

# Decoding 2016 Title 24, Part 6

## Let's Talk About Nonresidential Lighting

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Welcome



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# Agenda

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## Agenda for Today Approx. Length

- ✦ Welcome..... 10 minutes
- ✦ Why?!..... 10 minutes
- ✦ Let's Talk.....80 minutes
  - ✧ *Challenge A: Indoor Prescriptive... 20 minutes*
  - ✧ *Challenge B: Indoor Mandatory... 35 minutes*
  - ✧ *Challenge C: Outdoor Lighting... 15 minutes*
  - ✧ *Challenge D: Acceptance Testing. 10 minutes*
- ✦ Next Steps..... 15 minutes
- ✦ Wrap Up..... 5 minutes



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## California Statewide Codes & Standards



**EnergyCode Ace**<sup>TM</sup>  
Helping you play your cards right



This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission.



# Who Are We?

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Gabel Associates, LLC  
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## Host: Gina Rodda

Gina Rodda, our host for the Decoding Talk series, is a Certified Energy Analyst (CEA), and LEED Accredited Professional (AP).

She is involved in providing residential and non-residential energy calculations for a variety of building types throughout California; an instructor of full day trainings; and host of various webinars specific to Title 24 (Part 6) Building Energy Efficiency Standards.

Gina has been in the energy modeling field since 1991, through the course of *eight* California building energy code cycles.



**GABEL ASSOCIATES, LLC**  
BUILDING ENERGY ANALYSIS & ENERGY CODE COMPLIANCE



# Who Are We?

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California Lighting Technology Center  
[negraeber@ucdavis.edu](mailto:negraeber@ucdavis.edu)

## Co-Host: Nicole Graeber

Nicole Graeber, our co-host for the Decoding Talk series, is a senior development engineer at CLTC. She is a Lighting Certified (LC) professional.

Her work includes testing and development of emerging lighting technologies, as well as collaborating with CLTC's industry partners on demonstration and research projects.

Nicole graduated in 2009 from the University of California, Davis, receiving a degree in Civil Engineering with a focus on sustainable building science and energy efficiency.





# Our Goal Today

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- ✦ Review the changes to Title 24 Part 6 with the 2016 code cycle on Nonresidential Lighting:
  - ✦ What are the major changes to this code cycle.
  - ✦ What are the new options for indoor and outdoor lighting alterations.
  - ✦ Which mandatory controls are required and when.





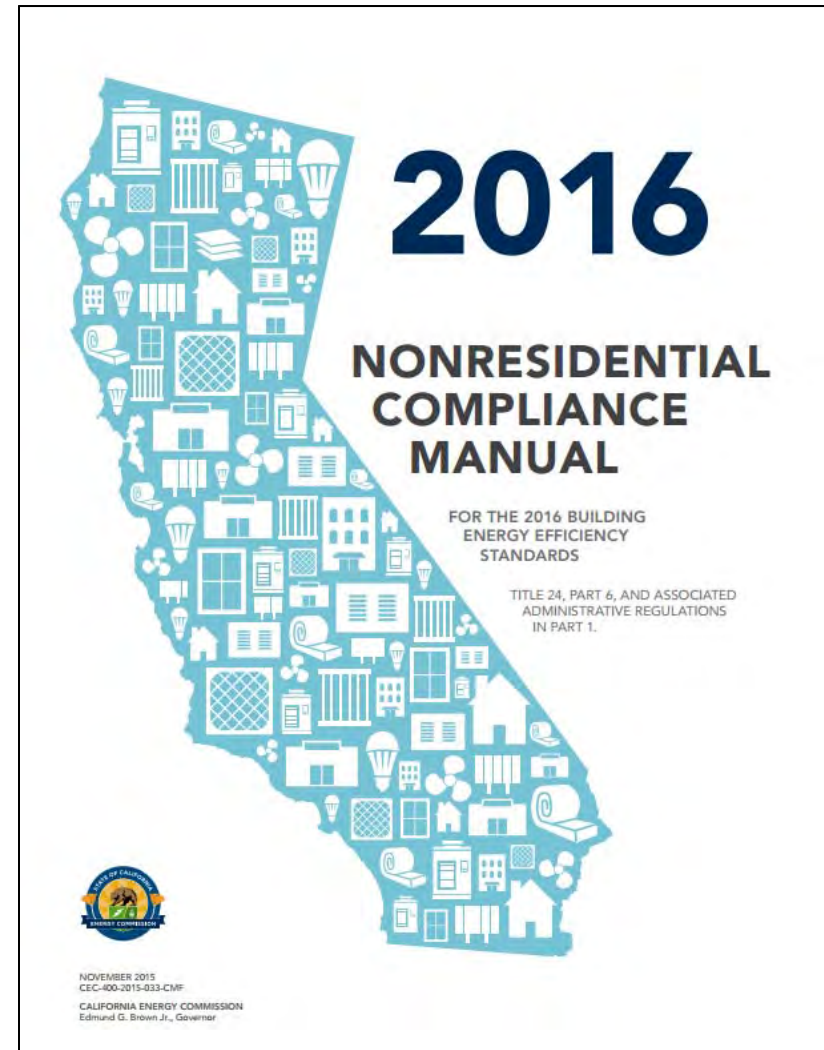
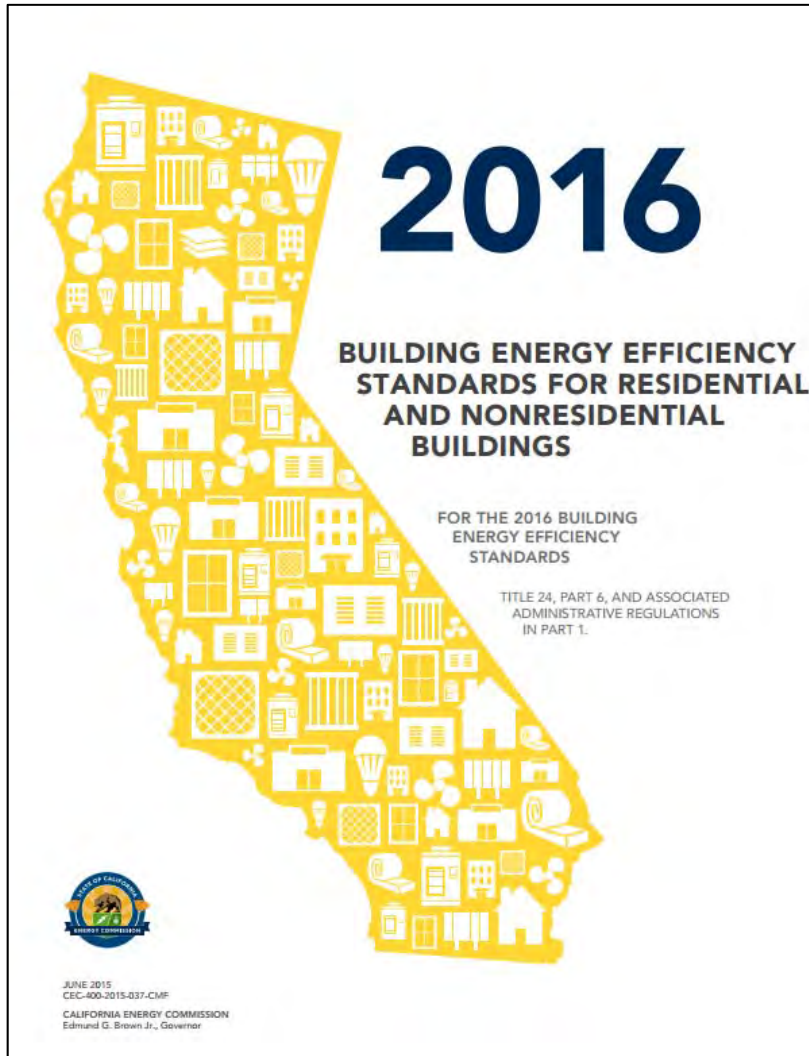
Why?



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# What? Title 24 Part 6: Energy Code

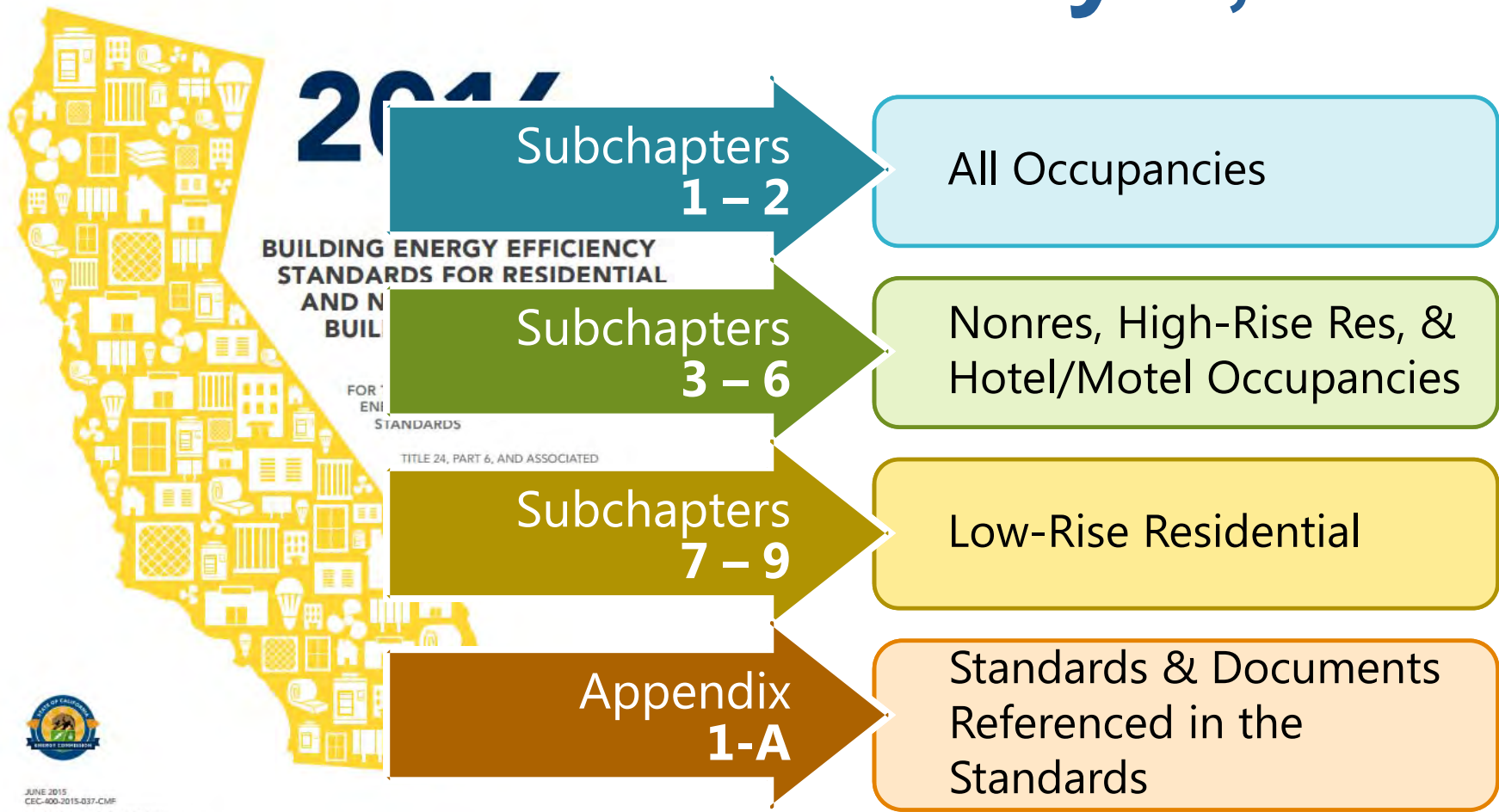


<http://www.energy.ca.gov/title24/2016standards/index.html>



# What? When?

## January 1, 2017



JUNE 2015  
CEC-400-2015-037-CMF  
CALIFORNIA ENERGY COMMISSION  
Edmund G. Brown Jr., Governor

