



CALIFORNIA STATEWIDE UTILITY CODES AND STANDARDS PROGRAM

2016 Title 24 Codes & Standards Enhancement (CASE) Proposal

Outdoor Lighting Controls Updates

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Proposed Code Change

- Nonresidential, Mandatory Measure
- Streamline the outdoor lighting controls requirements by removing current occupancy controls exemptions for:
 - Outdoor sales lots (e.g. car dealerships)
 - Sales canopies (e.g. gas stations)
- Reduce the minimum allowable dimmed level for multi-level lighting systems when dimmed in response to occupants





Proposed Code Change

- Rationale behind proposal
 - Improve upon existing requirements
 - Part-night control already required for these areas, but no amount of time specified
 - Occupancy control satisfies part-night control requirement
 - Additional savings potential in sales lots and sales canopy areas
 - New technologies offer customizable control options at relatively low cost
 - Market is already installing control systems
 - Streamline code by limiting exceptions



Market Overview

- **Outdoor Sales Lots**
 - An uncovered paved area used exclusively for the display of vehicles, equipment or other merchandise for sale.
 - Bulk of these are auto sales lots
 - Approximately 7,392 licensed auto sales dealers in California*
- **Sales Canopy**
 - Is a canopy specifically to cover and protect an outdoor sales area
 - Bulk of these are fueling station canopies- found in auto sales as well
 - Approximately 10,000 fueling stations in California**

*Taxable Sales in California 2012, California State Board of Equalization

**Retail Fuel Outlet Survey, California Energy Commission Energy Almanac



Controls Technology

- Occupancy control systems (OCS) currently exist for all lighting technologies- MH, HPS, and LED
- Outdoor fixture trends are moving to LED
- LEDs offer much more customization for controls, deeper dimmability, quicker response, and linear power vs. light characteristics (quantity & quality)
- Typical controls configurations
 - Circuit controlled (zone occupancy sensing)
 - Integrated in fixture



Current Code Requirements

130.2(c) Controls for Outdoor Lighting. Outdoor lighting controls shall be installed that meet the following requirements as applicable:

EXCEPTION 1 to Section 130.2(c): Outdoor lighting not permitted by a health or life safety statute, ordinance, or regulation to be turned OFF.

EXCEPTION 2 to Section 130.2(c): Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

1. All installed outdoor lighting shall be controlled by a photocontrol or outdoor astronomical time-switch control that automatically turns OFF the outdoor lighting when daylight is available.
2. All installed outdoor lighting shall be circuited and independently controlled from other electrical loads by an automatic scheduling control.



Current Code Requirements

Section 130.2 cont. – Outdoor Lighting Controls

- 130.2(c)3: All installed outdoor lighting, where the bottom of the luminaire is mounted 24 feet or less above the ground, shall be controlled with automatic lighting controls that meet all of the following requirements:
 - A. Shall be motion sensors or other lighting control systems that automatically controls lighting in accordance with Item B in response to the area being vacated of occupants; and
 - B. Shall be capable of automatically reducing the lighting power of each luminaire by at least 40 percent but not exceeding 80 percent, or provide continuous dimming through a range that includes 40 percent through 80 percent, and**
 - C. Shall employ auto-ON functionality when the area becomes occupied; and
 - D. No more than 1,500 watts of lighting power shall be controlled together.



Current Code Requirements

EXCEPTION 1 to Section 130.2(c)3: Lighting for Outdoor Sales Frontage, Outdoor Sales Lots, and Outdoor Sales Canopies complying with Section 130.2(c)4.

130.2(c)4. For Outdoor Sales Frontage, Outdoor Sales Lots, and Outdoor Sales Canopies lighting, an automatic lighting control shall be installed that meets the following requirements:

- A. A part-night outdoor lighting control as defined in Section 100.1; or**
- B. Motion sensors capable of automatically reducing lighting power by at least 40 percent but not exceeding 80 percent, and which have auto-ON functionality.**



Current Code Requirements

- **Part-Night Outdoor Lighting Control** is a time or occupancy-based lighting control device or system that is programmed to reduce or turn off the lighting power to an outdoor luminaire for a portion of the night.
- Further defined in the compliance manual as:
 - I. Be able to accurately predict sunrise and sunset within +/- 15 minutes and timekeeping accuracy within five minutes per year; and
 - II. Be able to setback or turn off lighting at night as required in §130.2(c), by means of a programmable timeclock or motion sensing device; and
 - III. When the setback or turning off is controlled with a timeclock, shall be capable of being programmed to allow the setback or turning off of the lighting to occur from any time at night until any time in the morning, as determined by the user.



Current Code Requirements

EXCEPTION 3 to Section 130.2(c)3: Outdoor lighting, where luminaire rated wattage is determined in accordance with Section 130.0(c), and which meet one of the following conditions:

- A. Pole-mounted luminaires each with a maximum rated wattage of 75 watts; or
- B. Non-pole mounted luminaires with a maximum rated wattage of 30 watts each; or
- C. Linear lighting with a maximum wattage of 4 watts per linear foot of luminaire.



