC hourly factors when calculating energy and energy cost impacts.

Daylight responsive controls are required in daylit zones with a general lighting load of 75 watts or greater. The current multilevel lighting controls requirements exempt spaces with an LPD of 0.5 watts per square foot or less. In other words, spaces achieving an LPD of 0.5 watts per square foot or less would not need to have continuous dimming, and daylight responsive controls may be implemented using stepped switching. The proposed change requires all daylight responsive controls to be implemented with continuous dimming. Therefore, energy savings for this proposed change are generated in daylit zones with a general lighting load of 75 watts or greater and an LPD of 0.5 watts per square foot or less. Consequently, the energy savings analysis focused only on spaces meeting these two criteria. The base case assumes that daylight responsive controls in the impacted spaces are implemented with stepped switching, where the lights remain on at full power and are turned off only when daylight illuminance exceeds

150 percent of the designed light level. The proposed case assumes continuous dimming for daylight responsive controls in the impacted spaces, minimally compliant with the current code requirements when daylight responsive controls are implemented with continuous dimming. In other words, for the proposed case, the lights are at full power when there is no daylight, proportionally dimmed as daylight illuminance increases, and reach 10 percent of full power when daylight illuminance exceeds 150 percent or more of the designed light level.

The Statewide CASE Team focused the energy savings analysis on the space types with an allowed LPD of 0.5 watts per square foot or less. For sidelit daylit zones, energy savings were estimated using the same methodology documented in the 2025 Daylighting CASE Report. The hourly daylight illuminance values at the far side of the primary and secondary sidelit zones for all hours of the year in a prototypical space were calculated for different climate zones using the ray-tracing technique. The reduction in the fraction of electric light required to supplement the available daylight for each hour of the year was then calculated based on the recommended light level for each space type. When summed up over a year, this represents the reduction in full-load hours (FLH). The per-unit savings were determined by multiplying the FLH by the allowed LPD for each impacted space type, in kilowatts per square foot. For skylit daylit zones, energy savings were estimated using the ray-tracing technique similar to methodology in the 2025 Daylighting CASE Report. Based on professional judgement by practitioners on the Statewide CASE Team, each space was assigned a likelihood of being skylit and daylit on a three-point scale: low, medium, and high. Energy savings for each space were estimated as the average of the savings from the skylit and sidelit scenarios, weighted by their respective assigned likelihoods.

Energy Savings Methodology per Prototypical Building

The 2028 CASE Methodology Report provides details on estimating energy savings per prototypical building and unit. The CEC directed the Statewide CASE Team to model energy impacts using specific prototypical building models that represent typical building geometries for different building types.

Since the prototypical buildings do not model granular space compositions within each building, they were not suitable for use in modeling energy savings for the proposed measure. Consequently, the prototypical building models were not used in estimating energy savings. The per-unit energy savings were calculated for each impacted space type, as described above.

Appendix B: Purpose and Necessity of Proposed Code Changes

Introduction

The sections below provide the purpose and necessity of proposed changes to Title 24, Part 1; Title 24, Part 6; and the reference appendices. This section intends to provide the CEC with the information needed for the Initial Statement of Reasons.

See Section 2.6 of this report for marked-up code language.

Parking Garage Daylight Adaptation Zones Nighttime Controls

Purpose and Necessity of Changes to Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

Purpose and Necessity of Changes to Title 24, Part 6

Section: 130.1(g)

Purpose: The purpose of this change is to separately control the parking garage daylight adaptation zone lighting to automatically reduce the lighting to no more than the general light level in the parking zone and ramps from sunset to sunrise.

Necessity: The necessity for this change is to increase energy savings in parking garages and ensure proper visual adaptation for drivers entering and exiting parking garages at night.

Purpose and Necessity of Changes to the Reference Appendices

Section: NA7.6.1.4 Continuous Dimming Control Systems Functional Testing Daylight Responsive Controls Acceptance Tests

Purpose: The purpose of this change is to update the existing testing language in NA7.6.1.4.

Necessity: The necessity for this change is to eliminate the testing procedure described in NA7.6.1.4 (d).

Require Occupant Sensing Controls in More Spaces

Content for this measure will be completed before the Final CASE Report is posted for public review.

Reduce Occupant Sensing Controls Delay time

Purpose and Necessity of Changes to Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

Purpose and Necessity of Changes to Title 24, Part 6

Section: 130.1(c)

Purpose: The purpose of this change is to reduce the occupancy sensing control delay time from 20 minutes to 15 minutes.

Necessity: The necessary for this change is to increase lighting energy savings.

Purpose and Necessity of Changes to the Reference Appendices

Section: NA7.6.2.3

Purpose: The purpose of this change is to update references to occupancy sensing control delay time from 20 minutes to 15 minutes.

Necessity: The necessity for this change is to align the reference appendices with the updated delay time requirement in section 130.1(c).

Update Multilevel Lighting Controls Requirements

Purpose and Necessity of Changes to Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

Purpose and Necessity of Changes to Title 24, Part 6

Section: 130.1(b)

Purpose: The purpose of this change is to stop using the term “multilevel lighting controls,” a terminology used for traditional non-LED light sources with limited dimming capability, and place the intended manual dimming requirements into the 130.1(a) manual controls requirements and the intended continuous dimming capability into 130.1(d) daylight responsive controls and 120.6(h) demand responsive controls requirements.

Necessity: The necessity for this change is to ensure the correct interpretation of the requirements regarding when manual dimmers are required and when continuous dimming capability needs to be made available to other mandatory lighting control requirements.

Section: 130.1(a)

Purpose: The purpose of this change is to specify the manual dimmer requirements that were in 130.1(b) multilevel lighting controls and place them as part of the manual controls requirements in the newly created subsection 130.1(a)4.

Necessity: The necessity for this change is to clarify the manual dimmer requirement originally specified with confusing code language in the 130.1(b) multilevel lighting controls section. Since manual dimmers allow occupants to manually adjust the light level using the lighting system's continuous dimming capability, it is logical to specify the requirements as part of the manual controls requirements in 130.1(a).

Section: 130.1(d)

Purpose: The purpose of this change is to directly require continuous dimming for all daylight responsive controls and remove the existing reference to the 130.1(b) multilevel lighting controls section for continuous dimming. The purpose of this change is also to require continuous dimming for all daylight responsive controls in 130.1(d) without exception.

Necessity: The necessity for this change is to improve occupant experience with daylight responsive controls and remove the lighting control behaviors that confuse and frustrate occupants when daylight responsive controls are implemented using on/off switching due to the original multilevel lighting controls exception in 130.1(b). The change also removes the confusing code intent that references the 130.1(b) multilevel lighting controls section for continuous dimming. By directly specifying continuous dimming to be used for all daylight responsive controls, it facilitates correct interpretation of code requirements and improves compliance.

Section: 130.1(c)

Purpose: The purpose of this change is to remove reference to the 130.1(b) multilevel lighting controls section and directly specify the required behaviors for partial-on occupant sensing controls in 130.1(c)5.

Necessity: The necessity for this change is to improve the clarity of the code requirements for partial-on occupant sensing controls, depending on whether manual dimmers are required, to avoid confusing references to the 130.1(b) multilevel lighting controls section, the use of which is removed for all commercial non-Group R occupancies and accessory occupancies, and to retain the original intent of this section.

Section: 110.12(c)

Purpose: The purpose of this change is to remove reference to the 130.1(b) multilevel lighting controls section and directly specify the required behaviors for demand responsive lighting controls in 110.12(c).

Necessity: The necessity for this change is to improve the clarity of the code requirements for demand responsive lighting controls, avoid confusing references to the 130.1(b) multilevel lighting controls section, the use of which is removed for all commercial non-Group R occupancies and accessory occupancies, and retain the original intent of this section.

Section: 120.6(h)

Purpose: The purpose of this change is to remove reference to the 130.1(b) multilevel lighting controls section and reference the new 130.1(a)4 for horticultural lighting manual dimmer requirements.

Necessity: The necessity for this change is to ensure the requirements in this section no longer reference the 130.1(b) multilevel lighting controls section, the use of which is removed for all commercial non-Group R occupancies and accessory occupancies. Instead, the manual dimmer requirement in the new 130.1(a)4 section is referenced to retain the original intent of this section.

Section: 140.6(a)

Purpose: The purpose of this change is to remove reference to the 130.1(b) multilevel lighting controls section and directly require continuous dimming for utilizing the PAF related to demand responsive lighting controls.

Necessity: The necessity for this change is to remove references to the 130.1(b) multilevel lighting controls section, which is removed for all commercial non-Group R occupancies and accessory occupancies, and retain the original intent of this section.

Section: 140.6(c)

Purpose: The purpose of this change is to remove reference to the 130.1(b) multilevel lighting controls section and directly require manual dimmers for controlling additional lighting in videoconference studios.

Necessity: The necessity for this change is to remove references to the 130.1(b) multilevel lighting controls section, which is removed for all commercial non-Group R occupancies and accessory occupancies, and retain the original intent of this section.

Section: Table 141.0-F

Purpose: The purpose of this change is to specify requirements for the new manual dimmer requirements, 130.1(a)4, and remove the current multilevel lighting controls requirements, 130,1(b), from the table for alteration projects.