**TABLE 100.0-A APPLICATION OF STANDARDS**

Occupancies	Application	Mandatory	Prescriptive	Performance	Additions Alterations			
General Provisions for All Buildings		100.0, 100.1, 100.2, 110.0						
<b>Nonresidential,</b>	General	120.0	140.0, 140.2					
	Envelope (conditioned)	110.6, 110.7, 110.8, 120.7	140.3					
	Envelope (unconditioned process spaces)	N.A.	140.3(c)					
	HVAC (conditioned)	110.2, 110.5, 120.1, 120.2, 120.3, 120.4, 120.5, 120.8	140.4					
	Water Heating	110.3, 120.3, 120.8, 120.9	140.5					
<b>High-Rise Residential, And Hotels/Motels</b>	Indoor Lighting (conditioned, process spaces)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6	140.0, 140.1	141.0			
	Indoor Lighting (unconditioned and parking garages)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6	N.A.				
	Outdoor Lighting	110.9, 130.0, 130.2, 130.4	140.7					
	Electrical Power Distribution	110.11, 130.5	N.A.		141.0 141.0(a)			
	Pool and Spa Systems	110.4, 110.5, 150.0(p)	N.A.					
	Solar Ready Buildings	110.10	N.A.					
<b>Covered Processes<sup>1</sup></b>	Envelope, Ventilation, Process Loads	110.2, 120.6	140.9	140.1	120.6, 140.9			
<b>Signs</b>	Indoor and Outdoor	130.0, 130.3	140.8	N.A.	141.0, 141.0(b)2H			
<b>Low-Rise Residential</b>	General	150.0	150.1(a, c)	150.1(a), 150.1(b)	150.2(a), 150.2(b)			
	Envelope (conditioned)	110.6, 110.7, 110.8, 150(a), 150.0(b), 150.0(c), 150.0(d), 150.0(e), 150.0(g)						
	HVAC (conditioned)	110.2, 110.5, 150.0(h), 150.0(i), 150.0(j), 150.0(m), 150.0(o)						
	Water Heating	110.3, 150.0(j, n)						
	Indoor Lighting (conditioned, unconditioned and parking garages)	110.9, 130.0, 150.0(k)						
	Outdoor Lighting	110.9, 130.0, 150.0(k)						
	Pool and Spa Systems	110.4, 150.0(p)				N. A.	N.A.	150.2(a), 150.2(b)
	Solar Ready Buildings	110.10				N. A.	N.A.	N.A.

<sup>1</sup> Nonresidential, high-rise and hotel/motel buildings that contain covered processes may conform to the applicable requirements of both occupancy types listed in this table.



Ace Resources

# Fact Sheets

2016 ENERGY CODE

## 2016 ENERGY CODE



Ace Resources

Title 24, Part 6

## Fact Sheet

### Nonresidential

# What's New with 2016 Code?

Information, see the CEC FAQ Sheet.



Figure 1: 2016 Energy Standards Update Infographic by CEC

In addition, the 2016 Energy Standards have set out to simplify and clarify several areas that were new in the 2013 Energy Standards, which were identified during the public comment period as needing clarification.

### Compliance Tools

The Compliance Manuals and other related manuals are being updated to reflect the adopted 2016 Energy Standards and are planned to be available in early 2016 on the CEC's website.

In addition, Energy Code Ace is working with the California Energy Commission (CEC) to produce a suite of 2016 Energy Standards Application Guides, which will provide project examples and other information that may be helpful in applying the energy code requirements. Look for these and other new tools, training and resources on EnergyCodeAce.com during the summer of 2016.

CBECC-Com, the state-funded nonresidential computer simulation tool, has been updated for the 2016 Energy Standards as well. A certified version is publicly available for free download now. This was developed early in order to give users time to utilize the software prior to the January 2017 implementation date.

ceilings have become more stringent under the 2016 Energy Standards. Additionally, prescriptive insulation requirements have become more stringent for metal and wood-framed walls in certain climate zones.

### Mandatory Measures – Section 120.7

Wall Insulation levels have been changed to the following:

- Metal framed: U-factor = 0.151 (R-13 w/R-2)
- Metal demising: U-factor = 0.151 (R-13 w/R-2)

All other mandatory insulation levels are unchanged. Additional exceptions apply for dedicated data centers.

### Prescriptive Measures – Section 140.3

- Prescriptive envelope requirements in Table 140.3-B have been updated for Nonresidential buildings.
- Prescriptive envelope requirements in Table 140.3-C have been updated for High-Rise Residential and Hotel/Motels.
- The prescriptive Roof/Ceiling Insulation (tradeoff for Aged Solar Reflectance Table 140.3) has been updated as shown below. Requirements apply to roof replacements as well as new installations.

Table 140.3 Nonresidential Roof U-Factor

Aged Solar Reflectance	Metal Building		Wood Framed and Other	
	All Zones	Zones 6 & 7	All other Zones	All other Zones
0.52-0.56	0.038	0.045	0.032	0.032
0.55-0.46	0.035	0.042	0.030	0.030
0.45-0.35	0.033	0.039	0.029	0.029
0.35-0.25	0.031	0.037	0.028	0.028

Table 140.3 Nonresidential Roof U-Factor



Title 24, Part 6 – Nonresidential Work with 2016 Code

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2016-04-21



# CALIFORNIA'S 2016 — NONRESIDENTIAL BUILDING ENERGY EFFICIENCY STANDARDS

CALIFORNIA ENERGY COMMISSION

The state's energy efficiency standards for new buildings and appliances have saved consumers billions in reduced electricity and natural gas bills. The building standards include better windows, insulation, lighting, air conditioning systems and other features that reduce energy consumption in homes and businesses. Since 1978 these standards have helped protect the environment by reducing more than 250 million metric tons of greenhouse gas emissions (or the equivalent of removing 37 million cars off California roads).

# 5% Increased Stringency



## DOOR AND WINDOW INTERLOCKS

Sensors on doors and windows adjust the thermostat to turn off the heating or cooling if a door or window is left open for more than five minutes. This allows occupants to take advantage of outside temperatures and save on heating and cooling costs.



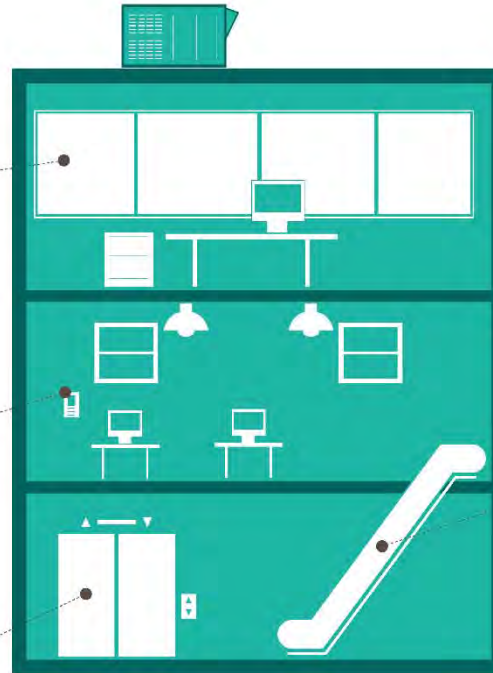
## DIRECT DIGITAL CONTROLS

For larger heating, ventilation and air conditioning systems, installing digital controls enables communication with building energy management systems, allowing managers to tailor the building's heating and cooling demands and prevent waste.



## ELEVATORS

Efficient ventilation fans and lighting sources installed within the elevator, along with controls that turn off the cab lighting and fans when the elevator is empty, save energy both when the elevator is in use and when empty.



These are cost effective measures that builders may consider to achieve new levels of efficiency. They can be traded for other efficient technologies such as higher efficiency HVAC units, higher efficiency water heaters, etc.



## OUTDOOR LIGHTING

The general power allowance for outdoor lighting has been lowered to include newer, more efficient luminaires which are widely available and commonly used for outdoor lighting applications.



## ESCALATORS

Requires escalators and moving walkways in transit areas to run at a lower, less energy-consuming speed when not in use.



# California Lighting Technology Center

[cltc.ucdavis.edu/publications](http://cltc.ucdavis.edu/publications)

LIGHTING BEST PRACTICES

WHAT'S NEW IN THE 2016 CODE?  
**NONRESIDENTIAL LIGHTING**

Key Changes to mandatory and prescriptive lighting requirements in California's 2016 Building Energy Efficiency Standards

California's new nonresidential Building Energy Efficiency Standards take effect on January 1, 2017. The 2016 Standards focus on several key areas to improve the energy efficiency of newly constructed buildings, additions and alterations to existing buildings. California's Standards now align with ASHRAE 90.1 2013 standards and include more stringent lighting power density limits for many indoor and outdoor spaces. Updates enhance and simplify many aspects of the 2013 requirements including indoor lighting control requirements for new construction and alterations. This publication offers an overview of important updates contained in the 2016 nonresidential lighting energy efficiency standards.

**MAJOR CHANGES**

- REDUCTION TO LIGHTING POWER DENSITY VALUES**  
Lighting power density allotments have been reduced for many indoor and outdoor spaces including spaces in auditoriums, libraries, and schools. Reductions affect building, area and tailored methods of compliance.
- UPDATED POWER ADJUSTMENT FACTORS**  
The 2016 Standards contain two new power adjustment factors (PAF) that address institutional tuning and daylight harvesting. Three other PAF have been eliminated.
- MULTILEVEL LIGHTING & OCCUPANCY CONTROLS**  
Multilevel lighting control requirements have been simplified. In addition, spaces that utilize certain types of occupancy controls are no longer required to also include multilevel control. Other occupancy control requirements are now to apply in practice.
- ALTERATIONS**  
The line between maintenance and retrofit has been redrawn. More projects are now exempt from alteration requirements. Those that are required to comply now have more options including some with reduced control requirements.

This guide is not intended to be used in lieu of California's Building Energy Efficiency Standards, and it is not a substitute for the code itself. Please visit [energy.ca.gov/Title24/2016standards](http://energy.ca.gov/Title24/2016standards) to download the official 2016 Title 24 Building Energy Efficiency Standards, Errata, Reference Appendices, and the Nonresidential Compliance Manual.

CALIFORNIA LIGHTING TECHNOLOGY CENTER · UNIVERSITY OF CALIFORNIA, DAVIS · CLTC.UCDAVIS.EDU

## ✦ What's New in the 2016 Code?

### ✦ Title 24

- Nonresidential
- Residential

### ✦ Title 20

## ✦ Application Guides

### ✦ Indoor/Outdoor Nonresidential

### ✦ Residential



Let's Talk



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## Our Question To You

1. What do you think the impact of the lighting alteration code alternatives will have on your work flow?
2. *What are your top 3 concerns regarding nonresidential lighting?*
3. What resources will you be using to help prepare for this next code cycle?
4. *If you could wave your magic wand, Title 24 Part 6 code changes would include \_\_\_\_\_ to make your job easier?*

1. Impact to design/construction schedule.
2. Impact to design/construction budget.
3. Facilities maintenance & operational needs.

