



WHAT'S NEW IN THE 2019 CODE?

NONRESIDENTIAL LIGHTING

Changes to mandatory and prescriptive lighting requirements in California's 2019 Building Energy Efficiency Standards

California's new nonresidential Building Energy Efficiency Standards (Energy Standards) take effect on January 1, 2020. The 2019 Energy Standards focus on several key areas to improve the energy efficiency of newly constructed buildings, additions and alterations to existing buildings.

Significant changes in the 2019 Energy Standards address ventilation, HVAC, demand response and lighting. Notably, the 2019 Energy Standards now include requirements for healthcare facilities, although there are many exceptions for this building type.

MAJOR CHANGES



LIGHTING POWER ALLOWANCES

On average, indoor lighting power densities have been reduced by 37 percent for the complete building method and 29 percent for the area category method. These reductions are based on the assumption that all new construction, alterations and additions will be installing LED lighting technologies by January 1, 2020. The Energy Commission estimates this to be the single largest savings in the 2019 Energy Standards for nonresidential occupancies.



POWER ADJUSTMENT FACTORS

New power adjustment factors (PAFs) have been added to encourage the use of clerestory fenestration, horizontal slats and light shelves. Existing PAFs from the 2016 Energy Standards also remain as options, for a total of seven PAFs.



ADDITIONS, ALTERATIONS AND REPAIRS

The additions, alterations and repairs section has been simplified. Now, the trigger for all alterations is 10 percent of the luminaires serving an enclosed space. Similar to 2016, there are three paths to compliance, but now, all share a universal set of exemptions and more clear-cut requirements.

NOTE: *This guide is not intended to be used in lieu of California's Energy Standards, and it is not a substitute for the Energy Standards itself. Please visit www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency to download the official 2019 Energy Standards, Reference Appendices and the Nonresidential Compliance Manual.*



INDOOR LIGHTING REQUIREMENTS

One of the largest changes in the 2019 Energy Standards is the inclusion of certain healthcare facilities as a newly regulated building type, although there are many exceptions. The new requirements only apply to Type I1–2 healthcare facilities. Additionally, there are significant indoor lighting power density (LPD) reductions for all nonresidential buildings and area types.

Most lighting control requirements remain unchanged as compared to the 2016 Energy Standards, although there are a few minor updates. For alterations, compliance options have been simplified.

The following sections highlight the significant indoor lighting-related changes contained in the 2019 Energy Standards.

LIGHTING POWER ALLOWANCES

On average, indoor lighting power densities have reduced by 37 percent for the complete building method and 29 percent for the area category method. These reductions are based on the assumption that all new construction, alterations and additions will be installing LED lighting technologies by January 1, 2020.

For the complete building method, the most significant LPD decreases impact the LPA of the following building types: religious facilities, assembly buildings, motion picture theaters and grocery stores (**Table 1**).

For the area category method, the most significant LPD decreases impact the LPA of the following function areas: museum displays, dining areas in cafeterias and fast food, videoconferencing studios, beauty salons and auditoriums. In addition, as part of **Table 140.6-C**, many space types have been renamed, footnotes have been added and general changes included so people understand all the new LPD changes impacting the area category method under the new Energy Standards.

Table 1. Lighting Power Density Updates from 2016 to 2019 for the Complete Building Method

Type of Building	Lighting Power Density (W/ft ²)	
	2019	Δ
Assembly ¹	0.7	↓ 0.7
Financial Institution	0.65	↓ 0.35
Industrial/Manufacturing	0.6	↓ 0.4
Grocery Store	0.95	↓ 0.55
Gymnasium	0.65	New
Library	0.7	↓ 0.5
Healthcare	0.9	New
Office	0.65	↓ 0.15
Parking Garage	0.13	↓ 0.07
Religious	0.7	↓ 0.8
Restaurant	0.7	↓ 0.4
Retail Store	0.9	New
School	0.65	↓ 0.3
Sports Arena	0.75	New
Motion Picture Theater ²	0.7	↓ 0.6
Performing Arts Theater ²	0.8	↓ 0.5
All Other Buildings	0.4	↓ 0.1

¹ Previously "Auditorium" building type under 2016 Energy Standards.