Necessity: The necessity for this change is to properly reflect the proposed code changes made to the manual controls section, 130.1(a)4, and the multilevel lighting

controls section,130.1(b), in the control requirements for indoor lighting system alterations.

Purpose and Necessity of Changes to the Reference Appendices

Section: NA7.6.1.5

Purpose: The purpose of this change is to remove the test method in NA7.6.1.5 for stepped switching as a partial daylight test option.

Necessity: The necessity for this change is to ensure the removal of the obsolete test method for the test scenarios of daylight responsive controls implemented with stepped switching that ATTs would no longer encounter after continuous dimming is required for all daylight responsive controls.

Appendix C: Assumptions for Statewide Savings Estimates

The Statewide CASE Team is anticipating updated construction forecasts to be released by the California Energy Commission in February 2026. This will impact statewide energy savings but not the cost effectiveness of the proposal. The final CASE Report will present the updated savings based on the new forecasts.

Parking Garage Daylight Adaptation Zones Nighttime Controls

Content for this section is still being developed as the Statewide CASE Team continues to build and refine the statewide energy saving estimates. This section may be updated before the Final CASE Report is posted for public review.

The Statewide CASE Team estimated statewide impacts for the first year by multiplying per-unit savings estimates by statewide construction forecasts provided by the CEC. The 2028 CASE Methodology Report includes additional information about the methodology and assumptions used to calculate statewide energy impacts.

The Statewide CASE Team calculated statewide savings for new construction by multiplying the per-unit savings, detailed in Section 2.4.2, by assumptions about the floor space associated with newly constructed buildings affected by the proposed code.

The Statewide CASE Team used the following assumptions and methodologies in the statewide savings analysis:

- The CBECC building prototype models represent the average square footage of each building type.
    - The Statewide CASE Team used the CBECC building prototype models square footage to convert total statewide square footage into total buildings.
- The number of parking spaces in each parking garage is based on the square footage of a best-practices parking space, and the square footage of the parking garage.
- The number of garage entrances in each building's parking garage is proportional to the number of parking spaces.
- The following building types in the 2029 New Construction Forecast do not include parking garages:
    - Medium Office; Small Office; Medium Retail; Strip Mall; Mixed-use Retail; Small School; Non-refrigerated Warehouse; Hotel; Restaurant;

Refrigerated Warehouse; Controlled-environment Horticulture; Vehicle Service; Manufacturing; Unassigned

- A portion of the following building types in the 2029 New Construction Forecast includes parking garages:
    - Large Office; Large Retail; Large School; Assembly; Hospital; Laboratory; Grocery

The statewide savings and cost estimates take the current market share rate into account. The current market share rate is estimated based on the Statewide CASE Team's professional judgment and data from the evaluation of past Title 24 code cycles.

Table 77 presents the projected nonresidential new construction that the proposed code change will impact in 2029. Table 78 shows the projected nonresidential existing statewide building stock that the proposed code change would affect through alterations in 2029. The Statewide CASE Team developed these estimates using the methods described in this section.

The Statewide CASE Team estimates that the proposed measure will apply to all new construction open- and enclosed-parking garages. The Statewide CASE Team applied an estimate of 2.1 percent to determine the fraction of other commercial building new construction that represents parking garages. The 2022 Statewide CASE Team developed this estimate for the 2022 Nonresidential Indoor Lighting CASE Report based on the last CBECS survey to include parking garages (The Statewide CASE Team 2020).

The Statewide CASE Team estimated the percentage of newly constructed floorspace that the proposed code change would impact. Table 79 shows the assumed percentage of affected floorspace by building type. If a proposed code change does not apply to a specific building type, the Statewide CASE Team assumes that zero percent of the floorspace would be impacted. If the assumed percentage is non-zero, but less than 100 percent, the proposal is expected to affect some—but not all—buildings. Table 80 represents the assumed percentage of affected floorspace by climate zone.

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues to build and refine the statewide impacted floorspace. Finalized values will be included in the Final CASE Report.

Table 77: Estimated Nonresidential New Construction and Additions Impacted by Proposed Code Change in 2029, by Climate Zone and Building Type (Million Square Feet)[64]

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Large Office	0.00	0.000	0.007	0.005	0.00	0.002	0.000	0.005	0.009	0.000	0.00	0.002	0.00	0.000	0.00	0.000	0.029
Large Retail	0.00	0.000	0.014	0.005	0.00	0.005	0.000	0.009	0.014	0.000	0.00	0.009	0.00	0.000	0.00	0.000	0.054
Large School	0.00	0.000	0.002	0.002	0.00	0.000	0.000	0.002	0.002	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.009
Assembly	0.00	0.000	0.014	0.005	0.00	0.005	0.000	0.009	0.014	0.000	0.00	0.009	0.00	0.000	0.00	0.000	0.054
Hospital	0.00	0.000	0.005	0.002	0.00	0.002	0.000	0.002	0.005	0.000	0.00	0.005	0.00	0.000	0.00	0.000	0.020
Laboratory	0.00	0.000	0.007	0.003	0.00	0.001	0.000	0.001	0.001	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.014
Open Parking Garage	0.00	0.000	0.007	0.005	0.00	0.002	0.000	0.005	0.009	0.000	0.00	0.002	0.00	0.000	0.00	0.000	0.029
Grocery	0.00	0.000	0.005	0.002	0.00	0.002	0.000	0.005	0.007	0.000	0.00	0.007	0.00	0.000	0.00	0.000	0.027
TOTAL	**0.00**	**0.002**	**0.072**	**0.042**	**0.00**	**0.060**	**0.016**	**0.066**	**0.071**	**0.009**	**0.00**	**0.036**	**0.00**	**0.002**	**0.00**	**0.002**	**0.378**

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues to build and refine the statewide impacted floorspace. Finalized values will be included in the Final CASE Report.

[64] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Table 78: Estimated Existing Nonresidential Floorspace Impacted by Proposed Code Change in 2026 (Alterations), by Climate Zone and Building Type (Million Square Feet)[65]

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Large Office	0.10	2.48	111.84	57.88	1.47	79.63	58.17	130.08	242.48	46.78	2.09	62.89	7.41	16.22	3.55	3.73	826.79
Large Retail	0.80	6.93	46.94	21.52	3.36	25.57	20.27	34.77	53.22	42.65	9.12	46.53	18.01	8.73	7.52	2.57	348.51
Large School	0.61	6.42	27.86	11.16	1.66	22.70	18.03	34.33	58.86	44.81	8.10	42.70	21.13	9.65	6.10	2.87	316.98
Assembly	3.46	14.54	73.07	36.05	5.28	45.80	32.72	71.31	96.16	73.40	13.08	55.78	24.10	15.16	9.46	5.15	574.53
Hospital	1.49	8.87	38.66	19.74	4.04	22.60	21.72	32.62	55.90	31.68	8.89	42.54	17.99	7.04	4.03	2.59	320.41
Laboratory	0.14	3.21	29.54	22.45	1.22	9.77	13.75	12.49	15.45	8.65	0.54	9.71	3.52	1.38	0.31	0.46	132.59
Open Parking Garage	0.18	5.62	44.02	33.46	3.09	32.91	28.14	65.95	81.92	27.66	3.57	31.97	5.05	8.84	1.72	4.49	378.59
Grocery	0.08	1.36	4.70	2.85	0.60	2.73	1.67	3.21	5.56	3.21	0.52	2.99	1.16	0.75	0.43	0.31	32.12
TOTAL	**27.7**	**164.1**	**799.4**	**467.1**	**76.4**	**606.2**	**437.7**	**912.0**	**1409.1**	**779.5**	**152.9**	**792.6**	**296.1**	**184.5**	**104.5**	**62.8**	**7,272.55**

[65] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues to build and refine the statewide impacted floorspace. Finalized values will be included in the Final CASE Report.

Table 79: Percentage of Nonresidential Buildings Impacted by Proposed Code Change in 2029, by Building Type[66]

Building Type	New Construction Impacted (Percent Buildings)	Existing Building Stock (Alterations) Impacted (Percent Buildings)
Large Office	50%	7%
Medium Office	0%	0%
Small Office	0%	0%
Large Retail	50%	7%
Medium Retail	0%	0%
Strip Mall	0%	0%
Mixed-Use Retail	0%	0%
Large School	50%	7%
Small School	0%	0%
Non-refrigerated Warehouse	0%	0%
Hotel	0%	0%
Assembly	50%	7%
Hospital	50%	7%
Laboratory	50%	7%
Restaurant	0%	0%
Enclosed Parking Garage	0%	0%
Open Parking Garage	100%	7%
Grocery	50%	7%
Refrigerated Warehouse	0%	0%
Controlled-Environment Horticulture	0%	0%
Vehicle Service	0%	0%
Manufacturing	0%	0%
Unassigned	0%	0%

[66] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

The values in the table below are preliminary estimates and need to be updated as the Statewide CASE Team continues to build and refine the statewide impacted floorspace. Finalized values will be included in the Final CASE Report.