*I was aware of the new compliance option for existing luminaires to be replaced and think its a well needed option.*

*A short, concise reference guide that I could refer to while designing the project.*

Attending training/informational seminars such as this.  
Networking with lighting industry partners/colleagues



# Challenges

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- ✦ Challenge A:
  - ✦ Indoor Lighting: Prescriptive



- ✦ Challenge B:
  - ✦ Indoor Lighting: Mandatory



- ✦ Challenge C:
  - ✦ Outdoor Lighting: Mandatory & Prescriptive



- ✦ Challenge D:
  - ✦ Acceptance Testing



# Challenge A

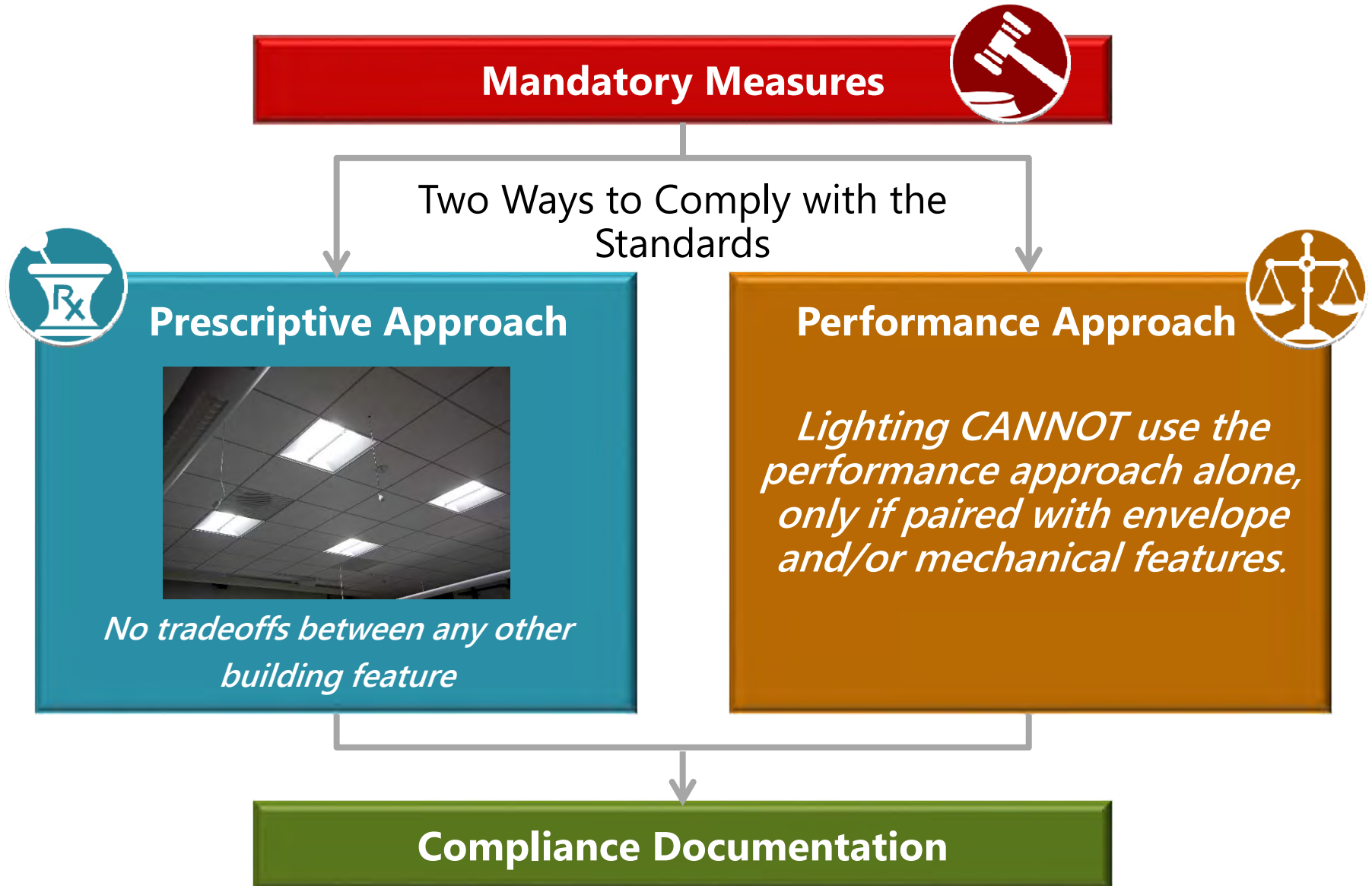
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**Challenge A**

**Indoor Lighting: Prescriptive**



# Defining the Difference





# Complete Building Method



(TABLE 140.6-B ) X (floor area of entire building ) =  
Allowed Lighting Power

TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES

TYPE OF BUILDING	ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)
Auditorium Building	1.4
Classroom Building	1.1
Commercial and Industrial Storage Building	0.60
Convention Center Building	1.0
Financial Institution Building	1.0
General Commercial Building/Industrial Work Building	1.00
Grocery Store Building	1.50
Library Building	1.2
Medical Building/Clinic Building	1.0

Office Building  
Parking Garage Building  
Religious Facility Building  
Restaurant Building  
School Building  
Theater Building  
All others buildings

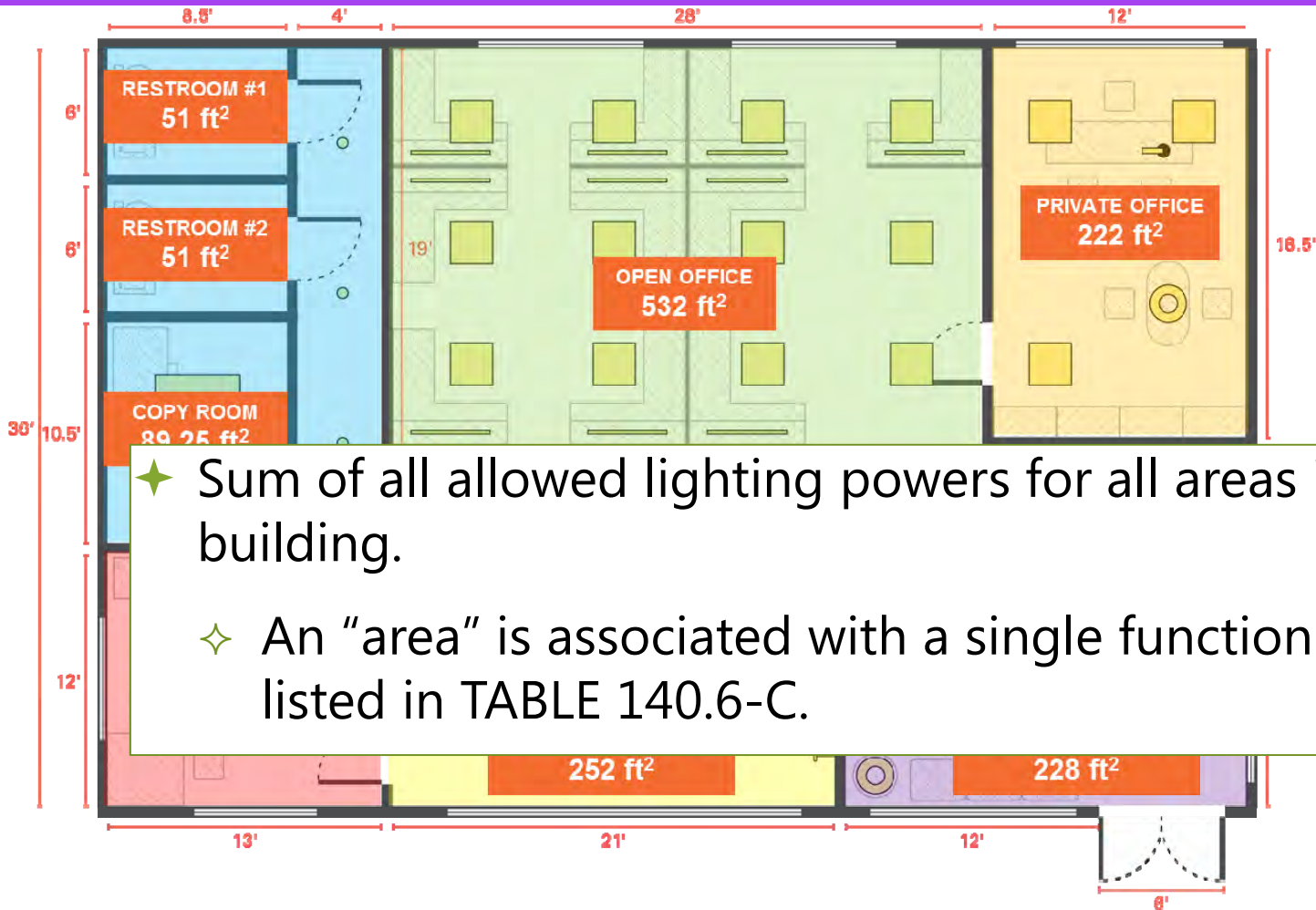
- ★ The Complete Building Method may only be used:
  - ✧ Entire buildings with one primary type of use occupancy;
  - ✧ Mixed use buildings or tenant spaces where 90% of the spaces is of one primary use.



# Area Category Method



(TABLE 140.6-C) X (floor area of area) =  
Allowed Lighting Power Density



2016 TABLE 140.6-C AREA CATEGORY METHOD *Lighting Power Density (LPD) (Watt/Ft<sup>2</sup>) / <85% of LPD for Alteration Control Exceptions*

PRIMARY FUNCTION AREA		2013 100%	2016 100%	PRIMARY FUNCTION AREA		2013 100%	2016 100%
Auditorium Area		1.5 <sup>3</sup>	1.4 <sup>3</sup>	Library Area	Reading areas	1.2 <sup>3</sup>	1.1 <sup>3</sup>
Auto Repair Area			0.9 <sup>2</sup>		Stack areas		1.5 <sup>3</sup>
Beauty Salon Area			1.7	Lobby Area	Hotel lobby	1.1 <sup>3</sup>	0.95 <sup>3</sup>
Civic Meeting Place Area			1.3 <sup>3</sup>		Main entry lobby	1.5 <sup>3</sup>	0.95 <sup>3</sup>
Classroom, Lecture, Training, Vocational Areas			1.2 <sup>5</sup>	Locker/Dressing Room		0.8	0.7
Commercial and Industrial Storage Areas (conditioned and unconditioned)			0.6	Lounge Area		1.1 <sup>3</sup>	0.90 <sup>3</sup>
Commercial and Industrial Storage Areas (refrigerated)			0.7	Malls and Atria		1.2 <sup>3</sup>	0.95 <sup>3</sup>
Convention, Conference, Multipurpose and Meeting Center Areas		1.4 <sup>3</sup>	1.2 <sup>3</sup>	Medical and Clinical Care Area			1.2
Corridor, Restroom, Stair, and Support Areas			0.6	Office Area	> 250 square feet		0.75
Dining Area		1.1 <sup>3</sup>	1.0 <sup>3</sup>		≤ 250 square feet		1.0
Electrical, Mechanical, Telephone Rooms		0.7 <sup>2</sup>	0.55 <sup>2</sup>	Parking Garage Area	Parking Area <sup>10</sup>		0.14
Exercise Center, Gymnasium Areas			1.0		Dedicated Ramps		0.3
Exhibit, Museum Areas		2.0	1.8		Daylight Adaptation Zn <sup>9</sup>		0.6
Financial Transaction Area		1.2 <sup>3</sup>	1.0 <sup>3</sup>	Religious Worship Area			1.5 <sup>3</sup>
General Commercial and Industrial Work Areas	Low bay		0.9 <sup>2</sup>	Retail Merchandise Sales, Wholesale Showroom Areas			1.2 <sup>6 and 7</sup>
	High bay		1.0 <sup>2</sup>				
	Precision		1.2 <sup>4</sup>				
Grocery Sales Area			1.2 <sup>6 and 7</sup>	Theater Area	Motion picture		0.9 <sup>3</sup>
Hotel Function Area		1.5 <sup>3</sup>	1.2 <sup>3</sup>		Performance		1.4 <sup>3</sup>
Kitchen, Food Preparation Areas		1.6	1.2	Transportation Function Area	Concourse & Baggage		0.5
Laboratory Area, Scientific			1.4 <sup>1</sup>		Ticketing	1.2	1.0
Laundry Area		0.9	0.7	Videoconferencing Studio			1.2 <sup>8</sup>
				Waiting Area		1.1 <sup>3</sup>	0.8 <sup>3</sup>
				All other areas		0.6	0.5