² Previously "Theater" building type under 2016 Energy Standards.

Based on Table 140.6-B in the Energy Standards

POWER ADJUSTMENT FACTORS

Power adjustment factors (PAFs) provide flexibility when developing a lighting design, effectively allowing projects to reduce their reported lighting power use. PAFs incentivize the additional use of specific lighting controls and daylighting strategies.

Three new PAFs have been added to the Energy Standards to encourage the use of clerestory fenestration, horizontal slats and light shelves. Four PAFs from the 2016 Energy Standards are also available (Table 2).

Now, projects may gain a 5 percent lighting power adjustment credit for implementing clerestory fenestration or horizontal slats and a 10 percent lighting power adjustment credit for implementing light shelves. Luminaires that are in a daylight zone adjacent to these devices are eligible for the credit.

Additionally, these credits may be combined with the credit for 'Daylight Dimming plus OFF Control'. The light shelf and clerestory fenestration credits may also be combined if used in the same space.

New power adjustments for small aperture tunable-white and dim-to-warm LED luminaires have been added, per Section 140.6(a)4.



Clerestory Fenestration



Horizontal Slats



Light Shelves

Table 2. Lighting Power Adjustment Factors

Type of Control	Type of Area	Factor	
<p>a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2.</p> <p>b. Only one PAF may be used for each qualifying luminaire unless stated below.</p> <p>c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF.</p>			
Daylighting Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone.	0.10	
Occupant Sensing Controls in Large Open Plan Offices	In open plan offices > 250 square feet, one sensor controlling an area that is:	No larger than 125 square feet	0.40
		From 126 to 250 square feet	0.30
		From 251 to 500 square feet	0.20
Institutional Tuning	Luminaires in non-daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.10	
	Luminaires in daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.05	
Demand Responsive Control	All building types of 10,000 square feet or smaller. Luminaires that qualify for other PAFs in this table may also qualify for this PAF.	0.05	
Clerestory Fenestration*	Luminaires in daylit areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus Off control may also qualify for this PAF.	0.05	
Horizontal Slats*	Luminaires in daylit areas adjacent to vertical fenestration with interior or exterior horizontal slats. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05	
Light Shelves*	Luminaires in daylit areas adjacent to clerestory fenestration with interior or exterior light shelves. This PAF may be combined with the PAF for clerestory fenestration. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.10	

* New for 2019

Based on Table 140.6-A in the Energy Standards

LIGHTING CONTROLS

Mandatory lighting control requirements contain minor revisions throughout, which are designed to make requirements more consistent and easier to apply in practice. The most significant updates were made to the automatic daylighting controls and demand responsive lighting controls. Additionally, a new section titled 'Control Interactions' has been added.

AUTOMATIC DAYLIGHTING CONTROLS

The mandatory automatic daylighting control language has been restructured and clarified, combining language for parking garages and indoor-only applications. Explicit direction is now included requiring separate controls for luminaires in each daylight zone type: skylit, primary sidelit and secondary sidelit.

A new exception has been added for areas under skylights where existing adjacent structures or outdoor objects block direct sunlight for more than 1,500 daytime hours per year between the hours of 8 A.M. and 4 P.M. Daylighting controls are not required in these areas.

Additionally, an exception has been added for areas adjacent to vertical glazing below an exterior overhang that meets specific sizing requirements. For these areas, automatic daylighting controls for the primary and secondary sidelit daylight zones are not required.

Luminaires in sidelit daylight zones in retail merchandise sales and wholesale showroom areas are also now exempt.

To learn more about the new changes related to automatic daylighting controls, see **Section 130.1(d)** of the Energy Standards.

DEMAND RESPONSIVE LIGHTING CONTROLS

The 2019 update moves the demand responsive lighting controls to a new section in the subchapter for the manufacturing, construction and installation of systems, equipment and building components. Lighting demand responsive controls requirements are now listed under **Section 110.12**—Demand Management, which also includes demand response requirements for other building systems, including HVAC systems and electronic message boards.

