# Proposal Summary

**2022 California Energy Code (Title 24, Part 6)**

## Nonresidential Grid Integration - Alternative HVAC Control Strategies: Compressor Control

Date last updated: Thursday, September 12, 2019

Prepared by: Kitty Wang, Energy Solutions

## Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on September 10th, 2019. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by September 24, 2019.

## Measure Description

The focus of the nonresidential grid integration CASE initiative is to adjust the demand response control requirements so buildings that comply with Title 24, Part 6 are more likely to use their controls to implement load management on a day to day basis, as well as participate in reliability or economic demand response events. This will help newly constructed nonresidential buildings contribute to grid reliability in a positive way, which is critical as California aims to achieve its energy and climate goals.

Currently, demand responsive controls for HVAC must be capable of increasing or decreasing temperature setpoints by four degrees. This requirement would remain in place, so at a minimum DR controls would be required to enable temperature adjustments to non-critical zones and this temperature adjustment strategy is verified through acceptance testing.

Temperature setpoint adjustments are the most common load management strategy for nonresidential buildings, but other control strategies focusing on specific HVAC equipment exist that offer more direct and focused load management. The current code requires that building have the capability of automatically adjusting temperature setpoints when a Demand Response (DR) Signal is received and that a specific temperature adjustment strategy be programmed into the control system at the time that acceptance testing is conducted. This measure aims to add an alternative pathway to comply with the HVAC DR control requirements to allow a load management strategy that limits the capacity of variable speed compressors. Adding this alternative control strategy enables a building to implement HVAC DR controls that best fits the buildings capabilities. Allowing for successful participation in DR programs at the time that the controls are installed and minimizing a need for reprogramming after the Title 24, Part 6 acceptance tests are complete.

The alternative control strategy will be designed such that the temperature change in the zone will remain within a comfortable range.

In addition to adding an alternative control strategy, this measure aims to realign Title 24, Part 6 language so it is more consistent with how HVAC controls commonly manage loads in nonresidential buildings. Specifically, the Statewide CASE Team is making the following recommendations:

- Revise language to clarify that the demand responsive controls for HVAC systems can either be controlled through the energy management control system (EMCS) or directly through the HVAC system zone controller.
- Revise the term "demand shed control" to reflect the new reality that load management does not always call for load to be reduced or shed.

## Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions).

***2019 Reference Nonresidential Appendix (NA)***

### 1.1 NA7.5.10 Automatic Demand Shed Control Acceptance

**NA7.5.10.2 Function Testing**

**NA 7.5.10 Automatic Demand Shed Control Acceptance**

***NA 7.5.10.1 Construction Inspection***

Prior to ~~Acceptance~~ Functional Testing, verify and document the following:

(a) That the EMCS or zone controller interface enables remote activation of the demand shed controls from a central contact or software point.

(b) Verify which functional test the building will use to verify compliance: Thermostat Setpoint Adjustment or Refrigerant Compressor Capacity Limit Adjustments.

***NA 7.5.10.1 Functional Testing***

**Functional Test for Thermostat Setpoint Adjustments**

Step 1: Engage the ~~global~~ automatic demand shed system. Initiate the programmed thermostat setpoint reset strategy. Verify and document the following:

(a) That the cooling setpoint in ~~non-critical spaces~~ Non-Critical zones increases by the ~~proper amount~~ four degrees or more as required by section 110.12b.

(b) That the cooling setpoint in critical ~~spaces~~ zones do not change.

Step 2: Disengage the ~~global~~ automatic demand shed system. Verify and document the following:

(c) That the cooling setpoint in ~~non-critical spaces~~ Non-Critical zones return to their ~~original values~~ pre-test setpoints.

(d) That the cooling setpoint in critical spaces do not change.

**Functional Test for Refrigerant Compressor Capacity Limit Adjustments**

Step 1: Engage the automatic demand shed system. Verify and document the following:

(a) That the refrigerant compressor capacity is reduced by the programmed percentages in Non-Critical zones.

(b) That the temperatures in Non-Critical zones increases by no more than four degrees.

(c) That the cooling setpoint in critical spaces do not change.

Step 2: Disengage the automatic demand shed system. Verify and document the following:

(d) That the refrigerant compressor capacity returns to the pre-test setpoints in Non-Critical zones.

(e) That the cooling setpoint in Non-Critical zones return to the pre-test levels.

(f) That the cooling setpoint in critical spaces do not change.



## Appendix JA 5 – Technical Specifications for Occupant Controlled Smart Thermostats

### JA5.2.6 Required Functional Behavior

(b) Demand Responsive Control. Upon receiving a price signal or a Demand Response Signal, OCSTs shall be capable of automatic event response by adjusting the currently applicable temperature setpoint by the number of degrees indicated in the temperature offset (heating or cooling, as appropriate).

OCSTs connected to an energy management control system or service that provides for alternate strategies shall be capable of event response by adjusting system heating or cooling capacity until the temperature in Non-Critical zones changes by 4 degrees or more relative to the setpoint in place before the signal.

Override: OCSTs shall allow an occupant or their representative to alter or eliminate the default response to price signals or Demand Response Signals, and to override any individual price response or Demand Responsive Control and allow the occupant to choose any temperature setpoint at any time including during a price event or a Demand Response Period.