Footnote #	Type of lighting system allowed	Maximum allowed added lighting power.
1	Specialized task work	0.2 W/ft <sup>2</sup>
2	Specialized task work	0.5 W/ft <sup>2</sup>
3	Ornamental lighting as defined in Section 100.1 and in accordance with Section 140.6.(c)2.	0.5 W/ft <sup>2</sup>
4	Precision commercial and industrial work	1.0 W/ft <sup>2</sup>
5	Per linear foot of white board or chalk board.	5.5 W per linear foot
6	Accent, display and feature lighting - luminaires shall be adjustable or directional	0.3 W/ft <sup>2</sup>
7	Decorative lighting - primary function shall be decorative and shall be in addition to general illumination	0.2 W/ft <sup>2</sup>
8	Additional Videoconferencing Studio lighting complying with all of the requirements in Section 140.6(c)2Gvii	1.5 W/ft <sup>2</sup>
9	Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage	
10	Additional allowance for ATM locations in Parking Garages (allowance per ATM)	200 watts for the 1 <sup>st</sup> ATM location; 50 watts for each additional ATM locations in a group



# Tailored Method



Allowed lighting power is determined by the occupancy type and the physical characteristics (e.g. ceiling height) of a space.

Table 140.6-D

TABLE 140.6-D TAILORED METHOD LIGHTING POWER ALLOWANCES

1	2	3	
Primary Function Area	General Illumination Level (Lux)	Wall Display Lighting Power Density (W/ft)	Allowed Comb and Task Light
Auditorium Area	300	2.25	
Civic Meeting Place	300	3.15	
Convention, Conference, Multipurpose, and Meeting Center Areas	300	2.50	
Dining Areas	200	1.50	
Exhibit, Museum Areas	150	15.0	
Financial Transaction Area	300	3.15	
Grocery Store Area	500	8.00	
Hotel Function Area	400	2.25	
Lobby Area:			
Hotel lobby			
Main entry lobby			
Lounge Area			
Malls and Atria			
Religious Worship Area			
Retail Merchandise Sales, and S			
Theater Area:			
Motion picture			
Performance	200	6.00	
Transportation Function Area	300	3.15	
Waiting Area	300	3.15	

★ This is the most granular of the three methods.

- ✧ Allowances for each area (just like area category)
- ✧ Allowances for display and task lighting within an area





# Power Adjustment Factors (PAF)



## AKA: Control Credits

### Table 140.6-A

TABLE 140.6-A LIGHTING POWER ADJUSTMENT FACTORS (PAF)

TYPE OF CONTROL	TYPE OF AREA		FACTOR
Daylight 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 ft <sup>2</sup> : One sensor controlling an area that is:	No larger than 125 ft <sup>2</sup>	0.40
		From 126 to 250 ft <sup>2</sup>	0.30
		From 251 to 500 ft <sup>2</sup>	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 less than 10,000 ft <sup>2</sup>		0.05
	Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF		

- ★ Reduction of actual lighting wattage through use of controls:
  - ✧ Type of control
  - ✧ Type of area



# Alterations



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# 2016 Indoor Lighting Alterations



2016 Indoor Luminaire Component Modification: $\geq 70$ per floor/tenant per year changed fixtures: 3 or more fixtures per room				
Alteration: $\geq 10\%$ moved, changed, replaced fixtures: 3 or more fixtures per room				
Mandatory Control	Table 141.0-E		NEW Reduced installed wattage from existing method* §141.0(b)2Jii	Adding to connected load or remodeling
	Reduced LPD (§140.6) $\leq 85\%$ of allowable	Reduced LPD (§140.6) $> 85\%$ of allowable		
Area device (on/off): §130.1(a)1,2,3	Yes <i>Excluding 130.1(a)4: separately controlled lighting systems.</i>	Yes <i>Excluding 130.1(a)4: separately controlled lighting systems.</i>	Yes <i>Excluding 130.1(a)4: separately controlled lighting systems.</i>	Yes
Multi-level control: §130.1(b)	Yes <i>2 level or 130.1(b) Only for modified luminaires</i>	Yes <i>Only for modified luminaires</i>	No	Yes
Auto shut-off control: §130.1(c)	Yes	Yes	Yes: auto shut-off all building types. Partial-OFF required for warehouse and parking garages Partial-OFF excluded at: <i>130.1(c)6B: libraries / 130.1(c)6C: 7A stairs/corridors 130.1(c)8: Hotel/Motel guest rm 30 min. controls N/A</i>	Yes
Daylighting control: §130.1(d)	No	Yes <i>Only for modified luminaires</i>	No	Yes
Demand response: §130.1(e)	No	Yes	No	Yes

\*50% Office, retail and hotel occupancies / \*35% All other occupancies

**Acceptance test technician** required when any number of controls for  $\geq 20$  fixtures being added for project

**2016 TABLE 140.6-C AREA CATEGORY METHOD *Lighting Power Density (LPD) (Watt/Ft<sup>2</sup>) / <85% of LPD for Alteration Control Exceptions***

PRIMARY FUNCTION AREA		2013 100%	2016 100%	2016 85%	PRIMARY FUNCTION AREA	2013 100%	2016 100%	2016 85%		
Auditorium Area		1.5 <sup>3</sup>	1.4 <sup>3</sup>	1.19	Library Area	Reading areas	1.2 <sup>3</sup>	1.1 <sup>3</sup>	0.94	
Auto Repair Area			0.9 <sup>2</sup>	0.77		Stack areas		1.5 <sup>3</sup>	1.28	
Beauty Salon Area			1.7	1.45	Lobby Area	Hotel lobby	1.1 <sup>3</sup>	0.95 <sup>3</sup>	0.81	
Civic Meeting Place Area			1.3 <sup>3</sup>	1.11		Main entry lobby	1.5 <sup>3</sup>	0.95 <sup>3</sup>	0.81	
Classroom, Lecture, Training, Vocational Areas			1.2 <sup>5</sup>	1.02	Locker/Dressing Room		0.8	0.7	0.60	
Commercial and Industrial Storage Areas (conditioned and unconditioned)			0.6	0.51	Lounge Area		1.1 <sup>3</sup>	0.90 <sup>3</sup>	0.77	
Commercial and Industrial Storage Areas (refrigerated)			0.7	0.60	Malls and Atria		1.2 <sup>3</sup>	0.95 <sup>3</sup>	0.81	
Convention, Conference, Multipurpose and Meeting Center Areas		1.4 <sup>3</sup>	1.2 <sup>3</sup>	1.02	Medical and Clinical Care Area			1.2	1.02	
Corridor, Restroom, Stair, and Support Areas			0.6	0.51	Office Area	> 250 square feet		0.75	0.64	
Dining Area		1.1 <sup>3</sup>	1.0 <sup>3</sup>	0.85		≤ 250 square feet			1.0	0.85
Electrical, Mechanical, Telephone Rooms		0.7 <sup>2</sup>	0.55 <sup>2</sup>	0.47	Parking Garage Area	Parking Area <sup>10</sup>		0.14	N/A	
Exercise Center, Gymnasium Areas			1.0	0.85		Dedicated Ramps			0.3	N/A
Exhibit, Museum Areas		2.0	1.8	1.5		Daylight Adaptation Zn <sup>9</sup>			0.6	N/A
Financial Transaction Area		1.2 <sup>3</sup>	1.0 <sup>3</sup>	0.85	Religious Worship Area			1.5 <sup>3</sup>	1.28	
General Commercial and Industrial Work Areas	Low bay		0.9 <sup>2</sup>	0.77	Retail Merchandise Sales, Wholesale Showroom Areas			1.2 <sup>6 and 7</sup>	1.02	
	High bay		1.0 <sup>2</sup>	0.85						
	Precision		1.2 <sup>4</sup>	1.02						
Grocery Sales Area			1.2 <sup>6 and 7</sup>	1.02	Theater Area	Motion picture		0.9 <sup>3</sup>	0.77	
						Performance		1.4 <sup>3</sup>	1.19	
Hotel Function Area		1.5 <sup>3</sup>	1.2 <sup>3</sup>	1.19	Transportation Function Area	Concourse & Baggage		0.5	0.43	
						Ticketing	1.2	1.0	0.85	
Kitchen, Food Preparation Areas		1.6	1.2	1.02	Videoconferencing Studio			1.2 <sup>8</sup>	1.02	
Laboratory Area, Scientific			1.4 <sup>1</sup>	1.19	Waiting Area		1.1 <sup>3</sup>	0.8 <sup>3</sup>	0.68	
Laundry Area		0.9	0.7	0.60	All other areas		0.6	0.5	0.43	

Footnote #	Type of lighting system allowed	Maximum allowed added lighting power.
1	Specialized task work	0.2 W/ft <sup>2</sup>
2	Specialized task work	0.5 W/ft <sup>2</sup>
3	Ornamental lighting as defined in Section 100.1 and in accordance with Section 140.6.(c)2.	0.5 W/ft <sup>2</sup>
4	Precision commercial and industrial work	1.0 W/ft <sup>2</sup>
5	Per linear foot of white board or chalk board.	5.5 W per linear foot
6	Accent, display and feature lighting - luminaires shall be adjustable or directional	0.3 W/ft <sup>2</sup>
7	Decorative lighting - primary function shall be decorative and shall be in addition to general illumination	0.2 W/ft <sup>2</sup>
8	Additional Videoconferencing Studio lighting complying with all of the requirements in Section 140.6(c)2Gvii	1.5 W/ft <sup>2</sup>
9	Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage	
10	Additional allowance for ATM locations in Parking Garages (allowance per ATM)	200 watts for the 1 <sup>st</sup> ATM location; 50 watts for each additional ATM locations in a group



# Forms

▶ **NRCC-LTI**



HELPING YOU PLAY YOUR CARDS RIGHT





## Applying for Permit: **NRCC**

# Certificate of Compliance



- ✦ Provided with plans or equipment schedule; submitted to building department for permit
- ✦ Reviewed by counter tech or plans examiner

*NRCC-LTI-01-E: Overview of Compliance*

*NRCC-LTI-02-E: Control Compliance*

*NRCC-LTI-03-E: Wattage Compliance*

*NRCC-LTI-04-E: Wattage Allowance using Tailored Method*

*NRCC-LTI-05-E: Wattage Method for Track Lighting*

*NRCC-LTI-06-E: Wattage Allowance using Reduced Wattage Method*



# NRCC-LTI-01-E

STATE OF CALIFORNIA  
**INDOOR LIGHTING**

CEC-NRCC-LTI-01-E (Revised 04/16)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE		NRCC-LTI-01-E
Indoor Lighting		(Page 1 of 6)
Project Name: Sample Project	Date Prepared: 9/22/16	

<b>A. General Information</b>			
Climate Zone:	3	Conditioned Floor Area: 1000	
		Unconditioned Floor Area: 0	
Building Type:	<input checked="" type="checkbox"/>	Nonresidential	<input type="checkbox"/> High-Rise Residential
<input type="checkbox"/> Schools	<input type="checkbox"/>	Relocatable Public Schools	<input type="checkbox"/> Conditioned Spaces
Phase of Construction:	<input type="checkbox"/>	New Construction	<input type="checkbox"/> Addition
Method of Compliance:	<input type="checkbox"/>	Complete Building	<input checked="" type="checkbox"/> Area Category
			<input type="checkbox"/> Hotel/Motel
			<input type="checkbox"/> Unconditioned Spaces
			<input checked="" type="checkbox"/> Alteration
			<input type="checkbox"/> Tailored
Project Address:			