Updates reference specific communication standards maintained by the OpenADR Alliance. The OpenADR Alliance standardizes, automates and simplifies demand response devices and distributed energy resources by establishing an open, highly secure, two-way information exchange standard.

Updates to the demand responsive lighting controls section now require demand responsive controls to either be a certified OpenADR 2.0a, OpenADR 2.0b Virtual End Node (VEN) or be certified by the manufacturer as being capable of responding to a demand response signal from a certified OpenADR 2.0b VEN.

Additionally, the updates allow for the use of alternative communication protocols, so long as the system also uses

one of the mandatory protocols: Wi-Fi, ZigBee, BACnet, Ethernet or hard-wiring. This allowance is ideal for cloud-based systems that offer demand response capabilities.

CONTROL INTERACTIONS

A new section, **Section 130.1(f)**, has been added that defines the interactions of all mandatory indoor lighting controls (manual ON/OFF, multi-level lighting, shut-off controls, automatic daylighting controls and demand responsive controls). The section outlines how each system should operate in order to ensure that all functions of the mandatory lighting controls are permitted or incorporated by the system as a whole.

OCCUPANCY SENSING & MULTI-LEVEL CONTROLS IN RESTROOMS

Now, restrooms of any size are required to be equipped with occupancy sensing controls that automatically shut-OFF all lights when the space is unoccupied. This can be achieved using an occupancy sensor, partial-ON occupancy sensor or vacancy sensor. Also, restrooms are now exempt from all multi-level controls requirements.

LIGHTING CONTROLS FOR HEALTHCARE FACILITIES

It is important to note that healthcare facilities are exempt from multi-level lighting controls, shut-OFF controls and demand responsive controls.

ADDITIONS, ALTERATIONS & REPAIRS

Indoor alteration requirements have changed. Requirements are now simpler and easier to apply in practice. In addition, compliance thresholds and exemptions are now consistent across all compliance options.

Now, alterations to indoor lighting systems that include 10 percent or more of the luminaires serving an enclosed space must meet one of the following requirements:

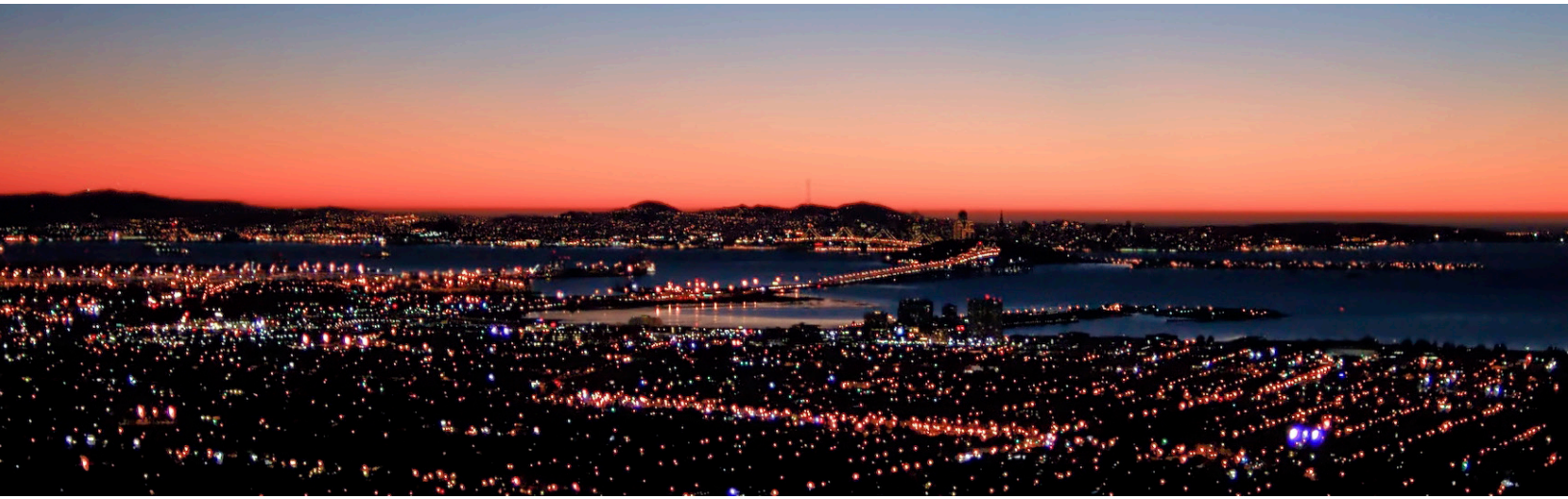
- **Option 1:** Comply with the indoor lighting power and lighting control requirements for new construction (second from the right column, **Table 3**).
- **Option 2:** Alterations using 80 percent or less of the indoor lighting power allowances for new construction must adhere to the lighting control requirements in the right column of **Table 3**. This is a reduction from 85 percent under the 2016 Energy Standards.
- **Option 3:** Projects in small buildings or tenant spaces (5,000 square feet or less) that include one-for-one luminaire alterations to more than 50 luminaires can retrofit with new luminaires or component modifications that achieve at least 40 percent power reductions over pre-alteration luminaires. The project must include the lighting controls shown in the right column of **Table 3**.