Proposed Code Language

(c) **Controls for Outdoor Lighting.** Outdoor lighting controls shall be installed that meet the following requirements as applicable:

EXCEPTION 1 to Section 130.2(c): Outdoor lighting not permitted by a health or life safety statute, ordinance, or regulation to be turned OFF.

EXCEPTION 2 to Section 130.2(c): Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

1. All installed outdoor lighting shall be controlled by a photocontrol or outdoor astronomical time-switch control that automatically turns OFF the outdoor lighting when daylight is available.
2. All installed outdoor lighting shall be circuited and independently controlled from other electrical loads by an automatic scheduling control.
3. All installed outdoor lighting, where the bottom of the luminaire is mounted 24 feet or less above the ground, shall be controlled with automatic lighting controls that meet all of the following requirements:
 - A. Shall be motion sensors or other lighting control systems that automatically controls lighting in accordance with item B in response to the area being vacated of occupants; and
 - B. Shall be capable of automatically reducing the lighting power of each luminaire by at least 40 percent but not exceeding ~~80~~ 90 percent, or provide continuous dimming through a range that includes 40 percent through ~~80~~ 90 percent, and
 - C. Shall employ auto-ON functionality when the area becomes occupied; and
 - D. No more than 1,500 watts of lighting power shall be controlled together.



Proposed Code Language

EXCEPTION 1 to Section 130.2(c)3: Lighting for Outdoor Sales Frontage, ~~Outdoor Sales Lots, and Outdoor Sales Canopies~~ complying with Section 130.2(c)4.

EXCEPTION 2 to Section 130.2(c)3: Lighting for Building Facades, Ornamental Hardscape and Outdoor Dining complying with Section 130.2(c)5.

EXCEPTION 3 to Section 130.2(c)3:, Outdoor lighting, where luminaire rated wattage is determined in accordance with Section 130.0(c), and which meet one of the following conditions:

- A. Pole-mounted luminaires each with a maximum rated wattage of 75 watts; or
- B. Non-pole mounted luminaires with a maximum rated wattage of 30 watts each; or
- C. Linear lighting with a maximum wattage of 4 watts per linear foot of luminaire.

EXCEPTION 4 to Section 130.2(c)3: Applications listed as Exceptions to Section 140.7(a) shall not be required to meet the requirements of Section 130.2(c)3.

4. For Outdoor Sales Frontage, ~~Outdoor Sales Lots, and Outdoor Sales Canopies~~ lighting, an automatic lighting control shall be installed that meets the following requirements:

- A. A part-night outdoor lighting control as defined in Section 100.1; or
- B. Motion sensors capable of automatically reducing lighting power by at least 40 percent but not exceeding ~~80~~ 90 percent, and which have auto-ON functionality.



Methodology for Energy Analysis

- Energy Impacts
 - Spreadsheet analysis, incorporating:
 - LED technology as a base case
 - Occupancy trends in outdoor sales lots areas and sales canopies
 - Space characterization from previous code with updates from stakeholders
 - Current and projected statewide stock
 - Annual energy consumption and savings
 - First year energy savings



Methodology for Cost Effectiveness Analysis

- Cost Effectiveness
 - Equipment cost data from distributors/retailers and other stakeholders
 - Incremental cost for controls
 - Calculate TDV energy cost savings (2016 values available summer 2014)



Prototype Scenarios

	Occupancy Type	Area (square feet)	Number of Fixtures	Operating Hours
Prototype 1	Large Sales Canopy	8,682	36	24 hours
Prototype 2	Large Sales Canopy	8,682	36	7:00 AM – 10:00PM
Prototype 3	Small Sales Canopy	3,006	16	24 hours
Prototype 4	Small Sales Canopy	3,006	16	7:00 AM – 10:00 PM
Prototype 5	Corner Outdoor Sales Lot	13,156	10 ¹	8:00 AM – 8:00 PM

1. Does not include sales frontage fixtures



Key Assumptions

Parameter	Assumption Used in Savings Model	Source
Dimmed Levels	Fixtures dimmed 60% below full output power	Based on current standards
Fixture Wattage	Canopies: 122W & 82W Sales Lots: 202W & 126W	Spec sheets from major manufacturers, common wattage ranges, and consistent with Outdoor LPA CASE proposal which pushes market to LED
Sensor Activation and Response Times	Response time: 4 minutes of continuous vacancy	IOU CASE Team experience with similar project installations
Occupancy Patterns for 24 Hour Gas Stations	6 occupants per hour during deep night hours, 15 occupants per hour in the evening and early morning	IOU CASE Team analysis and site observations
Occupancy Patterns for non 24 hour facilities	1 occupant per hour after business hours, and 15 occupants per hour during business hours (night)	IOU CASE Team analysis and site observations