<b>B. Lighting Compliance Documents</b> (select yes for each document included)			
<i>For detailed instructions on the use of this and all Energy Efficiency Standards compliance documents, refer to the Nonresidential Manual published by the California Energy Commission.</i>			
YES	NO	COMP. DOC.	TITLE
<input checked="" type="radio"/>	<input type="radio"/>	NRCC-LTI-01-E	Certificate of Compliance. All Pages required on plans for all submittals.
<input checked="" type="radio"/>	<input type="radio"/>	NRCC-LTI-02-E	Lighting Controls, Certificate of Compliance, and PAF Calculation. All Pages required on plans for all submittals.
<input checked="" type="radio"/>	<input type="radio"/>	NRCC-LTI-03-E	Indoor Lighting Power Allowance
<input type="radio"/>	<input type="radio"/>	NRCC-LTI-04-E	Tailored Method Worksheets
<input type="radio"/>	<input type="radio"/>	NRCC-LTI-05-E	Line Voltage Track Lighting Worksheets
<input type="radio"/>	<input type="radio"/>	NRCC-LTI-06-E	Indoor Lighting Existing Conditions



# NRCC-LTI-01-E: Indoor Lighting

STATE OF CALIFORNIA  
**INDOOR LIGHTING**  
 CEC-NRCC-LTI-01-E (R)  
 CERTIFICATE OF COMPLIANCE  
 Indoor Lighting  
 Project Name: Sample

**C. Summary of**

Conditioned and Unconditioned Spaces	
01	
02	
03	
04	
05	Alt 50/35 may

**D. Declaration of**

Declare by selecting	
YES	NO
<input checked="" type="radio"/>	<input type="radio"/>
<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>

CA Building Energy

STATE OF CALIFORNIA  
**INDOOR LIGHTING**  
 CEC-NRCC-LTI-01-E (Revised 08/15)

CALIFORNIA ENERGY COMMISSION 

CERTIFICATE OF COMPLIANCE		NRCC-LTI-01-E
Indoor Lighting		(Page 3 of 6)
Project Name: Nonres Sample	Date Prepared: 3/18/16	

**E. Declaration of Required Certificates of Acceptance**

Declare by checking all of the Certificates of Acceptance that will be submitted. (Retain copies and verify forms are completed and signed.)

YES	NO	Form/Title	
<input checked="" type="radio"/>	<input type="radio"/>	NRCA-LTI-02-A - Must be submitted for occupancy sensors and automatic time switch controls.	<input type="checkbox"/> Field Inspector
<input checked="" type="radio"/>	<input type="radio"/>	NRCA-LTI-03-A - Must be submitted for automatic daylight controls.	<input type="checkbox"/> Field Inspector
<input checked="" type="radio"/>	<input checked="" type="radio"/>	NRCA-LTI-04-A - Must be submitted for demand responsive lighting controls.	<input type="checkbox"/> Field Inspector

A separate Lighting Schedule Must Be Filled Out for Conditioned and Unconditioned Spaces. Installed Lighting Power listed on this Lighting Schedule is only for:

**CONDITIONED SPACE**     **UNCONDITIONED SPACE**

**F. Indoor Lighting Schedule and Field Inspection Energy Checklist**

- The actual indoor lighting power listed on this page and on the next page includes all installed permanent and planned portable lighting systems.
- When Complete Building Method is used for compliance, list each different type of luminaire on separate lines.
- When Area Category Method or Tailored Method is used for compliance, list each different type of luminaire by each different function area on separate lines
- Also include track lighting in schedule, and submit the track lighting compliance form (NRCC-LTI-05-E) when line-voltage track lighting is installed.





# NRCC-LTI-01-E: Indoor Lighting

STATE OF CALIFORNIA  
 INDOOR LIGHTING  
 CEC-NRCC-LTI-01-E (Revised 08/15)  
 CERTIFICATE OF COMPLIANCE  
 Indoor Lighting  
 Project Name: Nonres Sample

STATE OF CALIFORNIA  
**INDOOR LIGHTING**  
 CEC-NRCC-LTI-01-E (Revised 08/15)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE

NRCC-LTI-01-E

Indoor Lighting

(Page 5 of 6)

Project Name: Nonres Sample

Date Prepared: 3/18/16

A separate Lighting Schedule Must Be Filled Out for Conditioned and Unconditioned Spaces. Installed Lighting Power listed on this Lighting Schedule is only for:

**CONDITIONED SPACE**     **UNCONDITIONED SPACE**

G. Ins

## C. INDOOR LIGHTING SCHEDULE and FIELD INSPECTION ENERGY CHECKLIST

Luminaire Schedule		Installed Watts				Location	Field Inspector <sup>1</sup>		
1	2	3	4		5	6	7		
Name or Item Tag	Complete Luminaire Description (i.e, 3 lamp fluorescent troffer, F32T8, one dimmable electronic ballast)	Watts per Luminaire	How wattage was determined		Number Luminaires	Total Installed Watts in this area (C3 x C5)	Primary Function area in which these luminaires are installed	Pass	Fail
			CEC Default from NAS	According to §130.0(c)					
L-1	40 watt LED 2 x 4	40	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10	400	Office	<input type="radio"/>	<input type="radio"/>
			<input type="checkbox"/>	<input type="checkbox"/>		0		<input type="radio"/>	<input type="radio"/>
			<input type="checkbox"/>	<input type="checkbox"/>		0		<input type="radio"/>	<input type="radio"/>
			<input type="checkbox"/>	<input type="checkbox"/>		0		<input type="radio"/>	<input type="radio"/>
			<input type="checkbox"/>	<input type="checkbox"/>		0		<input type="radio"/>	<input type="radio"/>
			<input type="checkbox"/>	<input type="checkbox"/>		0		<input type="radio"/>	<input type="radio"/>
INSTALLED WATTS PAGE TOTAL:						400	Enter sum total of all pages into NRCC-LTI-01-E; Page 2		



CA Build

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance

August 2015



# NRCC-LTI-01-E: Indoor Lighting

STATE OF CALIFORNIA <b>INDOOR LIGHTING</b> CEC-NRCC-LTI-01-E (Revised 08/15)		CALIFORNIA ENERGY COMMISSION 	
CERTIFICATE OF COMPLIANCE		NRCC-LTI-01-E (Page 6 of 6)	
Indoor Lighting		Date Prepared: 3/18/16	
Project Name: Nonres Sample			
<b>DOCUMENTATION AUTHOR'S DECLARATION STATEMENT</b>			
1. I certify that this Certificate of Compliance documentation is accurate and complete.			
Documentation Author Name: Gina		Documentation Author Signature: 	
Company: Gabel		Signature Date:	
Address:		CEA Certification Identification (if applicable):	
City/State/Zip:		Phone:	
<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>			
I certify the following under penalty of perjury, under the laws of the State of California:			
1. The information provided on this Certificate of Compliance is true and correct.			
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).			
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.			
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.			
Responsible Designer Name:		Responsible Designer Signature:	
Company:		Date Signed:	
Address:		License:	
City/State/Zip:		Phone:	



# NRCC-LTI-03-E: Indoor Lighting

STATE OF CALIFORNIA

## INDOOR LIGHTING POWER ALLOWANCE

CEC-NRCC-LTI-03-E (Revised 04/16)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE

NRCC-LTI-03-E

Certificate of Compliance - Indoor Lighting Power Allowance

(Page 1 of 4)

Project Name: Sample Project

Date Prepared: 9/22/16

A separate page must be filled out for Conditioned and Unconditioned Spaces. This page is only for:

CONDITIONED spaces       UNCONDITIONED spaces

### A. SUMMARY TOTALS OF LIGHTING POWER ALLOWANCES

If using Complete Building Method for compliance, use only the total in column (a) as total allowed building watts.

If using Area Category Method, Tailored Method, or a combination of Area Category and Tailored Method for compliance, use only the total in column (b) as the total allowed building watts

	(a)	(b)
01 Complete Building Method Allowed Watts. Documented in section B of NRCC-LTI-03-E (below on this page)	0	
02 Area Category Method Allowed Watts. Documented in section C-1 of NRCC-LTI-03-E (below on this page)		750
03 Tailored Method Allowed Watts. Documented in section A of NRCC-LTI-04-E		
<b>TOTAL ALLOWED BUILDING WATTS. Enter number into correct cell on NRCC-LTI-01, Page 2, Row 1</b>	0	750

Check here if building contains both conditioned and unconditioned areas.

### B. COMPLETE BUILDING METHOD LIGHTING POWER ALLOWANCE

01	02	X	03	=	04
TYPE OF BUILDING (From §140.6 Table 140.6-B)	WATTS PER ft <sup>2</sup>		COMPLETE BLDG. AREA		ALLOWED WATTS
					0
Total Area:					
Total Watts. Enter Total Watts into section A, row 1 (Above on this page)					0

### C -1 AREA CATEGORY METHOD TOTAL LIGHTING POWER ALLOWANCES

	Watts
Total from section C-2.	750
Total from section C-3.	
Total Watts. Enter Total Watts into section A, row 2 (Above on this page).	750

**For Alterations Only** – Reduced lighting power option (Total Allowed Watts x 0.85). Enter this value into section A, row 2 if using this option.



COMMISSION


NRCC-LTI-03-E

(Page 2 of 4)

04
ALLOWED WATTS
750
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
750
WATTS



# NRCC-LTI-06-E: Indoor Lighting

STATE OF CALIFORNIA <b>INDOOR LIGHTING EXISTING CONDITIONS</b> CEC-NRCC-LTI-06-E (Revised 04/16)		 CALIFORNIA ENERGY COMMISSION
CERTIFICATE OF COMPLIANCE		NRCC-LTI-06-E
Indoor Lighting Existing Conditions		Page 1 of 2
Project Name: Sample Building	Date Prepared: 10/1/2016	
A. General Information		

## B. Existing Luminaire Schedule

Alterations in which replacement luminaires have at least 50/35 percent lower power consumption compared to the original luminaires. (Exceptions to 141.0(b)2lii or 141.0(b)2Jii)

Fill out LTI-06, LTI-01, LTI-02, and LTI-05. Use LTI-06 Table B, to record the information of the original, existing luminaires. Use LTI-01 Table H, to record information of the replacement luminaires, and luminaires with component modifications.

Name of the space with the alteration:

Lobby

01 Name or Item Tag	02 Luminaire Description	03 Wattage per Luminaire	04 How Wattage was Determined		05 Quantity of Luminaires	06 Total Wattage (Quantity x Wattage per Luminaire) (03 x 05)	
			CEC default from NAB	According to §130.0 (c)			
L1	2 x 4 3 lamp T8	108	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5	540	
L2	Recessed can 13w CFL	13	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4	52	
<b>Total Installed Watts:</b>						592	
Add Row	Delete Row						

### 141.0(b)2lii or 141.0(b)2Jii:

For alterations using the 50/35 percent power reduction compliance option in Section 141.0(b)2lii or 141.0(b)2Jii, multiply the Total Installed Wattage by a multiplier of 0.50 or 0.65 and enter the adjusted value in the box to the right.

Use 0.50 for office, retail, and hotel occupancies. Use 0.65 for all other occupancies.

Enter this value in Form NRCC-LTI-01-E, Table C, Cell 05 (Allowed Indoor Lighting Power).