When the price signal changes to a non-response level or the Demand Response Period is concluded, OCSTs shall return to normal operation. The thermostat setpoint shall be set to the setpoint that is programmed for the point in time that the event ends or to the manually established setpoint that existed just prior to the Demand Response Period.

The OCST shall also be equipped with the capability to allow occupants to define setpoints for cooling and heating in response to price signals or Demand Response Signals as an alternative to the default event response. The default setpoint definitions unless redefined by the occupant shall be as follows:

1. The default price response or Demand Response Period setpoint in the cooling mode for OCSTs shall be 82°F. The OCST shall allow the occupant to change the default event setpoint to any other value.

2. The default price response or Demand Response Period setpoint in the heating mode for OCSTs shall be 60°F. The OCST shall allow the occupant to change the default event setpoint to any other value.
3. The OCST shall ignore price response or Demand Response Period setpoints that are lower (in cooling mode) or higher (in heating mode) than the programmed or occupant selected prevailing setpoint temperature upon initiation of the price event or Demand Response Period.
4. By default, thermostats shall not be remotely set above 90°F or below 50°F. Occupants shall have the ability to redefine these limits. This measure protects occupant premises from extreme temperatures that might otherwise be imposed by event responses, should the occupant already have a very high or low temperature setpoint in effect.

The occupant may still override or change the setpoint during all price events and Demand Response Periods. Price signal response and Demand Responsive Control only modify the operating range of the thermostat. They do not otherwise affect the operation and use of features provided by the manufacturer's design.

# Proposal Summary

**2022 California Energy Code (Title 24, Part 6)**

## Nonresidential Grid Integration - Indoor Lighting Demand Management

Date last updated: Tuesday, July 31, 2019

Prepared by: David Jagger, Energy Solutions

## Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on September 10th, 2019. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by September 24, 2019.

## Measure Description

The demand management control requirements for lighting systems were adopted before Title 24, Part 6 lighting power density requirements were based on LED technology. To reflect this shift to LEDs, there are several changes that this submeasure will consider in demand management control requirements.

1. Eliminate or adjust the exception that demand management controls are not required if the lighting power density is 0.5 watts per square foot or less.
2. Eliminate the requirement that general lighting must be reduced in a manner consistent with the uniform level of illumination (per Table 130.1-A).
3. Translate the 10,000 square foot demand management exemption to an equivalent installed wattage.
4. Adjust, increase or decrease, the exception that demand management controls are not required in facilities greater than 10,000 square feet based on current market data. Or the equivalent installed wattage depending on the adoption of that proposal.

## Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions).

## 1.1 SECTION 110.12 – MANDATORY REQUIREMENTS FOR DEMAND MANAGEMENT

Buildings, other than healthcare facilities, shall comply with the applicable demand responsive control requirements of Sections 110.12(a) through 110.12(d)

(c) Demand Responsive Lighting Controls. Lighting controls in nonresidential buildings with installed wattage greater than XX Wattage ~~larger than 10,000 square feet~~ shall be capable of automatically reducing lighting power in response to a Demand Response Signal. ~~General lighting shall be reduced in a manner consistent with the uniform level of illumination requirements in TABLE 130.1-A.~~

1. For compliance testing, the lighting controls shall demonstrate a lighting power reduction in controlled spaces of a minimum of 15 percent below the total installed lighting power. The controls may provide additional demand responsive functions or abilities.

EXCEPTION 1 to 110.12(c): Spaces with a lighting power density of XX ~~0.5~~ watts per square foot or less are not required to install demand responsive controls and do not count toward the ~~10,000 square foot~~ XX Wattage threshold.

EXCEPTION 2 to 110.12(c): Spaces where a health or life safety statute, ordinance, or regulation does not permit the lighting to be reduced are not required to install demand responsive controls and do not count toward the ~~10,000 square foot~~ XX Wattage threshold.

## 1.2 SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

Nonresidential, high-rise residential, 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.

(e) **Demand Responsive Controls.** See Section 110.12 for requirements for demand responsive lighting controls.