If the project includes less than 10 percent of the luminaires in the enclosed space, or the enclosed space has just one luminaire, the project is exempt from these requirements.

Table 3. Control Requirements for Indoor Lighting System Alterations

Based on Table 141.0-F from the Energy Standards

Control Specifications	Trigger	Projects Complying with Section 141.0(b)2li	Projects Complying with Sections 141.0(b)2lii & 141.0(b)2liii	
Manual Area Controls	130.1(a)1 – Be readily accessible.	Enclosed areas with ceiling-height partitions of any size.	Required	Required
	130.1(a)2 – Be located in the same enclosed area with the lighting fixture it controls.		Required	Required
	130.1(a)3 – Provide separate control of general, display, ornamental and special effects lighting.		Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multi-Level Controls	130.1(b) – Allow level of lighting to adjust up and down.	Enclosed areas 100 square feet or larger with connected lighting load that exceeds 0.5 watts per square foot.	Required	Not Required
Shut-OFF Controls	130.1(c)1 – Be controlled by an occupant sensing control, automatic time-switch control or other control capable of automatically shutting OFF all lighting when the space is typically unoccupied; provide separate controls as specified in 130.1(c)1B-D; and include a manual-ON mode for automatic time-switch controls.	All installed indoor lighting (except healthcare facilities).	Required; 130.1(c)1D only required for new or completely replaced circuits	Required; 130.1(c)1D only required for new or completely replaced circuits
	130.1(c)2 – Countdown timers switches may be used to comply with shut-OFF control requirements in closets less than 70 square feet and server aisles in server rooms.		Required	Required
	130.1(c)3 – Manual override for automatic time-switch controls shall turn lighting off after 2 hours.		Required	Required
	130.1(c)4 – Holiday override for automatic time-switch controls shall turn lighting off for at least 24 hours and be able to resume normal scheduled operation.		Required	Required
	130.1(c)5 – Spaces required to use occupant sensing controls to shut OFF all lighting.		Required	Required
	130.1(c)6 – Spaces required to use full or partial-OFF occupant sensing controls to shut OFF all lighting.		Required	Required
	130.1(c)7 – Spaces required to use partial-OFF occupant sensing controls.		Required	Required
Automatic Daylighting Controls	130.1(d) – Automatically adjust the power of the installed lighting up and down to keep the total light level stable as the amount of incoming daylight changes.	General lighting totaling at least 120 watts in a room's combined skylit daylit zones and primary sidelit daylit zones, and with at least 24 square feet of glazing.	Required	Not Required
		General lighting totaling at least 60 watts in the combined primary and secondary sidelit daylit zones in parking garages with at least 36 square feet of glazing or opening.		
Demand Responsive Controls	130.1(e) – Lighting reduction in response to an automated demand response signal.	Buildings with more than 10,000 square feet of spaces with more than 0.5 watts per square foot. Healthcare buildings are exempt.	Required	Not Required



OUTDOOR LIGHTING REQUIREMENTS

In the 2019 Energy Standards, the California Energy Commission has updated three key areas related to outdoor lighting.