348.8 Watts



## Challenge B

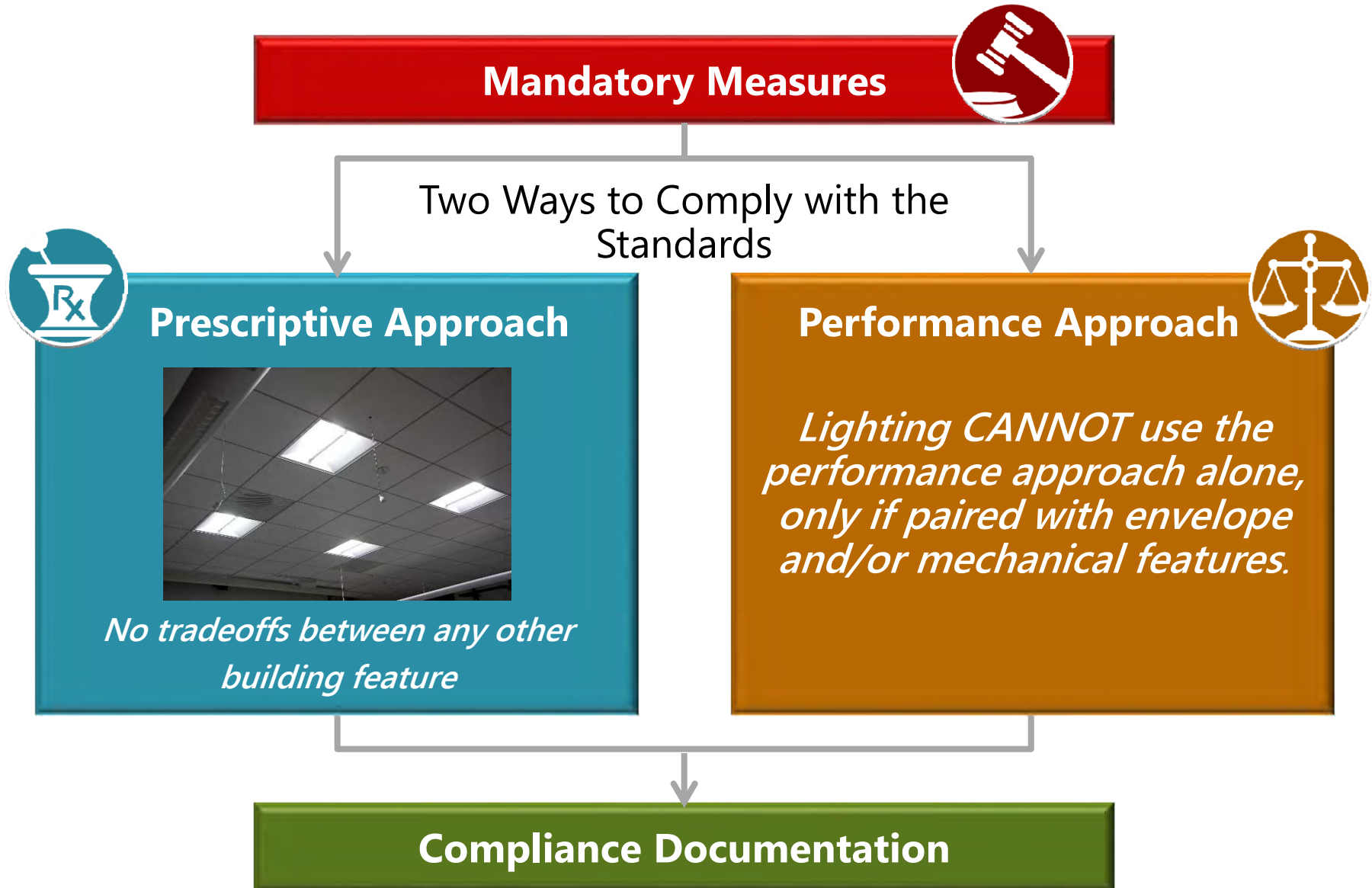
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**Challenge B**

**Indoor Lighting: Mandatory**



# Defining the Difference





# §130.1(a) Area Controls



## When Are They Triggered?

New Construction	Alterations
<ul style="list-style-type: none"><li>✦ On/off control easily accessible in each room</li><li>✦ Separately Control:<ul style="list-style-type: none"><li>✧ Each area of a building</li><li>✧ General lighting from</li><li>✧ Display, ornamental, track and special effects lighting</li></ul></li></ul> <p>EXCEPTIONS:</p> <ul style="list-style-type: none"><li>✦ In certain areas, the control can be annunciated or locked up</li><li>✦ Designed egress lighting up to 0.2 w/ft<sup>2</sup></li></ul>	<ul style="list-style-type: none"><li>✦ Same as New Construction</li></ul> <div data-bbox="1446 704 1728 1159"></div> <p>EXCEPTIONS:</p> <ul style="list-style-type: none"><li>✦ Display, ornamental, track and special effects lighting do NOT need to be controlled separately if not already</li></ul>

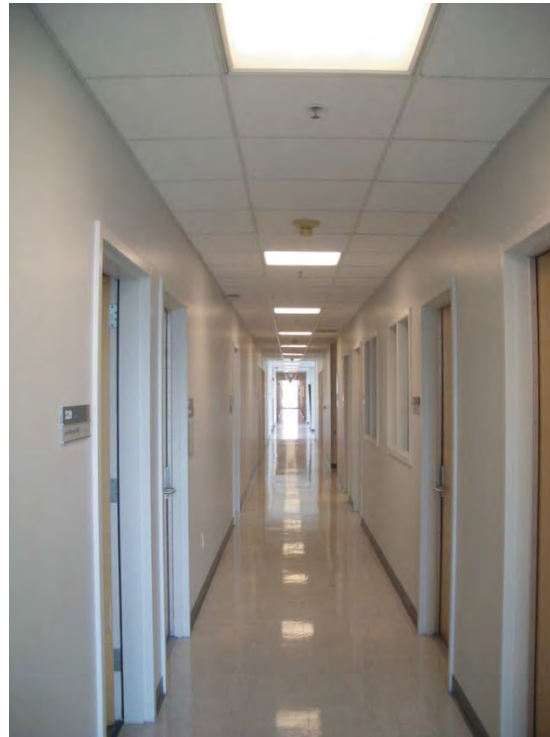


# Mandatory Controls §130.1



## Area Controls 130.1(a)

- ✦ On/off control easily accessible in room.
  - ✦ EXCEPTIONS: need not be accessible to public
    - Public restrooms with more than 2 stalls, parking areas, stairwells and corridors







# §130.1(a) Area Controls



## Annunciated

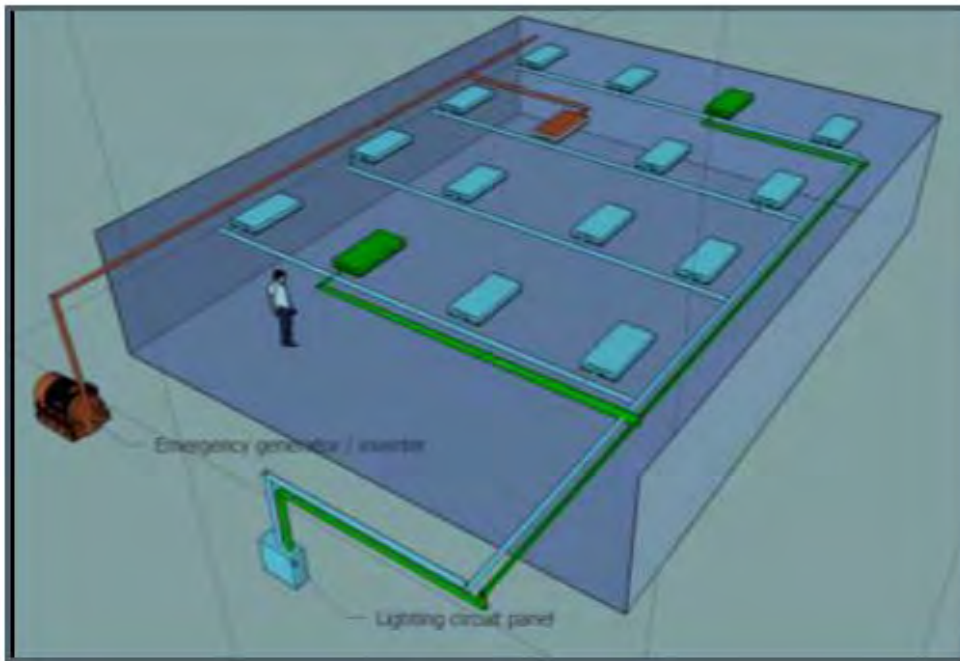
Malls and atria, auditorium areas, retail merchandise sales areas, wholesale showroom areas, commercial and industrial storage areas, general commercial and industrial work areas, convention centers, and arenas



Lighting control shall be located so that a person using the lighting control can see the lights or area controlled .



# §130.1(a) Area Controls



## Emergency Egress

- ✦ Up to  $0.2 \text{ w/ft}^2$  of lighting in any area within a building may be continuously illuminated during *occupied* times
- ✦ Unoccupied times:
  - ✧  $0.1 \text{ w/ft}^2$  lighting OFF
  - ✧  $0.1 \text{ w/ft}^2$  lighting ON

- Red luminaires are emergency
- Green luminaires are egress, they cannot be shut off by occupants, only by the floor-level shut-off controller



# §130.1(b) Multi-level Control



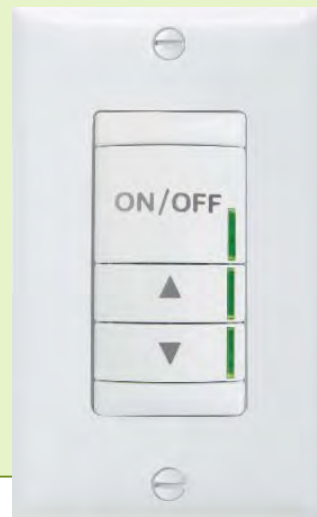
## When Are They Triggered?

### New Construction

- ✦ Areas  $\geq 100 \text{ ft}^2$  with connected lighting load  $> 0.5 \text{ W/ft}^2$ .
- ✦ Areas with one fixture with 2 lamps.



Image: Enlighted



### Alterations

- ✦ Modifying, replacing or moving  $\geq 10\%$  of existing luminaires or replace 3 or more fixtures in a space.
- ✦ Luminaire component modifications: 70 fixtures or more per year.
  - ✦ Reduced Wattage – Not required
  - ✦ Reduced LPD:
    - $\leq 85\%$  2 level allowed
    - $> 85\%$  Required



# §130.1(b) Multi-level Control



## Multi Level Controls 130.1(b)

- ✦ Ability to control lights at multiple levels of light using:
  - ✦ Dimmers or
  - ✦ Auto daylighting or
  - ✦ Demand response

### Source



Image: Cree



### Luminaire



Image: Cree



### Controls



Image: Enlighted



# §130.1(c) Automatic Shut-Off Control

## When Are They Triggered?



New Construction	Alterations
<ul style="list-style-type: none"><li>✦ All indoor lighting must have controls that:<ul style="list-style-type: none"><li>✧ Automatically turn off lighting when unoccupied</li><li>✧ Control each floor of a building separately (not including stairwells)</li></ul></li><li>✦ EXCEPTIONS<ul style="list-style-type: none"><li>✧ Where the lighting is in use 24/7, 365 days a year</li><li>✧ Lighting for egress (0.1 w/ft<sup>2</sup>)</li><li>✧ Electrical equipment rooms</li></ul></li></ul>	<ul style="list-style-type: none"><li>✦ Modifying, replacing or moving <math>\geq 10\%</math> of existing luminaires or replace 3 or more fixtures in a space.</li><li>✦ Luminaire component modifications: 70 fixtures or more per year.<ul style="list-style-type: none"><li>✧ Reduced Wattage – Required</li><li>✧ Reduced LPD:<ul style="list-style-type: none"><li>▪ <math>\leq 85\%</math> Required</li><li>▪ <math>&gt; 85\%</math> Required</li></ul></li></ul></li></ul>



## §130.1(c) Automatic Shut-Off Control

### Turn Off 100% When Vacant



Photo: Lutron

Automatic shut-off controls turn lights off when a space is unoccupied.