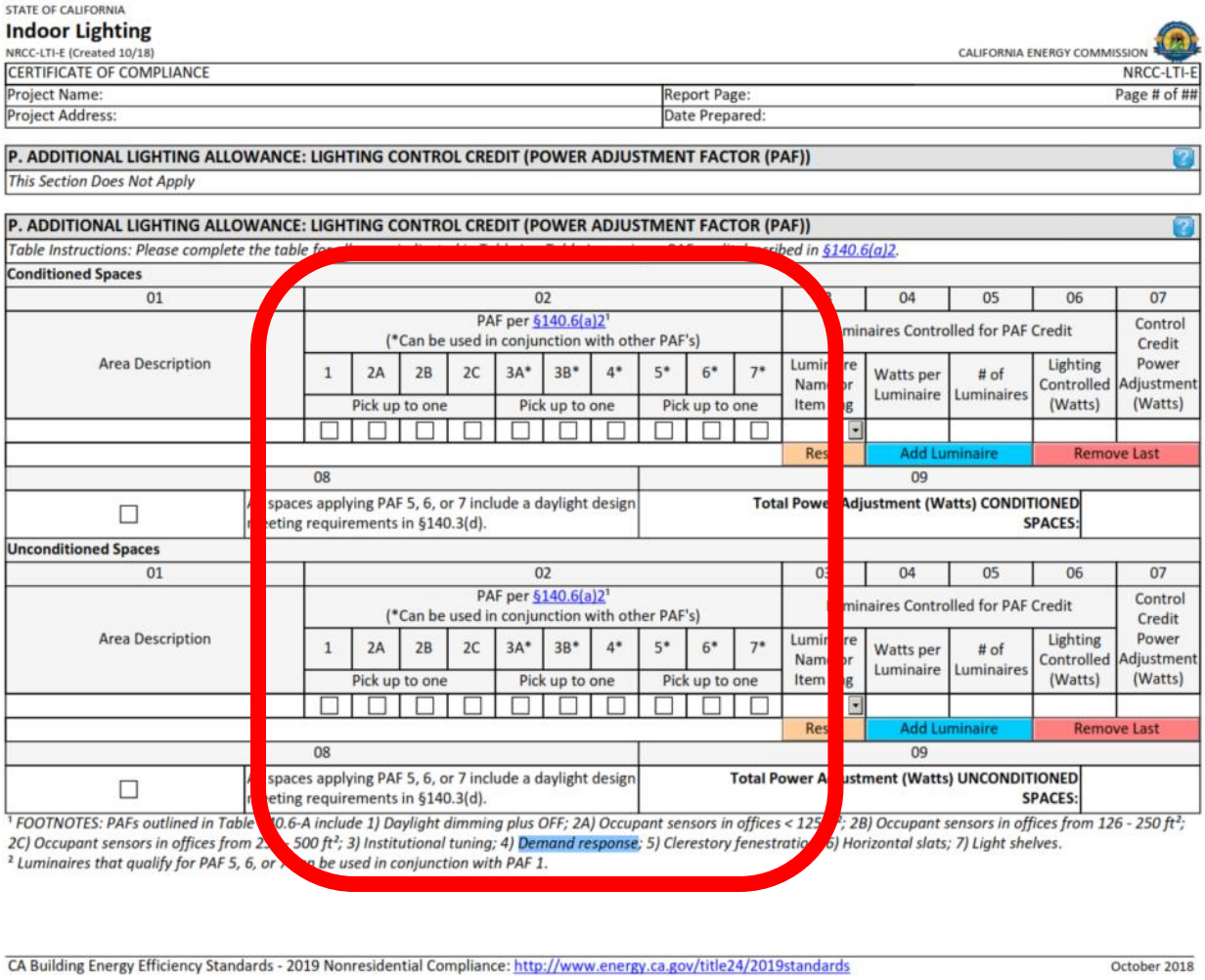
*TABLE 130.1-A MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS*

| **Luminaire Type** | **Minimum Required Control Steps ( percent of full rated power[1] )** | **Uniform level of illuminance shall be achieved by:** |
|---|---|---|
| Line-voltage sockets except GU-24 | Continuous dimming 10-100 percent | |
| Low-voltage incandescent systems | | |
| LED luminaires and LED source systems | | |
| GU-24 rated for LED | | |
| GU-24 sockets rated for fluorescent > 20 watts | Continuous dimming 20-100 percent | |

<table>
<tr><td>Pin-based compact fluorescent > 20 watts[2]</td><td colspan="4"></td><td></td></tr>
<tr><td>GU-24 sockets rated for fluorescent ≤ 20 watts</td><td colspan="4" rowspan="3">Minimum one step between 30-70 percent</td><td rowspan="3">Stepped dimming; or<br>Continuous dimming; or<br>Switching alternate lamps in a luminaire</td></tr>
<tr><td>Pin-based compact fluorescent ≤ 20 watts[2]</td></tr>
<tr><td>Linear fluorescent and U-bent fluorescent ≤ 13 watts</td></tr>
<tr><td rowspan="2">Linear fluorescent and U-bent fluorescent > 13 watts</td><td colspan="4">Minimum one step in each range:</td><td rowspan="2">Stepped dimming; or<br>Continuous dimming; or<br>Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner</td></tr>
<tr><td>20-40 %</td><td>50-70 %</td><td>75-85 %</td><td>100 %</td></tr>
<tr><td>Track Lighting</td><td colspan="4">Minimum one step between 30 – 70 percent</td><td>Step dimming; or<br>Continuous dimming; or<br>Separately switching circuits in multi-circuit track with a minimum of two circuits.</td></tr>
<tr><td>HID > 20 watts</td><td colspan="4" rowspan="3">Minimum one step between 50 - 70 percent</td><td rowspan="3">Stepped dimming; or<br>Continuous dimming; or<br>Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.</td></tr>
<tr><td>Induction > 25 watts</td></tr>
<tr><td>Other light sources</td></tr>
<tr><td colspan="6">1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor<br>2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps</td></tr>
<tr><td colspan="6">EXCEPTION 1 to Table 130.1-A Minimum Required Control Steps: Classrooms with a connected general lighting load of 0.7 watts per square feet or less shall have a minimum of one control step between 30-70 percent of full rated power, regardless of luminaire type.<br>EXCEPTION 2 to Table 130.1-A Minimum Required Control Steps: Library stack aisles, aisle ways and open areas in warehouses, parking garages, parking areas, loading and unloading areas, stairwells, and corridors shall have a minimum of one control step between 20-60 percent of full rated power, regardless of luminaire type.</td></tr>
</table>

### *2019 Indoor Lighting: Certificate of Compliance*

Remove areas of section P that provides a Power Adjustment Factor (PAF) for demand responsive controls in facilities that do not need to comply with section 110.12 Mandatory Requirements for Demand Management.