There are significant outdoor lighting power allowance reductions for all nonresidential buildings and area types. Additionally, luminaire cutoff requirements have been updated. Some outdoor lighting control requirements have also changed under the new Energy Standards.

The following sections highlight the critical outdoor lighting-related changes between the 2016 and 2019 iterations of the Energy Standards.

LIGHTING POWER ALLOWANCES

Outdoor lighting power allowances vary based on sites with concrete or asphalt surfaces. Clarifications have been added to make the lighting allowances for lighting systems serving outdoor areas with concrete hardscape in Lighting Zones 2 and 3 more transparent.

Overall, the outdoor lighting power allowances have reduced from 2016 levels (**Table 4**). Additional lighting power allowances are available for specific applications and are provided in the **2019 Nonresidential Lighting and Electrical Power Distribution Guide** on page 75.

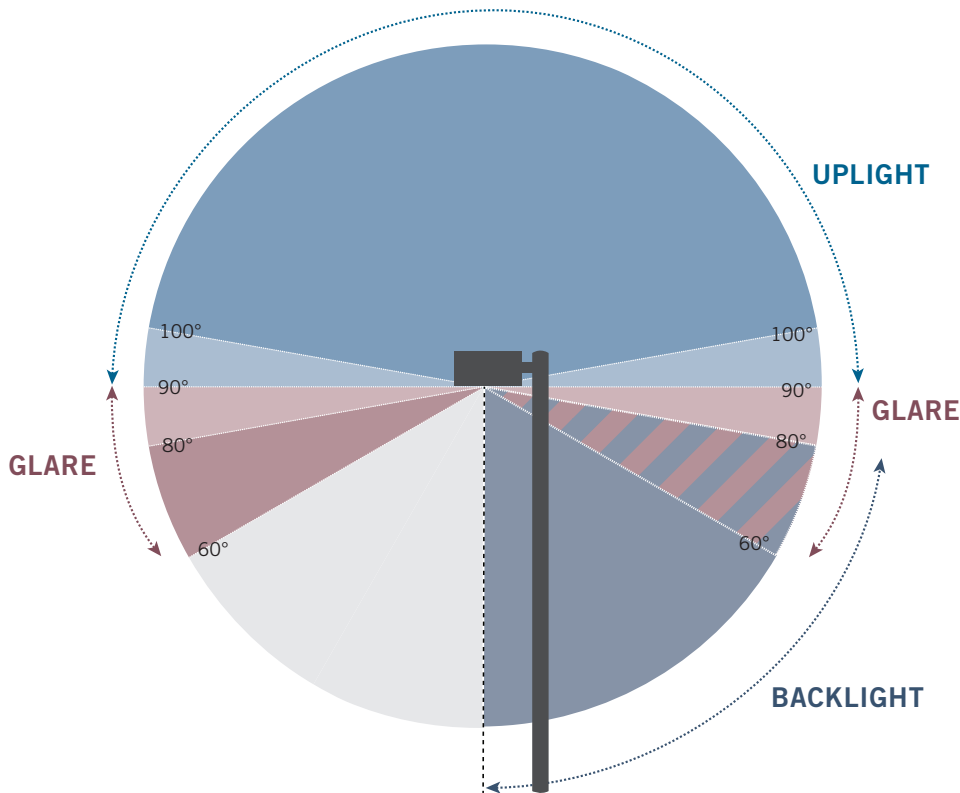
Table 4. General Hardscape Lighting Power Allowances for 2019 Energy Standards

Type of Power Allowance	Lighting Zone 0 ³	Lighting Zone 1 ³	Lighting Zone 2 ³		Lighting Zone 3 ³		Lighting Zone 4 ³
	Asphalt/Concrete	Asphalt/Concrete	Asphalt	Concrete ²	Asphalt	Concrete ²	Asphalt/Concrete
Area Wattage Allowance (AWA)	No allowance ¹	0.018 W/ft ²	0.023 W/ft ²	0.025 W/ft ²	0.025 W/ft ²	0.03 W/ft ²	0.03 W/ft ²
Linear Wattage Allowance (LWA)		0.15 W/lf	0.17 W/lf	0.4 W/lf	0.25 W/lf	0.4 W/lf	0.35 W/lf
Initial Wattage Allowance (IWA)		180W	250W		350W		400W

¹ Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed shall meet the maximum zonal lumens as specified in Section 130.2(b).