Preliminary Energy Savings Results

Prototype	Fixture Wattage	Per Unit First Year Savings ²			Per Unit TDV Energy Savings (kBTU)
		Electricity Savings (kWh/yr)	Peak Demand Savings (kW)	Natural Gas Savings (Therms/yr)	
Prototype 1: Large 24 Hr Sales Canopy	122W	4,039	NA	NA	67,036
	82W	2,715	NA	NA	45,057
Prototype 2: Large 15 Hr Sales Canopy	122W	4,250	NA	NA	46,145
	82W	2,857	NA	NA	68,655
Prototype 3: Small 24 Hr Sales Canopy	122W	1,795	NA	NA	29,794
	82W	1,207	NA	NA	20,025
Prototype 4: Small 15 Hr Sales Canopy	122W	1,889	NA	NA	20,509
	82W	1,270	NA	NA	30,513
Prototype 5: Corner Outdoor Sales Lot (12 Hrs)	202W	1,786	NA	NA	28,536
	126W	1,114	NA	NA	17,800



Preliminary Incremental Cost Results

Condition	Incremental Initial Construction Cost	Incremental Present Value of Maintenance Cost	Total Incremental Cost
Incremental Measure Cost per Fixture	\$105	\$0	\$105
Prototype 1 & 2 Large Sales Canopies	\$3,780	\$0	\$3,780
Prototype 3 & 4 Small Sales Canopies	\$1,680	\$0	\$1,680
Prototype 5 Outdoor Sales Lot	\$1,050	\$0	\$1,050



Preliminary Cost-effectiveness Results

Climate Zone	Fixture Wattage	Benefit: TDV Energy Cost Savings + Other Cost Savings (2013 PV \$)	Cost: Total Incremental Cost (2013 PV \$)	Change in Lifecycle Cost (2013 PV \$)	Benefit-to-Cost Ratio
Prototype 1 Large 24-Hr Sales Canopy	122W Fixtures	\$5,966	\$3,780	\$2,186	1.6
	82W Fixtures	\$4,010	\$3,780	\$230	1.1
Prototype 2 Large 15-Hr Sales Canopy	122W Fixtures	\$6,110	\$3,780	\$2,330	1.6
	82W Fixtures	\$4,107	\$3,780	\$327	1.1
Prototype 3 Small 24-Hr Sales Canopy	122W Fixtures	\$2,652	\$1,680	\$972	1.6
	82W Fixtures	\$1,782	\$1,680	\$102	1.1
Prototype 4 Small 15-Hr Sales Canopy	122W Fixtures	\$2,716	\$1,680	\$1,036	1.6
	82W Fixtures	\$1,825	\$1,680	\$145	1.1
Prototype 5 Corner Outdoor 12-Hr Sales Lot	202W Fixtures	\$2,540	\$1,050	\$1,490	2.4
	126W Fixtures	\$1,584	\$1,050	\$534	1.5



Summary of results

- Proposed code change was found to be cost-effective in all prototype facilities, using conservative assumptions:
 - Assumed the cost of sensor integrated controls (\$105/fixture). Zone occupancy sensor systems likely cost less on a per fixture basis (\$60-100)
 - Analysis assumed every time was motion detected, all fixtures come to full brightness.
 - Prototype auto sales lot was small – many in the state will be far larger with larger savings potential
 - Low LED fixture wattages were used in analysis
- Benefit/Cost ratios still ranges from 1.1 to 2.4



Statewide Savings Estimates

- Estimated first year measure savings assumptions
 - 2% of total stock is new each year, and 3% is retrofitted
 - Sales Canopies: 1.24 GWh
 - Approximately 10,000 service stations in CA
 - 65% are 24/7 facilities, 35% are 15 hr facilities
 - Assumed all have canopies, and all are below 24'
 - Assumed half are larger canopies (36 fixtures) and half are small canopies (16 fixtures)
 - Assumed half use higher wattage LED (122W) and half use lower wattage LED (82W)
 - Sales Lots: 0.38 GWh
 - Approximately 7,400 Auto sales lots in CA
 - Average Fixtures per Sales Lot (excluding frontage): 10
 - 70% of Sales Lot Fixtures below 24'
 - Statewide, half would be higher wattage LED (202W) and half would be lower wattage (126W)
- Conservative Total Measure Savings: 1.62 GWh



Stakeholder Meeting Feedback

- Stakeholder meeting held May 15, 2014
 - Comments included:
 - Maximum dimmed setting should be lowered beyond 80%. Some fixtures should be allowed to turn off completely.
 - Clarification that the proposed code is not impacting the 24' threshold for fixture height, and it is only impacting Outdoor Sales Lots and Outdoor Sales Canopies.
 - Petroleum station and car dealership associations need to be contacted for input

Notes and presentations from stakeholder meeting available at Title24Stakeholders.com.



Requests from Stakeholders

- Measured data of night time occupancy trends in these outdoor area types
- Hours of operation: ratio of all-night vs. part-night gas stations
- Growth projections for sales lots and sales canopies
- Identify potential monitoring sites
- Percent of auto sales lots poles that are under 24ft
- Percent of gas stations that have canopies
- Cost data for control systems for fixtures used in these applications (both canopy and area fixtures)
- Emerging technologies - new control systems and LEDs
- Safety and marketing issues
- Detailed RFI questions are available at <http://title24stakeholders.com/all-case-topics/>
- Please submit responses to info@title24stakeholders.com and/or directly to the CASE author.



Questions?

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