STATE OF CALIFORNIA
**Indoor Lighting**
NRCC-LTI-E (Created 10/18)
CALIFORNIA ENERGY COMMISSION

| CERTIFICATE OF COMPLIANCE | | NRCC-LTI-E |
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**P. ADDITIONAL LIGHTING ALLOWANCE: LIGHTING CONTROL CREDIT (POWER ADJUSTMENT FACTOR (PAF))**

*This Section Does Not Apply*

**P. ADDITIONAL LIGHTING ALLOWANCE: LIGHTING CONTROL CREDIT (POWER ADJUSTMENT FACTOR (PAF))**

*Table Instructions: Please complete the table for all ... described in §140.6(a)2.*

**Conditioned Spaces**

| 01 | 02 | | | | | | | | | | 03 | 04 | 05 | 06 | 07 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area Description | PAF per §140.6(a)2[1] (*Can be used in conjunction with other PAF's) | | | | | | | | | | Luminaires Controlled for PAF Credit | | | | Control Credit Power Adjustment (Watts) |
| | 1 | 2A | 2B | 2C | 3A* | 3B* | 4* | 5* | 6* | 7* | Luminaire Name or Item | Watts per Luminaire | # of Luminaires | Lighting Controlled (Watts) | |
| | Pick up to one | | | | Pick up to one | | | Pick up to one | | | | | | | |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | | | | | |
| | | | | | | | | | | | Res | Add Luminaire | | Remove Last | |

| 08 | 09 |
|---|---|
| ☐ spaces applying PAF 5, 6, or 7 include a daylight design ... eting requirements in §140.3(d). | **Total Power ... Adjustment (Watts) CONDITIONED SPACES:** |

**Unconditioned Spaces**

| 01 | 02 | | | | | | | | | | 03 | 04 | 05 | 06 | 07 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area Description | PAF per §140.6(a)2[1] (*Can be used in conjunction with other PAF's) | | | | | | | | | | ...minaires Controlled for PAF Credit | | | | Control Credit Power Adjustment (Watts) |
| | 1 | 2A | 2B | 2C | 3A* | 3B* | 4* | 5* | 6* | 7* | Luminaire Name or Item | Watts per Luminaire | # of Luminaires | Lighting Controlled (Watts) | |
| | Pick up to one | | | | Pick up to one | | | Pick up to one | | | | | | | |
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | | | | | |
| | | | | | | | | | | | Res | Add Luminaire | | Remove Last | |

| 08 | 09 |
|---|---|
| ☐ ... spaces applying PAF 5, 6, or 7 include a daylight design ... eting requirements in §140.3(d). | **Total Power A... ustment (Watts) UNCONDITIONED SPACES:** |

*[1] FOOTNOTES: PAFs outlined in Table ...0.6-A include 1) Daylight dimming plus OFF; 2A) Occupant sensors in offices < 125 ...; 2B) Occupant sensors in offices from 126 - 250 ft²; 2C) Occupant sensors in offices from 2... - 500 ft²; 3) Institutional tuning; 4) Demand response; 5) Clerestory fenestrati... 6) Horizontal slats; 7) Light shelves.*

*[2] Luminaires that qualify for PAF 5, 6, or ... be used in conjunction with PAF 1.*

## 5.4.5 Demand Responsive Lighting Controls

*§130.1(e); §110.12 (new for 2019)*

Nonresidential buildings with installed wattage larger than XX ~~larger than 10,000 sq. ft.~~ must have lighting systems with demand responsive lighting controls.

Spaces with a lighting power density of XX ~~0.5~~ W/ft$^2$ or less do not count towards the XX installed wattage ~~10,000 sq ft.~~ threshold for triggering demand responsive lighting control requirements. Also, spaces not permitted by a health or life safety statute, ordinance, or regulation to be reduced, are exempted from the requirement.

See Appendix D of this compliance manual for guidance on compliance with the demand responsive control requirements.

## 5.6.2 Demand Responsive Lighting Controls

The adjusted indoor lighting power of all building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building.

Some adjustments are available to reduce the indoor lighting power that must be reported. These adjustments are discussed below.

### A. Power Adjustment Factors (PAFs) or Reduction of Wattage Through Controls

The Energy Standards provide an option for a lighting power reduction credit when specific lighting controls are installed, provided those lighting controls are not required.

A power adjustment factor (PAF) is an adjustment to the installed lighting power in an area so that some of the installed lighting power is not counted toward the building's total installed lighting load.

In calculating adjusted indoor lighting power, the installed watts of a luminaire providing general lighting in a functional area listed in Table 140.6-C may be reduced by multiplying the watts controlled by the applicable power adjustment factor (PAF), per Table 140.6-A.