Table 80: Percentage of Nonresidential Floorspace Impacted by Proposed Measure, by Climate Zone[67]

Climate Zone	New Construction Impacted (Percent Square Footage)	Existing Building Stock (Alterations) Impacted (Percent Square Footage)
1	100%	100%
2	100%	100%
3	100%	100%
4	100%	100%
5	100%	100%
6	100%	100%
7	100%	100%
8	100%	100%
9	100%	100%
10	100%	100%
11	100%	100%
12	100%	100%
13	100%	100%
14	100%	100%
15	100%	100%
16	100%	100%

Require Occupant Sensing Controls in More Spaces

Content for this section is still being developed as the Statewide CASE Team continues to build and refine the statewide energy saving estimates. This section will be completed in the Final CASE Report.

[67] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Reduce Occupant Sensing Controls Delay time

Content for this section is still being developed as the Statewide CASE Team continues to build and refine the statewide energy saving estimates. This section will be completed in the Final CASE Report.

The Statewide CASE Team estimated statewide impacts for the first year by multiplying per-unit savings estimates by statewide construction forecasts provided by the CEC. The 2028 CASE Methodology Report includes additional information about the methodology and assumptions used to calculate statewide energy impacts.

The statewide savings and cost estimates take the current market share rate into account. The current market share rate is estimated based on the Statewide CASE Team's professional judgment and data from the evaluation of past Title 24 code cycles.

Table 81 presents the projected nonresidential new construction that the proposed code change will impact in 2026.

Table 82 shows the projected nonresidential existing statewide building stock that the proposed code change would affect through alterations in 2026. The Statewide CASE Team developed these estimates using the methods described in this section.

The Statewide CASE Team estimated the percentage of newly constructed floorspace that the proposed code change would impact. Table 83 shows the assumed percentage of affected floorspace by building type. If a proposed code change does not apply to a specific building type, the Statewide CASE Team assumes that zero percent of the floorspace would be impacted. If the assumed percentage is non-zero, but less than 100 percent, the proposal is expected to affect some—but not all—buildings. Table 85 represents the assumed percentage of affected floorspace by climate zone.

To determine the statewide savings, the Statewide CASE Team:

- The occ sensor measure applies to all space types that require occupancy sensors, and for the purposes of evaluation, the Statewide CASE Team grouped them into several different categories of activity:
    - Office
    - Entry/lobby/corridor/restroom/office support, etc.
    - Warehouse
    - Parking garage
    - Classroom
- The Statewide CASE Team then assigned these use types to spaces in all the relevant building types in the construction forecast with an area weighted approach to represent the space in each building type that is likely to have the incremental benefit of the measure.

- That then is scaled up from the prototype space to the statewide through the MeasureSET calculations.
- Occupancy sensors are not driven in every building type, as each space type varies in occupancy patterns.
    - Are they driven by occ sensors? In bars and auditoriums, the assumption is that these occupancy types are not driven by occupancy and if they are, to a small degree.
    - Less space-use types match if 60 percent of the building does not have as much savings.

  The Statewide CASE Team will focus on large offices which incorporate the following: 30 percent private office, 30 percent open offices, 10 restrooms, and 10 percent entry/lobby) medium and small office building prototype will have the space use type as private office, and open reception.

Table 81: Estimated New Nonresidential Construction Impacted by Proposed Code Change in 2026, by Climate Zone and Building Type (Million Square Feet)[68]

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Large Office	0.00	0.00	2.90	1.42	0.00	1.28	0.74	2.05	3.72	0.35	0.10	0.52	0.00	0.18	0.01	0.04	13.31
Medium Office	0.13	0.48	1.37	0.74	0.37	1.20	0.80	1.65	3.18	1.17	0.27	2.80	0.59	0.35	0.26	0.10	15.47
Small Office	0.01	0.43	0.19	0.02	0.06	0.15	0.23	0.16	0.36	0.41	0.09	0.54	0.38	0.04	0.10	0.03	3.22
Large Retail	0.00	0.00	1.10	0.55	0.15	0.70	0.37	0.83	1.66	0.63	0.30	1.30	0.36	0.14	0.18	0.06	8.34
Medium Retail	0.08	0.35	0.79	0.45	0.09	0.60	0.29	0.86	1.42	0.82	0.14	0.63	0.38	0.18	0.12	0.08	7.29
Strip Mall	0.00	0.15	0.50	0.23	0.01	0.56	0.49	0.99	1.07	1.35	0.07	0.59	0.33	0.32	0.10	0.06	6.81
Mixed-Use Retail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Large School	0.01	0.11	0.77	0.39	0.03	0.52	0.54	0.80	1.25	0.75	0.31	1.01	0.54	0.15	0.08	0.06	7.32
Small School	0.07	0.27	0.46	0.23	0.14	0.32	0.29	0.35	0.66	0.35	0.10	0.78	0.30	0.11	0.04	0.04	4.50
Non-refrigerated Warehouse	0.06	0.37	2.16	1.12	0.18	1.36	0.71	1.95	3.01	1.36	0.63	2.84	0.82	0.36	0.37	0.14	17.44
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Assembly	0.01	0.39	1.58	0.56	0.06	0.79	0.80	1.43	1.82	1.14	0.17	1.41	0.30	0.25	0.12	0.08	10.92
Hospital	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Laboratory	0.01	0.19	1.29	0.71	0.07	0.42	0.27	0.46	0.84	0.35	0.13	0.43	0.12	0.08	0.04	0.03	5.44
Restaurant	0.01	0.08	0.33	0.17	0.03	0.34	0.20	0.49	0.82	0.41	0.07	0.31	0.14	0.10	0.05	0.03	3.59
Enclosed Parking Garage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Open Parking Garage	0.00	0.12	2.47	1.68	0.06	3.65	1.20	3.20	2.16	0.65	0.02	0.53	0.04	0.20	0.05	0.09	16.12
Grocery	0.01	0.05	0.10	0.06	0.01	0.05	0.02	0.05	0.09	0.05	0.01	0.04	0.02	0.01	0.01	0.01	0.58

[68] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Refrigerated Warehouse	0.00	0.00	0.06	0.05	0.01	0.02	0.00	0.01	0.01	0.04	0.00	0.07	0.12	0.01	0.01	0.01	0.41
Controlled-Environment Horticulture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vehicle Service	0.00	0.08	0.55	0.36	0.03	0.55	0.34	0.80	1.81	0.57	0.02	0.39	0.25	0.20	0.06	0.05	6.05
Manufacturing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Unassigned	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42
TOTAL	**0.4**	**3.1**	**16.6**	**9.1**	**1.3**	**12.5**	**7.3**	**16.1**	**23.9**	**10.4**	**2.4**	**14.2**	**4.7**	**2.7**	**1.6**	**0.9**	**127.2**

Table 82: Estimated Existing Nonresidential Floorspace Impacted by Proposed Code Change in 2026 (Alterations), by Climate Zone and Building Type (Million Square Feet)[69]

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Large Office	0.00	0.00	2.90	1.42	0.00	1.28	0.74	2.05	3.72	0.35	0.10	0.52	0.00	0.18	0.01	0.04	13.31
Medium Office	0.13	0.48	1.37	0.74	0.37	1.20	0.80	1.65	3.18	1.17	0.27	2.80	0.59	0.35	0.26	0.10	15.47
Small Office	0.01	0.43	0.19	0.02	0.06	0.15	0.23	0.16	0.36	0.41	0.09	0.54	0.38	0.04	0.10	0.03	3.22
Large Retail	0.00	0.00	1.10	0.55	0.15	0.70	0.37	0.83	1.66	0.63	0.30	1.30	0.36	0.14	0.18	0.06	8.34
Medium Retail	0.08	0.35	0.79	0.45	0.09	0.60	0.29	0.86	1.42	0.82	0.14	0.63	0.38	0.18	0.12	0.08	7.29
Strip Mall	0.00	0.15	0.50	0.23	0.01	0.56	0.49	0.99	1.07	1.35	0.07	0.59	0.33	0.32	0.10	0.06	6.81
Mixed-use Retail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Large School	0.01	0.11	0.77	0.39	0.03	0.52	0.54	0.80	1.25	0.75	0.31	1.01	0.54	0.15	0.08	0.06	7.32
Small School	0.07	0.27	0.46	0.23	0.14	0.32	0.29	0.35	0.66	0.35	0.10	0.78	0.30	0.11	0.04	0.04	4.50

[69] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Non-refrigerated Warehouse	0.06	0.37	2.16	1.12	0.18	1.36	0.71	1.95	3.01	1.36	0.63	2.84	0.82	0.36	0.37	0.14	17.44
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Assembly	0.01	0.39	1.58	0.56	0.06	0.79	0.80	1.43	1.82	1.14	0.17	1.41	0.30	0.25	0.12	0.08	10.92
Hospital	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Laboratory	0.01	0.19	1.29	0.71	0.07	0.42	0.27	0.46	0.84	0.35	0.13	0.43	0.12	0.08	0.04	0.03	5.44
Restaurant	0.01	0.08	0.33	0.17	0.03	0.34	0.20	0.49	0.82	0.41	0.07	0.31	0.14	0.10	0.05	0.03	3.59
Enclosed Parking Garage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Open Parking Garage	0.00	0.12	2.47	1.68	0.06	3.65	1.20	3.20	2.16	0.65	0.02	0.53	0.04	0.20	0.05	0.09	16.12
Grocery	0.01	0.05	0.10	0.06	0.01	0.05	0.02	0.05	0.09	0.05	0.01	0.04	0.02	0.01	0.01	0.01	0.58
Refrigerated Warehouse	0.00	0.00	0.06	0.05	0.01	0.02	0.00	0.01	0.01	0.04	0.00	0.07	0.12	0.01	0.01	0.01	0.41
Controlled-Environment Horticulture	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vehicle Service	0.00	0.08	0.55	0.36	0.03	0.55	0.34	0.80	1.81	0.57	0.02	0.39	0.25	0.20	0.06	0.05	6.05
Manufacturing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Unassigned	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42
TOTAL	**0.4**	**3.1**	**16.6**	**9.1**	**1.3**	**12.5**	**7.3**	**16.1**	**23.9**	**10.4**	**2.4**	**14.2**	**4.7**	**2.7**	**1.6**	**0.9**	**127.2**