1. Room level using occupant sensing control *OR*
2. Building level using automatic time-switch *OR*
  - Building Energy Management System *OR*
  - Control mechanism capable of automatically shutting off all lights for vacant periods.



## §130.1(c) Automatic Shut-Off Control

### Turn Off 100% When Vacant



Offices  $\leq 250$  ft<sup>2</sup>  
Multipurpose room  $\leq 1000$  ft<sup>2</sup>  
Classrooms  
Conference room

- ✦ When multi-level controls required *then* lighting level partially on with: **Partial-ON occupancy or vacancy sensors**
- ✦ When multi-level **not** required *then* lighting level 100% off w/**Occupancy Sensors**



# §130.1(c) Automatic Shut-Off Control



## Partial-OFF *then* Turn Off 100% When Vacant

Stairwells / Corridors

Aisle ways and open areas in warehouses

Library book stack aisles 10 feet or longer

- ★ 50% of the light off when no one there *then* 100% of the light on when someone is there:

**Partial-OFF Occupancy Sensor**



Image credit: Philips

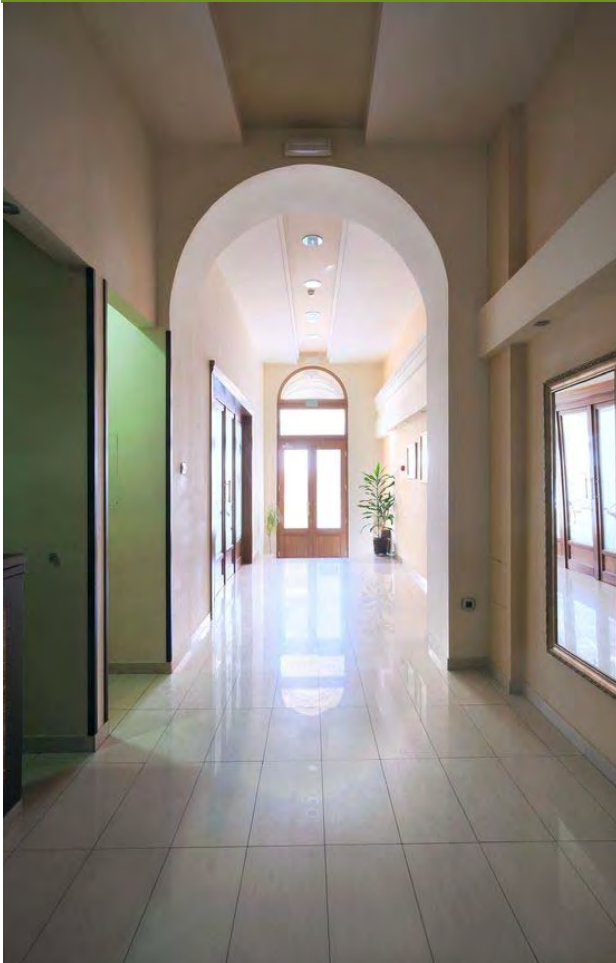




## §130.1(c) Automatic Shut-Off Control



### Partial-OFF 24 Hours/7 Days a Week



Stairwells and common area corridors in high-rise residential buildings and hotel/motels

- ★ 50% of the light off when no one there then 100% of the light on when someone is there: **Partial-OFF Occupancy Sensor**



# §130.1(c) Automatic Shut-Off Control

## Hotel/Motel Guest Rooms



Turn off lights after 30 minutes using captive card key, occupancy controls or automatic controls.

- ✦ EXCEPTION: One high-efficacy luminaire on a switch within 6 feet of the door





# §130.1(d) Automatic Daylighting



## When Are They Triggered?

New Construction	Alterations
<ul style="list-style-type: none"><li>✦ Primary daylighting zone when:<ul style="list-style-type: none"><li>✧ <math>\geq 24</math> ft<sup>2</sup> fenestration and</li><li>✧ <math>\geq 120</math> watts of lighting in <b>all</b> primary zone(s) combined</li></ul></li><li>✦ Parking garage areas with:<ul style="list-style-type: none"><li>✧ <math>\geq 36</math> ft<sup>2</sup> of glazing or openings</li><li>✧ <math>\geq 60</math> watts of general lighting in primary sidelit <b>all</b> zone(s) combined</li></ul></li></ul>	<ul style="list-style-type: none"><li>✦ Modifying, replacing or moving <math>\geq 10\%</math> of existing luminaires or replace <b>3 or more fixtures in a space</b>.</li><li>✦ Luminaire component modifications: <b>70 fixtures</b> or more per year.<ul style="list-style-type: none"><li>✧ Reduced Wattage – Not required</li><li>✧ Reduced LPD:<ul style="list-style-type: none"><li>▪ <math>\leq 85\%</math> Not required</li><li>▪ <math>&gt; 85\%</math> Required</li></ul></li></ul></li></ul>



# Mandatory Controls §130.1



## Auto Daylighting 130.1(d)

✦ Auto daylighting has minor changes on how illuminance levels are measure in parking garages



✦ **Skylit Zone:** An area illuminated by one or more skylights

✦ **Primary Sidelit Zone:** A daylit area directly adjacent to one or more windows





# §130.1(e) Demand Response



## When Are They Triggered?

### New Construction

- ✦ Building/addition >10,000 ft<sup>2</sup>
  - ✧ Not including spaces that are ≤0.5 watts per ft<sup>2</sup>
  - ✧ Including non-habitable spaces



### Alterations

- ✦ Modifying, replacing or moving ≥10% of existing luminaires or replace 3 or more fixtures in a space.
- ✦ Luminaire component modifications: 70 fixtures or more per year.
  - ✧ Reduced Wattage – Not required
  - ✧ Reduced LPD:
    - ≤85% Not required
    - >85% Required

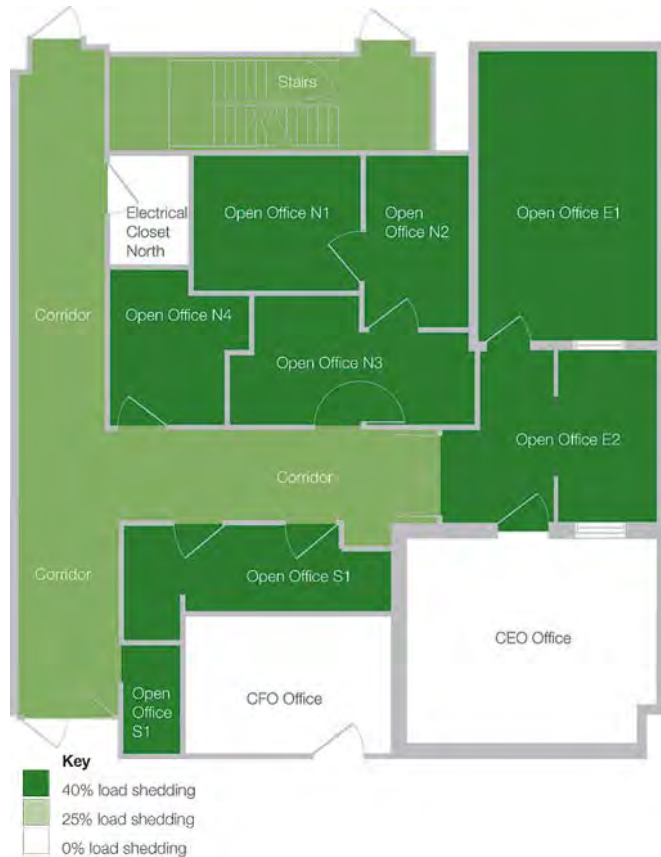


# Mandatory Controls §130.1



## Demand Response 130.1(e)

- ★ Non habitable spaces no longer exempt from the 10,000 ft<sup>2</sup> trigger (spaces less than 0.5 w/sf is still excluded)



Shall be capable of automatically reducing lighting power 15% in response to a Demand Response Signal.

- ★ 130.5(e): Demand responsive controls and equipment shall be capable of receiving and automatically responding to at least one standards-based messaging protocol by enabling demand response after receiving a demand response signal.



# Alterations



HELPING YOU PLAY YOUR CARDS RIGHT



# 2016 Indoor Lighting Alterations



2016 Indoor Luminaire Component Modification: $\geq 70$ per floor/tenant per year changed fixtures: 3 or more fixtures per room				
Alteration: $\geq 10\%$ moved, changed, replaced fixtures: 3 or more fixtures per room				
Mandatory Control	Table 141.0-E		NEW Reduced installed wattage from existing method* §141.0(b)2Jii	Adding to connected load or remodeling
	Reduced LPD (§140.6) $\leq 85\%$ of allowable	Reduced LPD (§140.6) $> 85\%$ of allowable		
Area device (on/off): §130.1(a)1,2,3	Yes <i>Excluding 130.1(a)4: separately controlled lighting systems.</i>	Yes <i>Excluding 130.1(a)4: separately controlled lighting systems.</i>	Yes <i>Excluding 130.1(a)4: separately controlled lighting systems.</i>	Yes
Multi-level control: §130.1(b)	Yes <i>2 level or 130.1(b) Only for modified luminaires</i>	Yes <i>Only for modified luminaires</i>	No	Yes
Auto shut-off control: §130.1(c)	Yes	Yes	Yes: auto shut-off all building types. Partial-OFF required for warehouse and parking garages Partial-OFF excluded at: <i>130.1(c)6B: libraries / 130.1(c)6C: 7A stairs/corridors 130.1(c)8: Hotel/Motel guest rm 30 min. controls N/A</i>	Yes
Daylighting control: §130.1(d)	No	Yes <i>Only for modified luminaires</i>	No	Yes
Demand response: §130.1(e)	No	Yes	No	Yes

\*50% Office, retail and hotel occupancies / \*35% All other occupancies

**Acceptance test technician** required when any number of controls for  $\geq 20$  fixtures being added for project





# Forms

▶ **NRCC-LTI**



HELPING YOU PLAY YOUR CARDS RIGHT





## Applying for Permit: **NRCC**

# Certificate of Compliance



- ✦ Provided with plans or equipment schedule; submitted to building department for permit
- ✦ Reviewed by counter tech or plans examiner

NRCC-LTI-01-E: *Overview of Compliance*

NRCC-LTI-02-E: *Control Compliance*

NRCC-LTI-03-E: *Wattage Compliance*

NRCC-LTI-04-E: *Wattage Allowance using Tailored Method*

NRCC-LTI-05-E: *Wattage Method for Track Lighting*

NRCC-LTI-06-E: *Wattage Allowance using Reduced Wattage Method*



# NRCC-LTI-02-E: Lighting Controls

STATE OF CALIFORNIA

## INDOOR LIGHTING – LIGHTING CONTROLS

CEC-NRCC-LTI-02-E (Revised 01/18)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE

NRCC-LTI-02-E

Indoor Lighting - Lighting Controls

(Page 1 of 3)