To qualify for a PAF, the following conditions are required to be met:

11. To qualify for the PAF for a demand responsive control in Table 140.6-A, a demand responsive control shall meet all of the following requirements:
    a. Because buildings with installed wattage larger than XX ~~larger than 10,000 sq. ft.~~ are required to have demand responsive controls, to qualify for the PAF, the building shall have installed wattage less than or equal to XX, ~~be 10,000 sq ft or smaller.~~
    b. The controlled lighting shall be capable of being automatically reduced in response to a demand response signal.
    ~~c. Lighting shall be reduced in a manner consistent with the uniform level of illumination requirements in Table 130.1-A.~~
    d. Spaces that are non-habitable shall not be used to comply with this requirement, and spaces with a lighting power of less than XX ~~0.5~~ watts per square foot shall not be counted toward the building's total lighting power.

## Appendix D - Demand Responsive Controls

Table D-1: Summary of DR Control Requirements for Newly Constructed Nonresidential Buildings

| Application | | Required DR Controls | Response Tested for Title 24 Compliance | Acceptance Test |
|---|---|---|---|---|
| **HVAC** | Direct Digital Control (DDC) to the Zone level[1] | Must have DR Controls that are compliant with Sections 110.12(a) and (b) | • During DR Period, in non-critical zones:<br>○ In cooling mode, increase the operating cooling temperature 4°F or more<br>○ In heating mode, decrease the operating heating temperature 4°F or more<br>• Upon conclusion of the DR Period, reset the temperature set points to their original settings.<br>• Provide an adjustable rate of change for the temperature. | NA7.5.10: Automatic Demand Shed Control Acceptance |
| | Single-zone air conditioner and heat pump system (without DDC to the Zone Level)[1,2] | Must have thermostatic controls that are compliant with Joint Appendix 5. | Defined in Joint Appendix 5. | Not applicable |
| **Lighting** | Lighting in buildings with installed wattage larger than XX ~~larger than 10,000 square feet~~[3] | Must have DR controls that are compliant with Sections 110.12(a) and (c) | Reduce lighting power by a minimum of 15 percent below the design full output level for the duration of the Demand Response Period. [3,4] | NA7.6.3 Demand Responsive Controls Acceptance |
| **Sign Lighting** | Electronic Message Centers (EMCs) having a new connected lighting power load greater than 15 kW[4] | Must have DR controls that are compliant with Sections 110.12(a) and (d) | Reduce lighting power by a minimum of 30 percent for the duration of the Demand Response Period. | Not applicable |
| **Electrical Power System** | Circuit-level controls installed as part of the electrical power distribution system[5] | Must have DR controls that are compliant with Sections 110.12(a) | Not applicable | Not applicable |

1. Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plants, or animals are exempt.
2. Package terminal air conditioners, package terminal heat pumps, room air conditioners, and room air-conditioner heat pumps are exempt.
3. Spaces with a lighting power density of XX ~~0.5~~ watts per square foot or less and spaces in which lighting power or illuminance is not permitted to be reduced in accordance with health or life safety statues, ordinances, or regulations: 1) are not required to be capable of automatically reducing lighting power when a DR Signal is received; and 2) shall not be included in calculations of the design full output level or the reduced lighting power level.
4. Lighting for EMCs where lighting power or illuminance is not permitted to be reduced by 30 percent in accordance with a health or life safety statute, ordinance, or regulation is exempt.
5. Circuit-level controls installed to control HVAC, lighting, or sign lighting equipment must comply with the requirements for that application.

## 4. DR Controls for Lighting Systems

*§110.12(c)*

Buildings with installed wattage larger than XX ~~larger than 10,000 square feet ($ft^2$)~~ must be equipped with DR controls for indoor lighting systems that comply with §110.12(a) and (c). There are two exceptions that impact the calculation of the installed wattage XX ~~10,000 $ft^2$~~ threshold and impact where DR controls can must be installed. Specifically, spaces that fall into these two categories do not need to have DR lighting controls and do not need to be included in the calculation of the installed wattage XX ~~10,000 $ft^2$~~ threshold:

1. Spaces with a lighting power density of XX ~~0.5~~W/ $ft^2$ or less; and
2. Spaces where health or life safety statute, ordinance, or regulation does not permit lighting to be reduced.

# Proposal Summary

**2022 California Energy Code (Title 24, Part 6)**

## Nonresidential Grid Integration - Outdoor Lighting Demand Management

Date last updated: Tuesday, July 31, 2019

Prepared by: David Jagger, Energy Solutions

## Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on September 10th, 2019. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by September 24, 2019.

## Measure Description

The demand management control requirements for lighting systems only addresses indoor lighting. This measure review will explore the cost-effectiveness of including mandatory requirements for outdoor lighting demand management.

## Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions).

### Standards

***2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings***

#### SECTION 130.2 – OUTDOOR LIGHTING CONTROLS AND EQUIPMENT

Nonresidential, high-rise residential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.2(a) through ~~130.2(c)~~ 130.2(d).

(d) **Demand Responsive Controls.** See Section 110.12 for requirements for demand responsive lighting controls.