Table 83: Percentage of Nonresidential Floorspace Impacted by Proposed Code Change in 2026, by Building Type[70]

Building Type	New Construction Impacted (Percent Square Footage)	Existing Building Stock (Alterations) Impacted (Percent Square Footage)
Large Office	100%	7%
Medium Office	100%	7%
Small Office	100%	7%
Large Retail	100%	7%
Medium Retail	100%	7%
Strip Mall	100%	7%
Mixed-Use Retail	100%	7%
Large School	100%	7%
Small School	100%	7%
Non-refrigerated Warehouse	100%	7%
Hotel	0%	0%
Assembly	100%	7%
Hospital	0%	0%
Laboratory	100%	7%
Restaurant	100%	7%
Enclosed Parking Garage	0%	0%
Open Parking Garage	100%	7%
Grocery	100%	7%
Refrigerated Warehouse	100%	7%
Controlled-Environment Horticulture	0%	0%
Vehicle Service	100%	7%
Manufacturing	0%	0%
Unassigned	100%	7%

[70] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Table 84: Percentage of Nonresidential Floorspace Impacted by Proposed Measure, by Climate Zone[71]

Climate Zone	New Construction Impacted (Percent Square Footage)	Existing Building Stock (Alterations) Impacted (Percent Square Footage)
1	100%	100%
2	100%	100%
3	100%	100%
4	100%	100%
5	100%	100%
6	100%	100%
7	100%	100%
8	100%	100%
9	100%	100%
10	100%	100%
11	100%	100%
12	100%	100%
13	100%	100%
14	100%	100%
15	100%	100%
16	100%	100%

Update Multilevel Lighting Controls Requirements

Content for this section is still being developed as the Statewide CASE Team continues to build and refine the statewide energy saving estimates. This section will be finalized for the Final CASE Report.

The Statewide savings were estimated separately for the two distinct components of the proposed code change and then summed up:

- Requiring manual dimmers in spaces with a general lighting load greater than 50 watts.
- Requiring continuous dimming for all daylight responsive controls.

The Statewide CASE Team estimated statewide impacts for the first year by multiplying per-unit savings estimates by statewide construction forecasts provided by the CEC. The 2028

[71] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

CASE Methodology Report includes additional information about the methodology and assumptions used to calculate statewide energy impacts.

Table 85 presents the projected nonresidential new construction that the proposed code change will impact in 2026. Table 86 shows the projected nonresidential existing statewide building stock that the proposed code change would affect through alterations in 2026. The Statewide CASE Team developed these estimates using the methods described in this section.

Table 85: Estimated Nonresidential New Construction Impacted by Proposed Code Change in 2029, by Climate Zone and Building Type (Million Square Feet)[72]

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Large Office	0.00	0.00	2.03	0.99	0.00	0.89	0.52	1.44	2.61	0.25	0.07	0.36	0.00	0.13	0.01	0.03	9.32
Medium Office	0.09	0.33	0.96	0.52	0.26	0.84	0.56	1.15	2.23	0.82	0.19	1.96	0.41	0.24	0.18	0.07	10.83
Small Office	0.01	0.30	0.13	0.01	0.04	0.10	0.16	0.11	0.25	0.29	0.06	0.38	0.27	0.03	0.07	0.02	2.25
Large Retail	0.00	0.00	0.77	0.38	0.10	0.49	0.26	0.58	1.16	0.44	0.21	0.91	0.25	0.10	0.13	0.04	5.83
Medium Retail	0.06	0.24	0.56	0.31	0.06	0.42	0.20	0.60	1.00	0.58	0.10	0.44	0.27	0.13	0.09	0.06	5.10
Strip Mall	0.00	0.11	0.35	0.16	0.01	0.39	0.34	0.69	0.75	0.94	0.05	0.41	0.23	0.22	0.07	0.04	4.77
Mixed-Use Retail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Large School	0.00	0.08	0.54	0.27	0.02	0.37	0.38	0.56	0.88	0.53	0.22	0.71	0.38	0.10	0.05	0.04	5.13
Small School	0.05	0.19	0.32	0.16	0.10	0.22	0.21	0.25	0.46	0.24	0.07	0.54	0.21	0.07	0.03	0.03	3.15
Non-refrigerated Warehouse	0.04	0.26	1.51	0.78	0.12	0.95	0.50	1.36	2.11	0.95	0.44	1.99	0.57	0.25	0.26	0.10	12.21
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Assembly	0.01	0.28	1.11	0.39	0.04	0.55	0.56	1.00	1.28	0.80	0.12	0.99	0.21	0.17	0.08	0.06	7.64
Hospital	0.02	0.12	0.57	0.29	0.05	0.22	0.37	0.30	0.53	0.55	0.10	0.56	0.18	0.10	0.08	0.03	4.08
Laboratory	0.01	0.13	0.90	0.50	0.05	0.29	0.19	0.32	0.59	0.24	0.09	0.30	0.08	0.06	0.03	0.02	3.81
Restaurant	0.01	0.06	0.23	0.12	0.02	0.24	0.14	0.35	0.57	0.29	0.05	0.22	0.10	0.07	0.03	0.02	2.52
Enclosed Parking Garage	0.00	0.01	1.28	0.87	0.00	1.81	0.49	1.59	1.07	0.04	0.00	0.03	0.00	0.01	0.00	0.01	7.21
Open Parking Garage	0.00	0.08	1.73	1.18	0.04	2.55	0.84	2.24	1.51	0.46	0.01	0.37	0.03	0.14	0.03	0.07	11.28
Grocery	0.00	0.03	0.07	0.04	0.01	0.03	0.01	0.04	0.06	0.03	0.01	0.03	0.02	0.01	0.01	0.00	0.41

[72] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Refrigerated Warehouse	0.00	0.00	0.04	0.04	0.01	0.02	0.00	0.00	0.01	0.03	0.00	0.05	0.08	0.01	0.01	0.00	0.29
Controlled-Environment Horticulture	0.06	0.05	0.22	0.03	0.14	0.18	0.00	0.02	0.02	0.19	0.21	0.21	0.06	0.01	0.03	0.00	1.46
Vehicle Service	0.00	0.05	0.38	0.25	0.02	0.39	0.24	0.56	1.27	0.40	0.02	0.27	0.17	0.14	0.04	0.03	4.23
Manufacturing	0.00	0.01	0.15	0.05	0.01	0.01	0.04	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34
Unassigned	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
TOTAL	**0.4**	**2.5**	**14.6**	**8.0**	**1.2**	**11.4**	**6.3**	**13.8**	**19.2**	**8.5**	**2.1**	**11.3**	**3.7**	**2.1**	**1.3**	**0.7**	**107.1**

Table 86: Estimated Existing Nonresidential Floorspace Impacted by Proposed Code Change in 2029 (Alterations), by Climate Zone and Building Type (Million Square Feet)[73]

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Large Office	0.10	2.48	111.84	57.88	1.47	79.63	58.17	130.08	242.48	46.78	2.09	62.89	7.41	16.22	3.55	3.73	826.79
Medium Office	2.70	24.79	63.03	33.82	10.66	38.25	35.10	47.29	69.07	53.35	13.55	81.36	20.14	10.66	8.20	3.25	515.23
Small Office	3.34	10.20	17.75	9.06	6.00	10.58	6.81	10.62	16.70	19.54	8.48	35.15	17.18	3.99	4.94	2.14	182.51
Large Retail	0.80	6.93	46.94	21.52	3.36	25.57	20.27	34.77	53.22	42.65	9.12	46.53	18.01	8.73	7.52	2.57	348.51
Medium Retail	0.94	10.49	35.62	20.59	4.35	35.42	27.73	53.38	86.56	53.51	8.30	48.40	19.32	12.42	7.02	4.14	428.17
Strip Mall	2.67	7.87	29.94	14.74	4.08	32.18	22.63	44.61	66.96	53.54	9.80	38.70	19.34	12.22	6.96	3.67	369.90
Mixed-use Retail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Large School	0.61	6.42	27.86	11.16	1.66	22.70	18.03	34.33	58.86	44.81	8.10	42.70	21.13	9.65	6.10	2.87	316.98
Small School	1.78	8.90	20.46	7.98	4.85	20.55	11.97	27.55	43.45	26.42	10.80	33.66	18.75	6.98	3.40	2.92	250.43