² Where greater than 50 percent of the paved surface of a parking lot is finished with concrete. This does not extend beyond the parking lot, and does not include any other General Hardscape areas.

³ Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm—as mandated by local, state or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna—shall be allowed a 2.0 lighting power allowance multiplier.



Uplight is defined as excess lighting directed up into the night sky, above 90 degrees. This causes light pollution, or artificial sky glow.

Glare is caused by light emitted between 60 and 90 degrees around a luminaire. Light emitted at these angles can be uncomfortable and even hazardous.

Backlight includes all illumination behind a luminaire. Backlight causes light trespass, which occurs when light spills into unwanted areas.

LUMINAIRE CUTOFF REQUIREMENTS

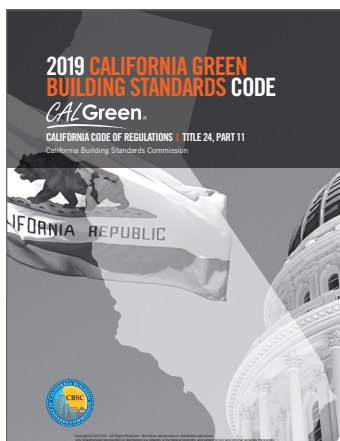
The 2019 Energy Standards updated luminaire cutoff requirements now only apply to luminaires with a light output of 6,200 lumens or greater. This is a change from the 2016 Energy Standards, which required all lamps greater than 150 watts to comply with the luminaire cutoff requirements.

Notably, backlight requirements have been added to **Section 130.2(b)** mandatory requirements in addition to uplight and glare. Additionally, an exception has been added for outdoor lighting attached to high-rise residential or hotel/motel buildings that is controlled from the inside of a dwelling unit or guest room, such as porch lights.

Detailed requirements regarding backlight, uplight and glare are contained in CALGreen.