#### SECTION 130.4 – LIGHTING CONTROL ACCEPTANCE AND INSTALLATION CERTIFICATE REQUIREMENTS

Nonresidential buildings other than healtcare facilities, high-rise residential buildings, and hotel/motel buildings shall comply with the applicable requirements of Sections 130.4(a) through 130.4(c). Healthcare facilites shall comply with the applicable acceptance and installation documentation requirements of OSHPD.

(a) **Lighting Control Acceptance Requirements.** Before an occupancy permit is granted, indoor and outdoor lighting controls serving the building, area, or site shall be certified as meeting the Acceptance Requirements for Code Compliance in accordance with Section 130.4(a). A Certificate of Acceptance shall be submitted to the enforcement agency under Section 10-103(a) of Part 1, that:

1. Certifies that all of the lighting acceptance testing necessary to meet the requirements of Part 6 is completed;
2. Certifies that the applicable procedures in Reference Nonresidential Appendix NA7.6 and NA7.8 have been followed;
3. Certifies that automatic daylight controls comply with Section 130.1(d) and Reference Nonresidential Appendix NA7.6.1;
4. Certifies that lighting shut-OFF controls comply with Section 130.1(c), 130.2(d), and Reference Nonresidential Appendix NA7.6.2;
5. Certifies that demand responsive controls comply with Section 130.1(e) and Reference Nonresidential Appendix NA7.6.3; and
6. Certifies that outdoor lighting controls comply with the applicable requirements of Section 130.2(c) and Reference Nonresidential Appendix NA7.8; and
7. Certifies that lighting systems receiving the Institutional Tuning Power Adjustment Factor comply with Section 140.6(a)2J and Reference Nonresidential Appendix NA7.7.6.2.

## SECTION 110.12 – MANDATORY REQUIREMENTS FOR DEMAND MANAGEMENT

Buildings, other than healthcare facilities, shall comply with the applicable demand responsive control requirements of Sections 110.12(a) through ~~110.12(d)~~ 110.12(e).

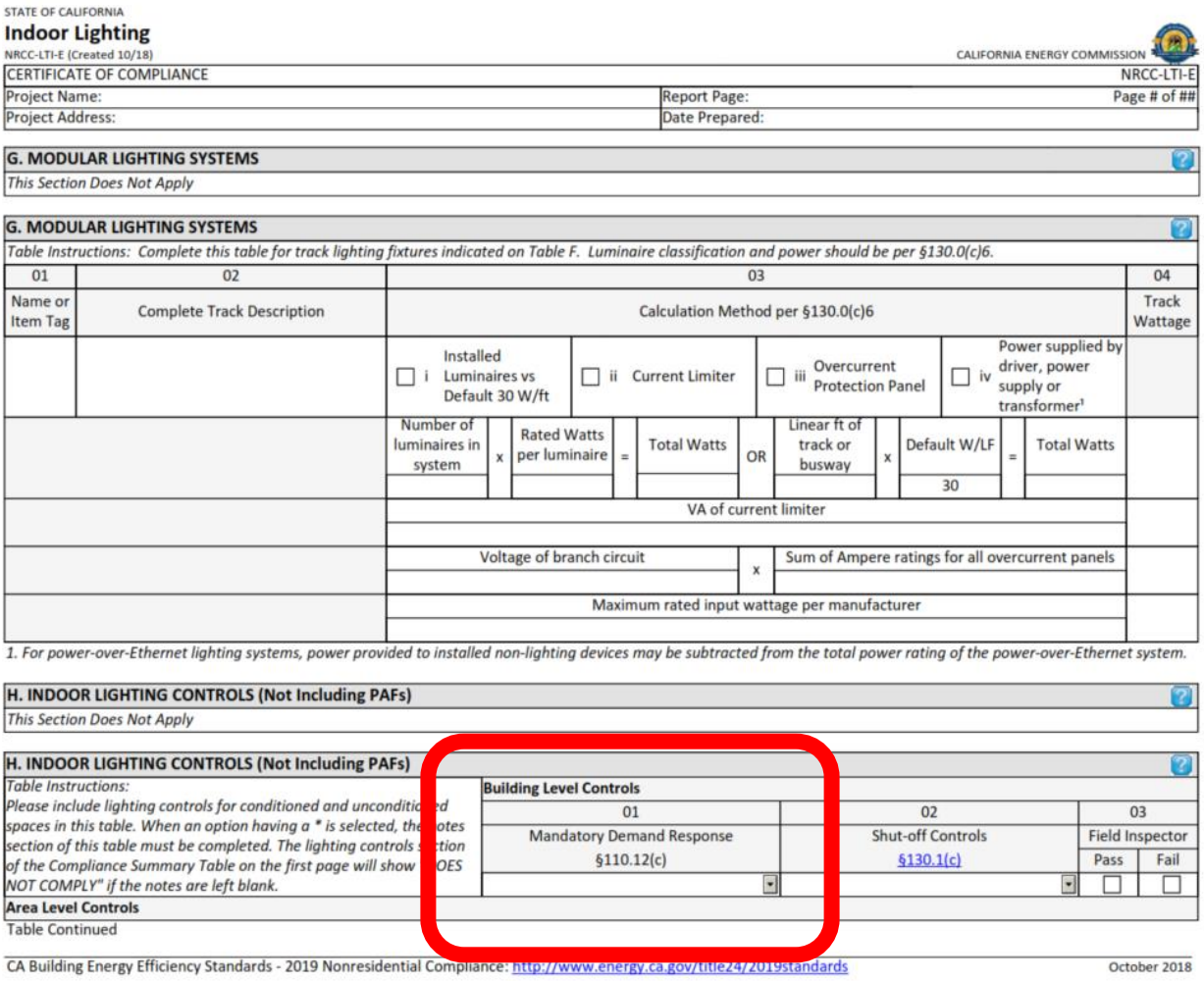
(e) Demand Responsive Outdoor Lighting Controls. Outdoor lighting controls in nonresidential spaces with installed wattage greater than XX shall be capable of automatically reducing lighting power in response to a Demand Response Signal.