[73] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Non-refrigerated Warehouse	2.66	16.18	86.64	42.74	7.84	71.98	41.18	102.72	165.84	146.16	26.98	118.64	40.86	31.10	23.24	9.30	934.08
Hotel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Assembly	3.46	14.54	73.07	36.05	5.28	45.80	32.72	71.31	96.16	73.40	13.08	55.78	24.10	15.16	9.46	5.15	574.53
Hospital	1.49	8.87	38.66	19.74	4.04	22.60	21.72	32.62	55.90	31.68	8.89	42.54	17.99	7.04	4.03	2.59	320.41
Laboratory	0.14	3.21	29.54	22.45	1.22	9.77	13.75	12.49	15.45	8.65	0.54	9.71	3.52	1.38	0.31	0.46	132.59
Restaurant	0.49	2.89	11.78	6.00	1.24	13.17	8.58	19.02	32.00	25.93	2.81	13.56	6.19	5.49	2.76	1.52	153.42
Enclosed Parking Garage	0.01	0.43	32.57	24.75	0.24	23.32	16.54	46.73	58.02	2.14	0.28	2.47	0.39	0.68	0.13	0.35	209.06
Open Parking Garage	0.18	5.62	44.02	33.46	3.09	32.91	28.14	65.95	81.92	27.66	3.57	31.97	5.05	8.84	1.72	4.49	378.59
Grocery	0.08	1.36	4.70	2.85	0.60	2.73	1.67	3.21	5.56	3.21	0.52	2.99	1.16	0.75	0.43	0.31	32.12
Refrigerated Warehouse	0.00	0.36	0.73	0.17	0.31	0.37	0.02	0.34	0.63	0.52	0.21	1.72	3.13	0.15	0.16	0.12	8.92
Controlled-Environment Horticulture	0.56	0.37	2.10	0.86	5.06	6.61	0.86	0.59	1.28	2.89	2.01	3.63	4.29	0.37	0.52	0.19	32.17
Vehicle Service	0.73	4.95	26.92	12.78	2.38	26.98	18.46	39.62	65.42	45.23	5.04	30.66	14.59	12.07	4.94	2.83	313.61
Manufacturing	3.28	13.51	49.54	63.64	4.47	58.66	26.62	98.16	134.48	39.66	10.29	45.61	20.78	13.58	4.12	7.42	593.83
Unassigned	0.29	5.26	7.22	5.05	0.18	2.06	0.62	3.02	6.29	2.04	2.69	11.48	2.35	0.62	0.32	0.82	50.31
TOTAL	**27.7**	**164.1**	**799.4**	**467.1**	**76.4**	**606.2**	**437.7**	**912.0**	**1409.1**	**779.5**	**152.9**	**792.6**	**296.1**	**184.5**	**104.5**	**62.8**	**7,272.55**

Requiring manual dimmers in spaces with a general lighting load greater than 50 watts

The statewide savings and cost estimates take the current market share rate into account. The current market share rate is estimated based on the Statewide CASE Team's professional judgment and data from the evaluation of past Title 24 code cycles. The estimate does not include Group R occupancies and common or public use areas.

The Statewide CASE Team estimated the percentage of newly constructed floorspace that the proposed code change would impact. Table 87 shows the assumed percentage of affected floorspace by space type. If a proposed code change does not apply to or is not expected to affect a specific space type, the Statewide CASE Team assumes that zero percent of the floorspace would be impacted. If the assumed percentage is non-zero, but less than 100 percent, the proposal is expected to affect some—but not all—spaces. These estimates are the Statewide CASE Team's professional judgment of the average fraction of each affected space type within each building type that will have a general lighting load of greater than 50 watts and are originally exempted from the multilevel lighting controls to trigger the proposed requirement. Spaces meeting the triggering criteria are expected to be small in size. The same fraction assumptions were applied to both new constructions and existing buildings. For existing buildings, it is further assumed that the spaces will be affected over 15 years; in other words, only one-fifteenth of the existing floorspace will be converted in the first year and each year thereafter. The Statewide CASE Team assumed that the fraction of affected spaces does not vary by climate zones. Table 88 shows the resulting percentage of affected floorspace by building type.

Table 87: Estimated Percentage of Nonresidential Floorspace Impacted by Proposed Code Change in 2026, by Space Type – Requiring Manual Dimmers[74]

Space Type (Area Category)	New Construction Impacted (Percent Square Footage)	Existing Building Stock (Alterations) Impacted (Percent Square Footage)
Aging Eye/Low-vision: Dining	0.0%	0.0%
Aging Eye/Low-vision: Main Entry Lobby	0.0%	0.0%
Aging Eye/Low-vision: Lounge/Waiting Area	0.0%	0.0%
Aging Eye/Low-vision: Multipurpose Room	0.0%	0.0%
Aging Eye/Low-vision: Religious Worship Area	0.0%	0.0%
Audience Seating Area	80.0%	5.3%

[74] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Space Type (Area Category)	New Construction Impacted (Percent Square Footage)	Existing Building Stock (Alterations) Impacted (Percent Square Footage)
Auditorium Area	0.0%	0.0%
Auto Repair / Maintenance Area	0.1%	0.0%
Barber, Beauty Salon, and Spa Area	1.0%	0.1%
Civic Meeting Place Area	0.5%	0.0%
Classroom, Lecture, Training, Vocational Area	1.0%	0.1%
Concourse and Atria Area	0.0%	0.0%
Convention, Conference, Multipurpose and Meeting Area	0.5%	0.0%
Dining Area: Bar/Lounge and Fine Dining	100.0%	6.7%
Dining Area: Cafeteria/Fast Food	80.0%	5.3%
Dining Area: Family and Leisure	80.0%	5.3%
Exercise/Fitness Center and Gymnasium Area	80.0%	5.3%
Financial Transaction Area	0.1%	0.0%
Library : Reading Area	0.1%	0.0%
Library : Stacks Area	0.0%	0.0%
Main Entry Lobby	0.5%	0.0%
Lounge, Breakroom, or Waiting Area	10.0%	0.7%
Museum Area: Exhibition/Display	0.1%	0.0%
Museum Area: Restoration Room	0.1%	0.0%
Office Area: > 250 square feet	0.0%	0.0%
Office Area: ≤ 250 square feet	5.0%	0.3%
Pharmacy Area	5.0%	0.3%
Retail Sales Area: Grocery Sales	0.0%	0.0%
Retail Sales Area: Retail Merchandise Sales	0.0%	0.0%
Retail Sales Area: Fitting Room	5.0%	0.3%
Religious Worship Area	1.0%	0.1%
Sports Arena – Playing Area: Class I Facility	0.0%	0.0%
Sports Arena – Playing Area: Class II Facility	0.0%	0.0%
Sports Arena – Playing Area: Class III Facility	0.0%	0.0%
Sports Arena – Playing Area: Class IV Facility	0.0%	0.0%
Theater Area: Motion picture	100.0%	6.7%
Theater Area: Performance	0.0%	0.0%
Videoconferencing Studio	0.5%	0.0%

Table 88: Percentage of Nonresidential Floorspace Impacted by Proposed Code Change in 2026, by Building Type – Requiring Manual Dimmers[75]

Building Type	New Construction Impacted (Percent Square Footage)	Existing Building Stock (Alterations) Impacted (Percent Square Footage)
Large Office	2.3%	0.2%
Medium Office	2.2%	0.1%
Small Office	2.2%	0.1%
Large Retail	1.0%	0.1%
Medium Retail	1.0%	0.1%
Strip Mall	1.0%	0.1%
Mixed-Use Retail	0.0%	0.0%
Large School	11.5%	0.8%
Small School	5.1%	0.3%
Non-refrigerated Warehouse	0.3%	0.0%
Hotel	0.0%	0.0%
Assembly	20.4%	1.4%
Hospital	1.9%	0.1%
Laboratory	2.1%	0.1%
Restaurant	40.1%	2.7%
Enclosed Parking Garage	0.0%	0.0%
Open Parking Garage	0.0%	0.0%
Grocery	0.0%	0.0%
Refrigerated Warehouse	0.3%	0.0%
Controlled-Environment Horticulture	0.0%	0.0%
Vehicle Service	0.8%	0.1%
Manufacturing	1.2%	0.1%
Unassigned	5.0%	0.3%

Requiring continuous dimming for all daylight responsive controls

The Statewide CASE Team is still working on modeling and estimating per-unit savings from requiring continuous dimming for all daylight responsive controls, on which the statewide savings estimate will be built. The related assumptions will be fully developed and presented in the Final CASE Report.

[75] This proposed change excludes Group R occupancies and Group R common use and public areas as mandated by California Assembly Bill 130.

Appendix D: Environmental Analysis

Parking Garage Daylight Adaptation Zones Nighttime Controls

Potential Significant Environmental Effect of Proposal

The Statewide CASE Team has considered the environmental benefits and adverse impacts of its proposal, including—but not limited to—an evaluation of factors contained in the California Code of Regulations, Title 14, section 15064, and has determined that the proposal will not result in a significant effect on the environment.

Direct Environmental Impacts

Direct Environmental Benefits

The direct environmental benefits include a positive impact resulting from energy savings and GHG reduction.

Direct Adverse Environmental Impacts

Direct adverse environmental impacts include the slight potential for increased materials use from implementing the required controls, as detailed in section 22.

Indirect Environmental Impacts

Indirect Environmental Benefits

Indirect environmental benefits from the proposed measure include a reduced potential for light pollution and light trespass due to the reduced light levels at parking garage entries at night.