High-Rise Outdoor Lighting Controlled from Inside the Dwelling Unit

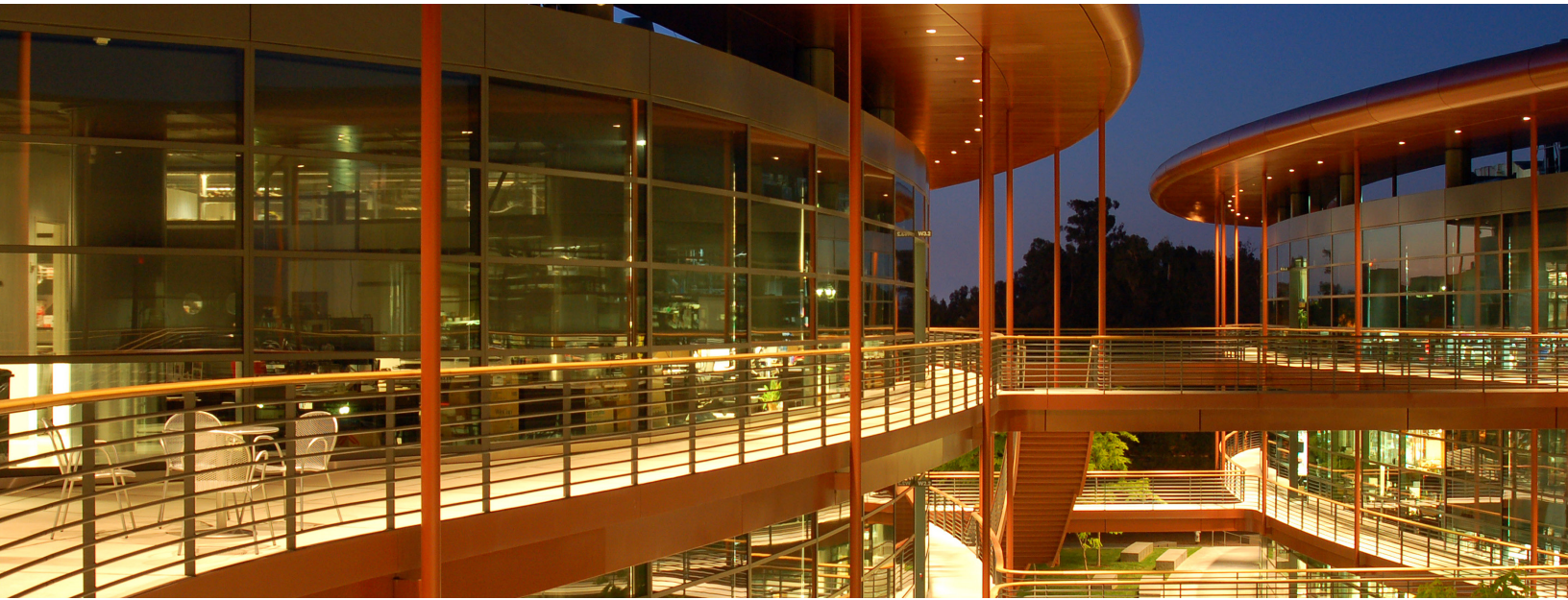


WHAT IS CALGREEN?

CALGreen, also known as Title 24, Part 11, was developed in an effort to meet the California Global Warming Solutions Act of 2006 (AB 32). The purpose of CALGreen is to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts having a reduced negative impact or positive environmental impact and encouraging sustainable construction practices.

The backlight, uplight and glare requirements for outdoor lighting are contained in CALGreen as part of the light pollution reduction section.

Detailed information on how to effectively comply with CALGreen can be found here: codes.iccsafe.org/content/chapter/15778.



CONTROLS FOR OUTDOOR LIGHTING

The 2019 Energy Standards have clarified the functionality for many types of outdoor lighting controls. Specifically, language has been refined for automatic scheduling controls and motion sensing controls.

AUTOMATIC SCHEDULING CONTROLS

New language refines the automatic scheduling controls functionality requirements and acceptance testing procedure to verify installed systems. Now, automatic scheduling controls need to be capable of reducing the outdoor lighting power by at least 50 percent but no more than 90 percent. Additionally, the device needs to be able to turn the lights OFF during periods of scheduled unoccupied periods and allow for the scheduling of at least two nighttime periods.

MOTION SENSING CONTROLS

Language has been added to clarify the functionality of motion sensing controls. Similar to automatic scheduling controls, the motion sensor control must be capable of reducing the lighting power by at least 50 percent but no more than 90 percent and be separately capable of turning OFF the lights during periods of vacancy.

New language has established a maximum timeout of 15 minutes when there is no motion in the area, after which the system returns to its dimmed or OFF mode.

While it is still required for outdoor luminaires mounted at 24 feet above grade or lower to be paired with motion sensors, the exceptions have been updated. Now, all luminaires 40 watts or less are exempt from the motion sensing control requirement, regardless of their form factor or product category. Also, occupancy sensor requirements for incandescent luminaires rated over 100W have been removed.



Examples of automatic scheduling controls (left to right): Leviton EZ-MAX Plus 8 Relay Panel, WattStopper LP8 Peanut Lighting Control Panels



Example of motion sensor controls: WattStopper EW-200-120 Outdoor Motion Sensor, PIR technology

THE CALIFORNIA LIGHTING TECHNOLOGY CENTER was established in 2003 by the California Energy Commission in collaboration with the U.S. Department of Energy and the National Electrical Manufacturers Association. Part of the Department of Design at the University of California, Davis, CLTC is dedicated to accelerating the development and deployment of energy-efficient lighting and daylighting technologies.

Developed and provided by the California Statewide Codes & Standards Program, **ENERGY CODE ACE** offers free training, tools and resources for those who need to understand and meet the requirements of the Energy Standards and Appliance Efficiency Regulations. The program aims to advance the adoption and effective implementation of energy efficiency measures and building practices to lock in long-term energy savings. For more information, visit energycodeace.com.