1. For compliance testing, the lighting controls shall demonstrate a lighting power reduction in controlled spaces of a minimum of 50 percent below the total installed lighting power. The controls may provide additional demand responsive functions or abilities.

EXCEPTION 2 to 110.12(c): Spaces where a health or life safety statute, ordinance, or regulation does not permit the lighting to be reduced are not required to install demand responsive controls and do not count toward XX installed wattage threshold.

### *2019 Outdoor Lighting: Certificate of Compliance*

Include demand management section to certificate of compliance NRCC-LTO-E, similar to relevant section in NRCC-LTI-E. Relevant section in NRC-LTI-E are highlighted below:



STATE OF CALIFORNIA

**Indoor Lighting**

NRCC-LTI-E (Created 10/18) — CALIFORNIA ENERGY COMMISSION

| CERTIFICATE OF COMPLIANCE | | NRCC-LTI-E |
|---|---|---|
| Project Name: | Report Page: | Page # of ## |
| Project Address: | Date Prepared: | |

**G. MODULAR LIGHTING SYSTEMS**

*This Section Does Not Apply*

**G. MODULAR LIGHTING SYSTEMS**

*Table Instructions: Complete this table for track lighting fixtures indicated on Table F. Luminaire classification and power should be per §130.0(c)6.*

| 01 | 02 | 03 | | | | | | | | | | 04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name or Item Tag | Complete Track Description | Calculation Method per §130.0(c)6 | | | | | | | | | | Track Wattage |
| | | ☐ i Installed Luminaires vs Default 30 W/ft | | ☐ ii Current Limiter | | ☐ iii Overcurrent Protection Panel | | ☐ iv Power supplied by driver, power supply or transformer[1] | | | | |
| | | Number of luminaires in system | x | Rated Watts per luminaire | = | Total Watts | OR | Linear ft of track or busway | x | Default W/LF (30) | = | Total Watts |
| | | VA of current limiter | | | | | | | | | | |
| | | Voltage of branch circuit | | | x | Sum of Ampere ratings for all overcurrent panels | | | | | | |
| | | Maximum rated input wattage per manufacturer | | | | | | | | | | |

*1. For power-over-Ethernet lighting systems, power provided to installed non-lighting devices may be subtracted from the total power rating of the power-over-Ethernet system.*

**H. INDOOR LIGHTING CONTROLS (Not Including PAFs)**

*This Section Does Not Apply*

**H. INDOOR LIGHTING CONTROLS (Not Including PAFs)**

*Table Instructions:*
*Please include lighting controls for conditioned and unconditioned spaces in this table. When an option having a * is selected, the notes section of this table must be completed. The lighting controls section of the Compliance Summary Table on the first page will show "DOES NOT COMPLY" if the notes are left blank.*

| Building Level Controls | | | | |
|---|---|---|---|---|
| 01 | | 02 | 03 | |
| Mandatory Demand Response §110.12(c) | | Shut-off Controls §130.1(c) | Field Inspector | |
| | | | Pass ☐ | Fail ☐ |

**Area Level Controls**

Table Continued

### 5.4.5 Demand Responsive Lighting Controls

*§130.1(e); §110.12 (new for 2019)*

Nonresidential buildings larger than 10,000 sq. ft. must have lighting systems with demand responsive lighting controls.

Spaces with a lighting power density of 0.5 W/ft$^2$ or less do not count towards the 10,000 sq ft. threshold for triggering demand responsive lighting control requirements. Also, spaces not permitted by a health or life safety statute, ordinance, or regulation to be reduced, are exempted from the requirement.

Outdoor lighting controls in nonresidential spaces with installed wattage greater than XX shall be capable of automatically reducing lighting power in response to a demand response signal.

See Appendix D of this compliance manual for guidance on compliance with the demand responsive control requirements.