Indirect Adverse Environmental Impacts

The Statewide CASE Team determined this measure would not result in indirect adverse environmental impacts.

Mitigation Measures

The Statewide CASE Team did not determine this measure would result in significant direct or indirect adverse environmental impacts and therefore, did not develop any mitigation measures.

Reasonable Alternatives to Proposal

The Statewide CASE Team has considered alternatives to the proposal and determined that no alternative would achieve its purpose with less environmental effect.

Water Use and Water Quality Impacts Methodology

The Statewide CASE Team determined that there are no impacts to water quality or water use.

Require Occupant Sensing Controls in More Spaces

Potential Significant Environmental Effect of Proposal

The Statewide CASE Team has considered the environmental benefits and adverse impacts of its proposal, including—but not limited to—an evaluation of factors contained in the California Code of Regulations, Title 14, section 15064, and has determined that the proposal will not result in a significant effect on the environment.

Direct Environmental Impacts

Direct Environmental Benefits

Content for this section is still being developed and will be completed before the Final CASE Report is posted for public review.

Direct Adverse Environmental Impacts

Content for this section is still being developed and will be completed before the Final CASE Report is posted for public review.

Indirect Environmental Impacts

Indirect Environmental Benefits

Content for this section is still being developed and will be completed before the Final CASE Report is posted for public review.

Indirect Adverse Environmental Impacts

Content for this section is still being developed and will be completed before the Final CASE Report is posted for public review.

Mitigation Measures

The Statewide CASE Team did not determine that this measure would result in significant direct or indirect adverse environmental impacts and therefore, did not develop any mitigation measures.

Reasonable Alternatives to Proposal

The Statewide CASE Team has considered alternatives to the proposal and determined that no alternative would achieve its purpose with less environmental effect.

Water Use and Water Quality Impacts Methodology

The Statewide CASE Team determined that there are no impacts to water quality or water use.

Reduce Occupant Sensing Controls Delay time

Potential Significant Environmental Effect of Proposal

The Statewide CASE Team has considered the environmental benefits and adverse impacts of its proposal, including—but not limited to—an evaluation of factors contained in the California Code of Regulations, Title 14, section 15064, and has determined that the proposal will not result in a significant effect on the environment.

Direct Environmental Impacts

Direct Environmental Benefits

The direct environmental benefits include a positive impact resulting from energy savings and GHG reduction.

Direct Adverse Environmental Impacts

The Statewide CASE Team determined this measure would not result in direct adverse environmental impacts.

Indirect Environmental Impacts

Indirect Environmental Benefits

The Statewide CASE Team determined this measure would not result in indirect environmental benefits.

Indirect Adverse Environmental Impacts

The Statewide CASE Team determined this measure would not result in indirect adverse environmental impacts.

Mitigation Measures

The Statewide CASE Team did not determine that this measure would result in significant direct or indirect adverse environmental impacts and therefore did not develop any mitigation measures.

Reasonable Alternatives to Proposal

The Statewide CASE Team has considered alternatives to the proposal and determined that no alternative would achieve its purpose with less environmental effect.

Water Use and Water Quality Impacts Methodology

The Statewide CASE Team determined that there are no impacts to water quality or water use.

Update Multilevel Lighting Controls Requirements

Potential Significant Environmental Effect of Proposal

The Statewide CASE Team has considered the environmental benefits and adverse impacts of its proposal, including—but not limited to—an evaluation of factors contained in the California Code of Regulations, Title 14, section 15064, and has determined that the proposal will not result in a significant effect on the environment.

Direct Environmental Impacts

Direct Environmental Benefits

Numbers cited below are based on preliminary estimates and will need to be updated as the Statewide CASE Team continues data collection and refines the statewide impacts. The values will be updated before the Final CASE Report is posted for public review.

As described in Section 5.5, this proposed code change is expected to result in 3.70 GWh statewide energy savings and reduce electrical demand by 0.33 MW annually. The resulting savings and demand reductions would translate to annual reductions in 233.41 metric tons of greenhouse gas emissions.

Direct Adverse Environmental Impacts

The Statewide CASE Team did not find any studies, data or other information suggesting the proposed code change, by installing manual dimmers and continuous dimmable lighting in more spaces, would result in direct adverse environmental impacts.

Indirect Environmental Impacts

Indirect Environmental Benefits

The Statewide CASE Team did not find any studies, data or other information supporting any indirect environmental benefits for the proposed code change.

Indirect Adverse Environmental Impacts

The Statewide CASE Team did not find any studies, data or other information demonstrating that the proposed code change, by installing manual dimmers and continuously dimmable lighting in more spaces, would cause indirect environmental impacts.

Mitigation Measures

The Statewide CASE Team has considered opportunities to minimize the environmental impact of the proposal, including an evaluation of “specific economic, environmental, legal, social, and technological factors” (Cal. Code Regs., tit. 14, § 15021). The Statewide CASE Team did not determine that this measure would result in significant direct or indirect adverse environmental impacts and therefore, did not develop any mitigation measures.

Reasonable Alternatives to Proposal

The Statewide CASE Team has considered alternatives to the proposal and determined that no alternative would achieve its purpose with less environmental effect.

Water Use and Water Quality Impacts Methodology

The proposed code change is not related to water usage, and there are no impacts to water quality or water use.

Appendix E: Summary of Stakeholder Engagement

Introduction to Stakeholder Engagement

Collaborating with stakeholders who may be affected by proposed code changes is a core component of the Statewide CASE Team's process. The Statewide CASE Team engages interested parties to identify and address issues related to the proposals, with the goal of submitting recommendations to the CEC in this Draft CASE Report that reflect broad support. Public stakeholders provide valuable feedback on draft analyses and help identify and address adoption challenges, including cost effectiveness, market and technical barriers, compliance and enforcement, and potential impacts on human health or the environment. Some stakeholders also provide data that the Statewide CASE Team uses to support analyses.

This appendix summarizes the stakeholder engagement conducted by the Statewide CASE Team during the development and refinement of the report's recommendations.

Utility-Sponsored Stakeholder Meetings

Utility-sponsored stakeholder meetings provide an opportunity to learn about the Statewide CASE Team's role in the advocacy effort and to hear about specific code change proposals that the Statewide CASE Team is pursuing for the 2028 code cycle. The goal of these meetings is to solicit input on proposals from stakeholders early enough to ensure the proposals and the supporting analyses are vetted and have as few outstanding issues as possible. To promote transparency in the development of code change proposals, the Statewide CASE Team uses stakeholder meetings to solicit feedback on:

- Proposed code changes
- Draft code language
- Draft assumptions and results of analyses
- Data to support assumptions
- Compliance and enforcement
- Technical and market feasibility

The Statewide CASE Team hosted one stakeholder meeting for Indoor Lighting Controls via webinar and planned the second one in March 2026, as described in Table 89. Please see below for dates and links to event pages on Title24Stakeholders.com. Materials from each meeting, such as slide presentations, proposal summaries with code language, and meeting notes, are included in the bibliography section of this report.

Table 89: Utility-Sponsored Stakeholder Meetings

Meeting Name and Link to Materials	Meeting Date	Summary of Items Discussed
First Round of Indoor Lighting Controls Utility-Sponsored Stakeholder Meeting	Wednesday, September 24, 2025	• Introduced the four lighting controls measures and the background of each measure • Presented the plan for estimating energy savings and collecting cost data • Highlighted specific information that the Statewise CASE Team was requesting from the stakeholders • Discuss stakeholder concerns on triggering additional occupied standby requirements • Clarify the intent of updating multilevel lighting controls with stakeholders
Second Round of Indoor Lighting Controls Utility-Sponsored Stakeholder Meeting	Friday, March 6, 2026 (planned)	(Planned key topics) • Present the updated code change proposals for indoor lighting controls • Discuss the rationale of the updates and solicit feedback • Present the estimated energy savings for each of the lighting controls measure • Highlight information the Statewide CASE Team is still seeking from the stakeholders

The first round of utility-sponsored stakeholder meetings began in September 2025 and served as an early forum to promote transparency and gather stakeholder feedback on measures under consideration by the Statewide CASE Team.

The objectives of the first round of stakeholder meetings were to solicit input on the scope of the 2028 code cycle proposals; request data and feedback on the specific approaches, assumptions, and methodologies for the energy impacts and cost-effectiveness analyses; and understand potential technical and market barriers. The Statewide CASE Team also presented the initial draft code language for stakeholders to review.

The second round of utility-sponsored stakeholder meetings is scheduled from February to March 2026 to provide updated details on proposed code changes. These meetings will introduce early results of energy, cost effectiveness, and incremental cost analyses, and solicit feedback on refined draft code language.

Utility-sponsored stakeholder meetings were open to the public. For each stakeholder meeting, two promotional emails were distributed from info@title24stakeholders.com. One email was sent to the full Title 24 Stakeholders listserv, which includes over 3,000

individuals. A second email targeted specific recipients based on their subscription preferences.

The Title 24 Stakeholders listserv is an opt-in service comprising participants from diverse industries and trades, such as manufacturers, advocacy groups, local government, and building and energy professionals. Each meeting was announced on the Title 24 Stakeholders LinkedIn page and cross-promoted on the CEC LinkedIn page approximately two weeks in advance to engage individuals, organizations, and broader channels beyond the listserv. The Statewide CASE Team conducted extensive personal outreach to stakeholders identified in initial work plans who had not yet opted in to the listserv. Exported webinar meeting data captured attendance numbers, individual comments, and results from live attendee polls to help evaluate stakeholder participation and support.