## Appendix D - Demand Responsive Controls

Table D-1: Summary of DR Control Requirements for Newly Constructed Nonresidential Buildings

| Application | | Required DR Controls | Response Tested for Title 24 Compliance | Acceptance Test |
|---|---|---|---|---|
| **HVAC** | Direct Digital Control (DDC) to the Zone level[1] | Must have DR Controls that are compliant with Sections 110.12(a) and (b) | • During DR Period, in non-critical zones:<br>○ In cooling mode, increase the operating cooling temperature 4°F or more<br>○ In heating mode, decrease the operating heating temperature 4°F or more<br>• Upon conclusion of the DR Period, reset the temperature set points to their original settings.<br>• Provide an adjustable rate of change for the temperature. | NA7.5.10: Automatic Demand Shed Control Acceptance |
| | Single-zone air conditioner and heat pump system (without DDC to the Zone Level)[1,2] | Must have thermostatic controls that are compliant with Joint Appendix 5. | Defined in Joint Appendix 5. | Not applicable |
| **Lighting** | Lighting in buildings larger than 10,000 square feet[3] | Must have DR controls that are compliant with Sections 110.12(a) and (c) | Reduce lighting power by a minimum of 15 percent below the design full output level for the duration of the Demand Response Period. [3,4] | NA7.6.3 Demand Responsive Controls Acceptance |
| | Outdoor Lighting in nonresidential spaces with installed wattage greater than XX | Must have DR controls that are compliant with Sections 110.12(a) and (e) | Reduce lighting power by a minimum of 50% below the design full output level for the duration of the Demand Response Period. | NA7.6.3 Demand Responsive Controls Acceptance |
| **Sign Lighting** | Electronic Message Centers (EMCs) having a new connected lighting power load greater than 15 kW[4] | Must have DR controls that are compliant with Sections 110.12(a) and (d) | Reduce lighting power by a minimum of 30 percent for the duration of the Demand Response Period. | Not applicable |
| **Electrical Power System** | Circuit-level controls installed as part of the electrical power distribution system[5] | Must have DR controls that are compliant with Sections 110.12(a) | Not applicable | Not applicable |

1. Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plants, or animals are exempt.
2. Package terminal air conditioners, package terminal heat pumps, room air conditioners, and room air-conditioner heat pumps are exempt.
3. Spaces with a lighting power density of 0.5 watts per square foot or less and spaces in which lighting power or illuminance is not permitted to be reduced in accordance with health or life safety statues, ordinances, or regulations: 1) are not required to be capable of automatically reducing lighting power when a DR Signal is received; and 2) shall not be included in calculations of the design full output level or the reduced lighting power level.
4. Lighting for EMCs where lighting power or illuminance is not permitted to be reduced by 30 percent in accordance with a health or life safety statute, ordinance, or regulation is exempt.
5. Circuit-level controls installed to control HVAC, lighting, or sign lighting equipment must comply with the requirements for that application.

## 4. DR Controls for Lighting Systems

*§110.12(c)*

Buildings larger than 10,000 square feet ($ft^2$) must be equipped with DR controls for indoor lighting systems that comply with §110.12(a) and (c). There are two exceptions that impact the calculation of the 10,000 $ft^2$ threshold and impact where DR controls can must be installed. Specifically, spaces that fall into these two categories do not need to have DR lighting controls and do not need to be included in the calculation of the 10,000 $ft^2$ threshold:

1. Spaces with a lighting power density of 0.5W/ $ft^2$ or less; and
2. Spaces where health or life safety statute, ordinance, or regulation does not permit lighting to be reduced.

Outdoor lighting controls in nonresidential spaces with installed wattage greater than XX shall be capable of automatically reducing lighting power in response to a demand response signal

***2019 Demand Responsive Lighting Control Acceptance Document: NRCA-LTI-04-A***

Include appropriate outdoor lighting measurements and acceptance requirements, mirroring the indoor lighting acceptance document.

*2019 Reference appendices*

## NA7.6.3 Demand Responsive Controls Acceptance Tests

### NA7.6.3.1 Construction Inspection

Prior to Functional testing, verify and document the following:

(a) That the demand responsive control is capable of receiving a demand response signal directly or indirectly through another device and that it complies with the requirements in Section 130.1(e) or Section 130.2(d), as applicable to indoor and outdoor lighting respectively.

(b) If the demand response signal is received from another device (such as an EMCS), that system must itself be capable of receiving a demand response signal from a utility meter or other external source.

### NA7.6.3.2 Functional testing

For buildings with up to seven (7) outdoor spaces, requiring demand responsive lighting controls, all spaces shall be tested. For buildings with more than seven (7) outdoor sensors for requiring demand responsive lighting controls, sampling may be done on outdoor areas with similar lighting systems that cover similar unobstructed areas; sampling shall include a minimum of 1 outdoor space for each group of up to 7 additional outdoor spaces. If the first outdoor space with a demand responsive lighting control in the sample group passes the acceptance test, the remaining outdoor areas in the sample group also pass. If the first outdoor space with a demand responsive lighting control in the sample group fails the acceptance test, the rest of the outdoor spaces in that group must be tested. If any tested demand responsive lighting control system fails it shall be repaired, replaced, or adjusted until it passes the tests.

Test the capability to reduce outdoor lighting power due to the demand responsive lighting control by measuring the reduction in electrical current in spaces required to meet Section 130.2(d), as follows:

(a) At the lighting circuit panel, select at least one lighting circuit that serves spaces required to meet Section 130.2(d).

(b) Full output test

1. Set the lighting system to full output. Note that the lighting in areas with solar illumination may be at less than full output or may be off. This test should be conducted when the luminaire output is non-zero because of these controls.
2. Take one electric current measurement for each selected circuit.
3. Simulate a demand response condition using the demand responsive control.
4. Add together all the circuit currents and calculate the reduction in current in the demand response condition, compared with the full output condition. The combined reduction must be at least 50% but must not reduce the output of any individual circuit by more than 90%.