Statewide CASE Team Communications

This section will be updated before the Final CASE Report is posted for public review, as the Statewide CASE Team continues stakeholder engagement.

The Statewide CASE Team held personal communications over email and phone with numerous stakeholders when developing this report, listed in Table 90.

Table 90: Engaged Stakeholders

Organization/Individual Name	Market Role	Mentioned in CASE Report Sections
Legrand	Manufacturer	
Signify	Manufacturer	
Lutron	Manufacturer	
Current	Manufacturer	
National Electrical Manufacturers Association	Industry Association	
KW Engineering	Acceptance Test Technician	
National Lighting Contractors Association of America	Acceptance Test Technician	
CalEnergy Corporation	Energy Consultant	
California Energy Alliance	Energy Efficiency Advocates	
DesignLights Consortium	Energy Efficiency Advocates	
Northwest Energy Efficiency Alliance	Energy Efficiency Advocates	
[PLACEHOLDER] XX County Permit Department	Code Enforcement Department	

Engagement with ESJ communities

Efforts related to engaging with ESJ communities will be documented in the Final CASE Report after the Statewide CASE Team completes targeted stakeholder outreach.

Appendix F: Proposed Code Language

The proposed markup language in sections 2.6, 3.6, 4.6, and 5.6 confined to the scope of each individual measure. This section provides the markup language when the scopes of all measures are considered.

Administrative Code (Title 24, Part 1)

There are no proposed changes to the Administrative Code (Title 24, Part 1).

Energy Code (Title 24, Part 6)

SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 120.6(a) through 120.6(k), and the applicable requirements of Sections 110.2(a) and 120.3.

…

(h) **Mandatory requirements for Controlled Environment Horticulture (CEH) spaces.**

…

5. **Horticultural lighting.** In a building with CEH spaces or a greenhouse with more than 40 kW of aggregate horticultural lighting load, the electric lighting system used for plant growth and plant maintenance shall meet the following requirements:

   …

   C. ~~Multilevel lighting controls~~Manual dimmers shall be installed and comply with Section ~~130.1(b)~~130.1(a)4.

   …

SECTION 110.12 – MANDATORY REQUIREMENTS FOR DEMAND MANAGEMENT

Buildings, other than healthcare facilities, which install or are required to install demand responsive controls shall comply with the applicable demand responsive control requirements of Sections 110.12(a) through 110.12(e).

…

(c) **Demand Responsive Lighting Controls.** Buildings with nonresidential lighting systems having a total installed lighting power of 4,000 watts or greater that are subject to the requirements of Section 130.1(a)4 ~~130.1(b)~~ or 160.5(b)4B shall install controls that are capable of automatically reducing lighting power in response to a demand response signal.

1. For compliance testing, the lighting controls shall demonstrate a 15-percent or greater reduction in lighting power as described in NA7.6.3. The controls may provide additional demand responsive functions or abilities.
2. For buildings where demand response controls are required, demand responsive controls shall control the general lighting in the spaces required to meet Section ~~130.1(b)~~ 130.1(a)4 or 160.5(b)4B.
3. General lighting power shall be reduced by continuous dimming ~~in a manner consistent with the requirements of Section 130.1(b)~~ or consistent with the requirements of Section 160.5(b)4B.

Exception to Section 110.12(c): Spaces where a health or life safety statute, ordinance, or regulation does not permit the general lighting to be reduced are not required to install demand responsive controls and do not count toward the 4,000-watt threshold.

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.1(a) through 130.1(f), in addition to the applicable requirements of Sections 110.9 and 130.0.

(a) **Manual controls**. Each space shall be provided with lighting controls that allow the lighting in that space to be manually turned on and off. The manual control shall:

…

4. In Group R occupancies and common or public use areas, where the connected general lighting exceeds 75 watts, controls shall be capable of continuous manual dimming to 10 percent or less of full lighting power in addition to full ON and OFF control. In spaces in nonresidential buildings, where the connected general lighting exceeds 50 watts, controls shall be capable of continuous manual dimming to 10 percent or less of full lighting power in addition to full ON and OFF control.

Exception 1 to Section 130.1(a)4: Lighting in commercial/industrial shipping and receiving areas, copy rooms, corridors, electrical/mechanical/telephone rooms, kitchen/food preparation areas, laboratories, laundry rooms, locker rooms, manufacturing/commercial/industrial work areas, parking garages, restrooms, stairwells, and transportation concourse/baggage/ticketing areas.

Exception 2 to Section 130.1(a)4: HID (high intensity discharge) and induction lighting with manual controls that have a minimum of one control step between 30 and 70 percent of full rated power in addition to full ON and full OFF.

Exception 3 to Section 130.1(a)4: Healthcare Facilities.

…

(b) **RESERVED.~~Multilevel lighting controls.~~** ~~The general lighting of any space with a size of 100 square feet or larger and with a connected lighting load greater than 0.5 watts per square foot shall be provided with multilevel lighting controls. The multilevel lighting controls shall provide and enable continuous dimming from 100 percent to 10 percent or lower of lighting power.~~

…

(c) **Shut-OFF ~~C~~controls.** All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is unoccupied.

1. All installed indoor lighting shall be equipped with controls that meet the following requirements:

   A. Shall be controlled with an occupant sensing control set to no more than a ~~20~~15-minute delay time, automatic time-switch control, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and

…

5. **Occupant sensing controls.** In offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, classrooms, conference rooms, and restrooms, lighting shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting in ~~20~~15 minutes or less after the control zone is unoccupied.

   ~~In areas required by Section 130.1(b) to have multi-level lighting controls, the~~The occupant sensing controls shall function either as a:

   A. Partial-ON occupant sensing controls capable of automatically activating between 50 and 70 percent of controlled lighting power, or

B. Vacancy sensing controls, where all lighting responds to a manual ON input only.

~~In areas not required by Section 130.1(b) to have multilevel lighting controls, the occupant sensing controls shall function either as:~~

~~A. Automatic full-on occupant sensing controls; or~~

~~B. Partial-ON occupant sensing controls, or~~

~~C. Vacancy sensing controls, where all lighting responds to a manual ON input only.~~

In addition, controls shall be provided that allow the lights to be manually shut OFF in accordance with Section 130.1(a) regardless of the sensor status.

Exception 1 to Section 130.1(c)5: Lighting systems not required to comply with the manual dimmer requirement in Section 130.1(a)4 may comply with this section with automatic full-on occupant sensing controls.

6. **Full or partial-OFF occupant sensing controls.** For warehouse aisle ways, warehouse open areas, library book stack aisles, exercise/fitness centers, gymnasium areas, laboratories, lounge, breakrooms, waiting areas, financial transaction areas, computer rooms, main entry lobbies, corridors, stairwells, offices greater than 250 square feet, parking garages, parking areas, loading areas, and unloading areas, the installed lighting shall meet the following requirements:

   A. In warehouse and computer room aisle ways and warehouse and computer room open areas, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall independently control lighting in each warehouse and computer room aisle way, and shall not control lighting beyond the aisle way being controlled by the sensor.

   …

   D. In office spaces greater than 250 square feet, general lighting shall be controlled with occupant sensing controls that meet all of the following:

      …

      ii. In ~~20~~15 minutes or less after the control zone is unoccupied, the occupant sensing controls shall uniformly reduce lighting power in the control zone to no more than 20 percent of full power. Control functions that switch control zone lights completely off when the zone is vacant meet this requirement; and

iii. In ~~20~~15 minutes or less after the entire office space is unoccupied, the occupant sensing controls shall automatically turn off lighting in all control zones in the space; and

…

E. In parking garages, parking areas and loading and unloading areas, general lighting shall be controlled by occupant sensing controls that meet the requirements below instead of complying with Section 130.1(c)1:

i. The occupant sensing controls shall uniformly reduce lighting power in the control zone to between 20 percent and 50 percent of full power and with at least one control step; and

ii. No more than 500 watts of rated lighting power shall be controlled together as a single zone; and

iii. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled zone and shall be automatically activated from all designed paths of egress.

Interior areas of parking garages are under the classification of indoor lighting and shall comply with Section 130.1(c)6E. Parking areas on the roof of a parking structure are under the classification of outdoor hardscape and shall comply with Section 130.2.

EXCEPTION to Section 130.1(c)6E: Luminaires located in a parking garage daylight adaptation zone and dedicated to providing illuminance for daylight adaptation.

…

(d) **Daylight responsive controls.**

…

2. All daylight responsive controls shall meet the following requirements:

A. All skylit daylit zones, primary sidelit daylit zones, secondary sidelit daylit zones, and the combined primary and secondary sidelit daylit zones in parking garages shall be shown on the plans"; and

…

C. The daylight responsive controls shall control general lighting as follows ~~meet the following~~:

i. For spaces in Group R occupancies and common or public use areas, where the installation of ~~multilevel lighting controls~~manual dimmer is required under Section ~~130.1(b)~~130.1(a)4, ~~allow the multilevel~~

~~lighting controls to adjust the light level with continuous dimming~~in response to availability of daylight, the daylighting control shall dim the lighting system continuously between 100 percent to 10 percent or lower of lighting power. For spaces in nonresidential buildings, in response to availability of daylight, the daylighting control shall dim the lighting system continuously between 100 percent to 10 percent or lower of lighting power;

Exception to Section 130.1(d)2Ci: Where general lighting is provided by HID or induction light sources, a daylight responsive control shall be permitted that has a minimum of one control step between 30 and 70 percent of full rated power in addition to full ON and full OFF.

…

F. ~~The automatic daylighting control shall permit the multilevel lighting control to adjust the level of lighting.~~ In spaces where manual controls are required, the manual controls shall be capable of turning off or decreasing light levels below the light level set by the daylight responsive controls. When manual controls are capable of temporarily increasing electric lighting above the light level set by the daylight responsive controls, the controls shall be configured to reset electric lighting controls back to the Section 130.1(d)2C defaults after electric lighting have been turned off or reduced by a manual control, occupancy sensor or timeclock.

…

(g) **Parking Garage Daylight Adaptation Zone Lighting Controls.** Parking garage daylight adaptation zone lighting shall be separately controlled to automatically reduce the lighting to no more than LPD for general light in parking zone and ramps from sunset to sunrise.

EXCEPTION to Section 130.1(g): Group R occupancies and common or public use areas.

SECTION 140.6 – PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

(a) **Calculation of adjusted indoor lighting power.** The adjusted indoor lighting power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through 4 of this subsection, and the requirements of Subdivision 4 of this subsection.

…

2. **Reduction of wattage through controls.** In calculating adjusted indoor lighting power, the installed watts of a luminaire providing general lighting in an area listed in Table 140.6-A may be reduced by the product of (i) the number of watts controlled as described in Table 140.6-A, times (ii) the applicable power adjustment factor (PAF), if all of the following conditions are met:

   …

   K. To qualify for the PAF for a demand responsive control in Table 140.6-A, the general lighting wattage receiving the PAF shall not be within the scope of Section 110.12(c) and a demand responsive control shall meet all of the following requirements:

      i. The controlled lighting shall be capable of being automatically reduced in response to a demand response signal; and

      ii. General lighting power shall be reduced by continuous dimming ~~in a manner consistent with the requirements of Section 130.1(b)~~.

…

(c) **Calculation of allowed indoor lighting power: specific methodologies.** The allowed indoor lighting power for each building type, or each primary function area shall be calculated using only one of the methods in Subsection 1 or 2 below as applicable.

…

2. **Area Category Method.** Requirements for using the Area Category Method include all of the following:

   …

   G. In addition to the allowed indoor lighting power calculated according to Sections 140.6(c)2A through F, the building may add additional lighting power allowances for qualifying lighting systems as specified in the Qualifying Lighting Systems column in TABLE 140.6-C under the following conditions:

      …

      vii. In addition to meeting Sections 140.6(c)2Gi through vi, additional lighting power for videoconferencing as specified in Table 140.6-C shall be allowed in a videoconferencing studio, as defined in Section 100.1, provided the following conditions are met:

         …

         c. General lighting is switched in accordance with the requirements of Section ~~130.1(b)~~130.1(a)4; and

         …

SECTION 141.1 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND THE INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS

Table 141.0-F – Control Requirements for Indoor Lighting System Alterations

Control Specifications	Coded Section	Projects complying with Section 141.0(b)2li	Projects complying with Sections 141.0(b)2lii or 141.0(b)2liii
Manual Area Controls	130.1(a)1	Required	Required
Manual Area Controls	130.1(a)2	Required	Required
Manual Area Controls	130.1(a)3	Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Manual Area Controls	130.1(a)4	Required	Not Required
~~**Multilevel Controls**~~	~~130.1(b)~~	~~Required~~	~~Not Required~~
Automatic Shut-Off Controls	130.1(c)1	Required	Required
Automatic Shut-Off Controls	130.1(c)2	Required	Required
Automatic Shut-Off Controls	130.1(c)3	Required	Required
Automatic Shut-Off Controls	130.1(c)4	Required	Required
Automatic Shut-Off Controls	130.1(c)5	Required	Required
Automatic Shut-Off Controls	130.1(c)6	Required	Required; except for 130.1(c)6D
Automatic Shut-Off Controls	130.1(c)8	Required	Required
Daylight Responsive Controls	130.1(d)	Required	Not Required
Demand Responsive Controls	110.12(a) and 110.12(c)	Required	Not Required

Reference Appendices

NA7.6 Indoor Lighting Controls Acceptance Tests

NA7.6.1 ~~Automatic Daylighting~~Daylight Responsive Controls Acceptance Tests

…

NA7.6.1.5 ~~Stepped Switching or~~ Stepped Dimming Control Systems Functional Testing

Stepped ~~switching or stepped~~ dimming control systems provide no more than 10 discrete steps of control of light output.

…

(d) **Partial daylight test**. If the control system has one (1) to three (3) steps of control between on and off, test all control steps between on and off. If the control system has more than three (3) steps between on and off, testing three (3) control steps between on and off is sufficient to demonstrate compliance. ~~If the control system has zero (0) steps between on and off, the partial daylight test is not necessary. For stepped switching control systems, steps in a controlled zone are achieved by turning some luminaires or groups of luminaires on or off without any steps between on and off.~~

For each control stage that is tested in this step, the control stages with lower setpoints than the stage tested are left ON and those stages of control with higher setpoints are dimmed or controlled off. Simulate or provide conditions so that each control stage turns on and off or dims. Verify and document the following for each control stage:

1. Measure that the combined daylight and controlled electric lighting illuminance at the Reference Location is no less than the reference illuminance measured at this location during the No Daylight Test.
2. Verify that the combined daylight and controlled electric lighting illuminance at the Reference Location is no greater than 150 percent of the reference illuminance.
3. Light output is stable with no visible flicker. (Note: only luminaires in daylit zones are affected by daylight control)

4. The control stage shall not cycle on and off or cycle between dim and undimmed while daylight illuminance remains constant.

Appendix G: Methodology of Converting LPD-based Trigger to Wattage-based Trigger for Multilevel Lighting Controls

The methodology for converting the specification of multilevel lighting controls from the current lighting power density (LPD) trigger to a wattage trigger is based on the equivalence of the overall long-term system cost (LSC) across impacted spaces.

Per the 2025 Title 24, Part 6, Section 130.1(b), multilevel lighting controls are required for spaces that:

(a) Have a connected general lighting load (LPD) greater than 0.5 watts per square foot

(b) Have a size of 100 square feet or larger

(c) Have more than one luminare

(d) Are not restrooms

(e) Are not healthcare facilities.

The space types considered in the derivation are the Primary Function Areas of different Building Type/Use and their allowed LPD values in 2025 Title 24, Part 6, Table 140.6-C for utilizing the area category method to comply with the LPD requirements.

The Statewide CASE Team first estimated the statewide square footage that will be impacted in the first year. This estimate follows the same methodology for estimating the statewide energy impact as that used in the Indoor Lighting Power Density CASE Report. The estimate is based on both the Complete Building types in Table 140.6-B and the Primary Functional Areas in Table 140.6-C. Each Complete Building is mapped to different Primary Functional Areas with assumed fractions. In other words, it assumes that a Complete Building is composed of different fractions of Primary Functional Areas, and that all fractions of all Primary Functional Areas within each Complete Building add up to 100 percent. The fractions of Primary Functional Areas within each Complete Building were derived from building surveys that were used to develop the US EIA Commercial Building End-Use Survey (CBECS) database and were originally used by PNNL to develop the whole-building weighted LPDs for the Whole Building approach in ASHRAE 90.1.

A fraction of the Complete Building method areas is then assigned to each of the building types included in the CEC 2029 construction forecast. For each CEC construction building type, the fractions add up to 100 percent.

For new construction, the estimated square footage of each Primary Functional Area (in million square feet) was derived from the two mappings above based on CEC 2029 forecast for new construction. For alteration, the same method was applied to CEC 2029 forecast for existing building stock, with an additional assumption that the complete stock turnover would take place over a 15-year period. In other words, only one-fifteenth of the existing building stock would be impacted in the first year.

The CBECC lighting schedule for each prototype building was assigned to each Primary Functional Area to construct an annual 8760-hour lighting usage profile, and it was assumed that 5 percent of the lighting in all spaces is designated as egress lighting and is uncontrolled. The LSC per watt controlled (PV$/W) for each Primary Functional Area and each climate zone was derived by multiplying the 8760-hour lighting usage profile and the 2028 Energy Code LSC hourly factor for each of the 16 California climate zones provided by CEC.

The overall LSC for each Primary Functional Area was calculated as the sum-product of the allowed LPD values, the per-watt-controlled LSC, and total impacted square footage in 2029 for each Primary Functional Area across all climate zones. The total LSC was the sum of the LSCs of all impacted Primary Functional Areas.

To calculate the equivalent wattage trigger, the triggering criteria (b) through (e) above must remain true for equal stringency. The sum-product of the pre-watt-controlled LSC and the total 2029 impacted square footage for each impacted Primary Functional Area across all climate zones was first calculated. The wattage trigger was derived by dividing the total LSC calculated in the step above by the product of this value and the 100 square-foot minimum square footage.