Project Name: Sample Project

Date Prepared: 9/22/16

### A. Mandatory Lighting Control Declaration Statements (Indicate if the measure applies by checking yes or no below.)

YES	NO	Control Requirements
<input checked="" type="radio"/>	<input type="radio"/>	Lighting shall be controlled by self-contained lighting control devices which are certified to the Energy Commission according to the Title 20 Appliance Efficiency Regulations in accordance with Section 110.9.
<input checked="" type="radio"/>	<input type="radio"/>	Lighting shall be controlled by a lighting control system or energy management control system in accordance with §110.9. An Installation Certificate shall be submitted in accordance with Section 130.4(b).
<input type="radio"/>	<input checked="" type="radio"/>	One or more Track Lighting Integral Current Limiters shall be installed which have been certified to the Energy Commission in accordance with §110.9 and §130.0. Additionally, an Installation Certificate shall be submitted in accordance with Section 130.4(b).
<input type="radio"/>	<input checked="" type="radio"/>	A Track Lighting Supplementary Overcurrent Protection Panel shall be installed in accordance with Section 110.9 and Section 130.0. Additionally, an Installation Certificate shall be installed in accordance with Section 130.4(b).
<input checked="" type="radio"/>	<input type="radio"/>	All lighting controls and equipment shall comply with the applicable requirements in §110.9 and shall be installed in accordance with the manufacturer's instructions in accordance with Section 130.1.
<input checked="" type="radio"/>	<input type="radio"/>	All luminaires shall be functionally controlled with manual ON and OFF lighting controls in accordance with Section 130.1(a).
<input checked="" type="radio"/>	<input type="radio"/>	General lighting shall be separately controlled from all other lighting systems in an area. Floor and wall display, window display, case display, ornamental, and special effects lighting shall each be separately controlled on circuits that are 20 amps or less. When track lighting is used, general, display, ornamental, and special effects lighting shall each be separately controlled; in accordance with Section 130.1(a)4.
<input checked="" type="radio"/>	<input type="radio"/>	The general lighting of any enclosed area 100 square feet or larger, with a connected lighting load that exceeds 0.5 watts per square foot shall meet the multi-level lighting control requirements in accordance with Section 130.1(b).
<input checked="" type="radio"/>	<input type="radio"/>	All installed indoor lighting shall be equipped with controls that meet the applicable Shut-OFF control requirements in Section 130.1(c).
<input type="radio"/>	<input checked="" type="radio"/>	Lighting in all Daylit Zones shall be controlled in accordance with the requirements in Section 130.1(d) and daylit zones are shown on the plans.
<input type="radio"/>	<input checked="" type="radio"/>	Lighting power in buildings larger than 10,000 square feet shall be capable of being automatically reduced in response to a Demand Responsive Signal in accordance with Section 130.1(e).
<input checked="" type="radio"/>	<input type="radio"/>	Before an occupancy permit is granted for a newly constructed building or area, or a new lighting system serving a building, area, or site is operated for normal use, indoor 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). The controls required to meet the Acceptance Requirements include automatic daylight controls, automatic shut-OFF controls, and demand responsive controls.



# NRCC-LTI-02-E: Lighting Controls

STATE OF CALIFORNIA

## INDOOR LIGHTING – LIGHTING CONTROLS

CEC-NRCC-LTI-02-E (Revised 01/16)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE

NRCC-LTI-02-E

Indoor Lighting - Lighting Controls

(Page 2 of 3)

Project Name: Sample Project

Date Prepared: 9/22/16

A separate document must be filled out for Conditioned and Unconditioned Spaces. This page is used only for the following:

CONDITIONED SPACES       UNCONDITIONED SPACES

### B. Mandatory and Prescriptive Indoor Lighting Control Schedule, PAF Calculation, and Field Inspection Checklist

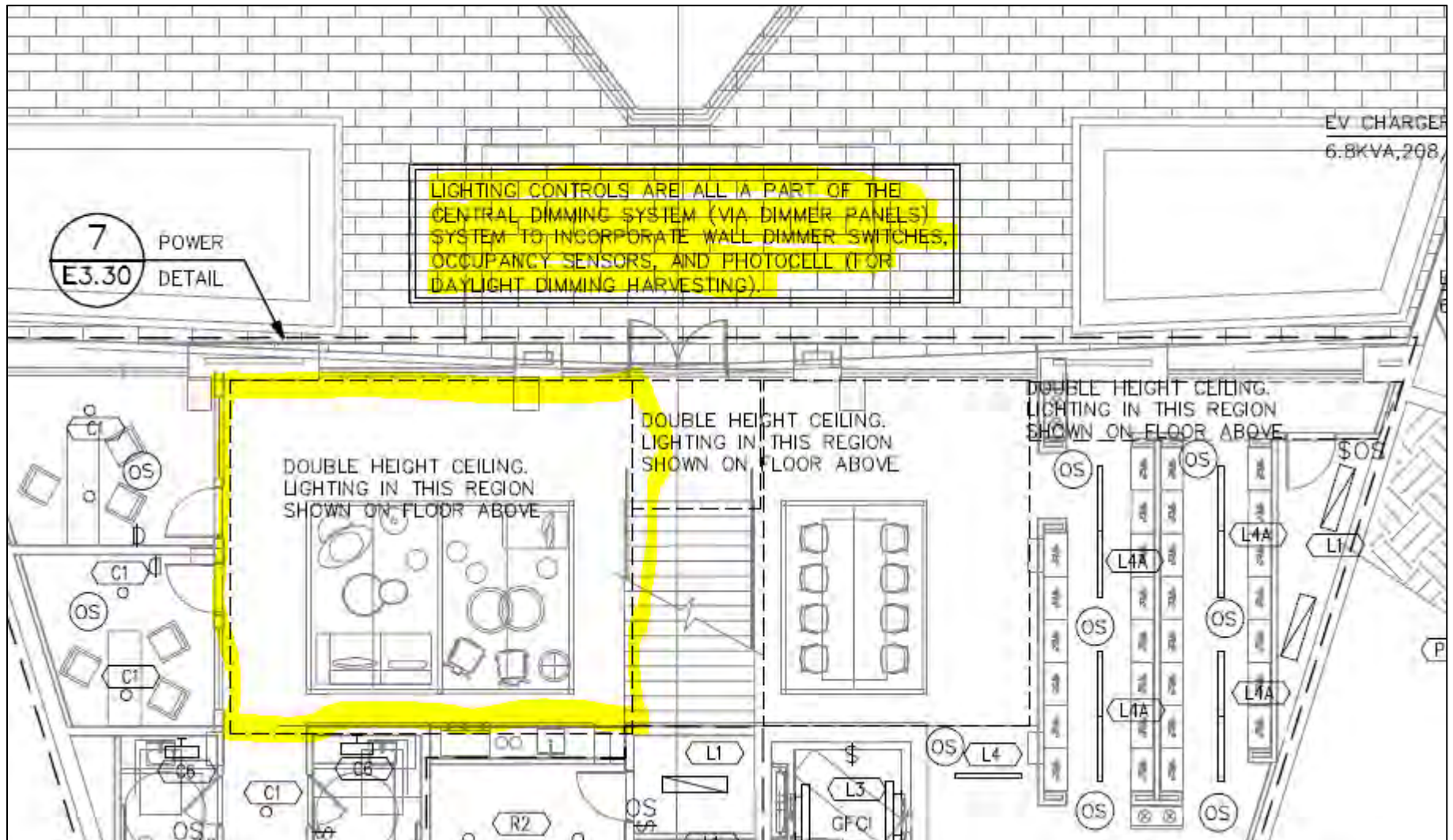
Lighting Control Schedule			Standards Complying With <sup>1</sup> (✓ all that apply, or leave empty if Exempted)							PAF Credit Calculation <sup>2</sup>			✓ if Acceptance Test Required	Field Inspector		
										Watts of Controlled Lighting	PAF	Control Credit (11 x 12)		Pass	Fail	
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	
Location in Building	Type/ Description of Lighting Control (i.e.: occupancy sensor, automatic time switch, dimmer, automatic daylight, etc...)	# of Units	\$130.1(a)	\$130.0(b)	\$130.1(c)	\$130.1(d)	\$130.1(e)	\$140.6(a)2	\$140.6(d)							
Lobby and office	On/off switch	2	♦									0	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	
Lobby and Office	Timeclock	existing			♦							0	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	
Office	Partial on	1			♦							0	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	
												0	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	
												0	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	
												0	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	
												0	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	
Control Credit PAGE TOTAL (Sum of Column 13):													0			
IF MULTIPLE PAGES ARE USED, ENTER SUM TOTAL OF Control Credit for all pages HERE (Sum of all Column 13):																
													Enter Control Credit total into NRCC-LTI-01-E; Page 1.			

1. §130.1(a) = Manual area controls; §130.0(b) = Multi Level; §130.1(c) = Auto Shut-Off; §130.1(d) = Mandatory Daylight; §130.1(e) = Demand Responsive; §140.6(d) = Additional lighting controls installed to earn a PAF; §140.6(d) = Prescriptive Secondary Sidelit Daylight Controls.  
 2. Check Table 140.6-A for correct Factor. PAFs shall not be traded between conditioned and unconditioned spaces. As a condition to earn a PAF, an Installation Certificate is also required to be filled out, signed, and submitted.





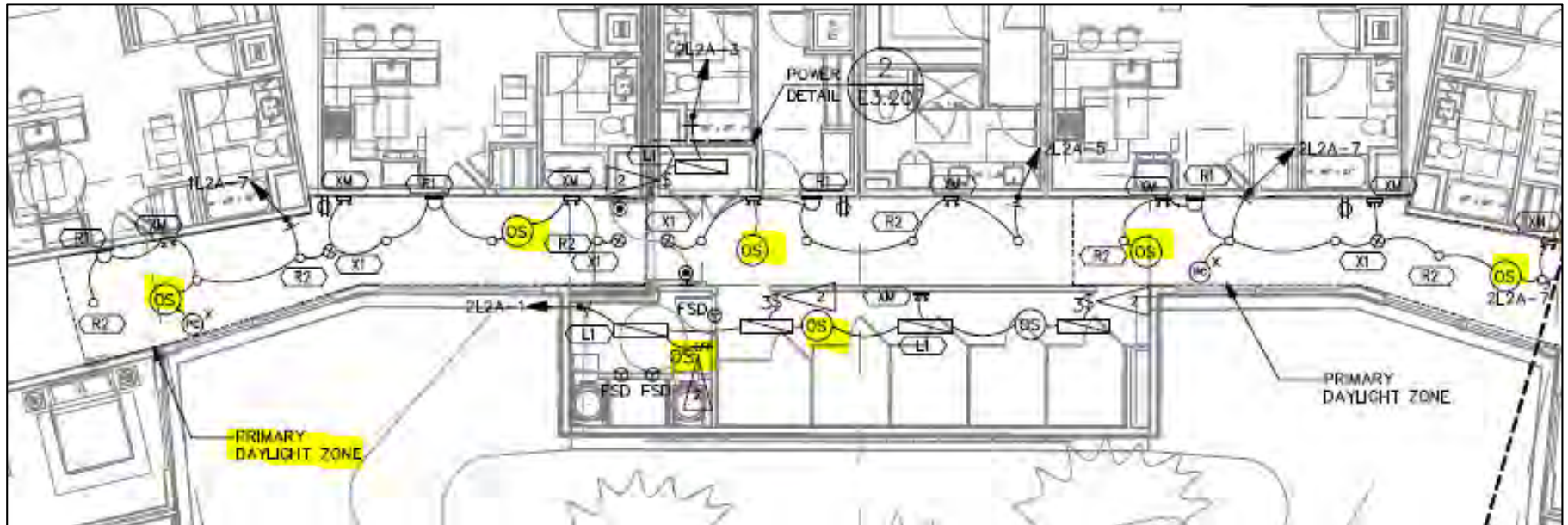
# Plan Set View: Daylighting



Courtesy of Emerald City Engineers



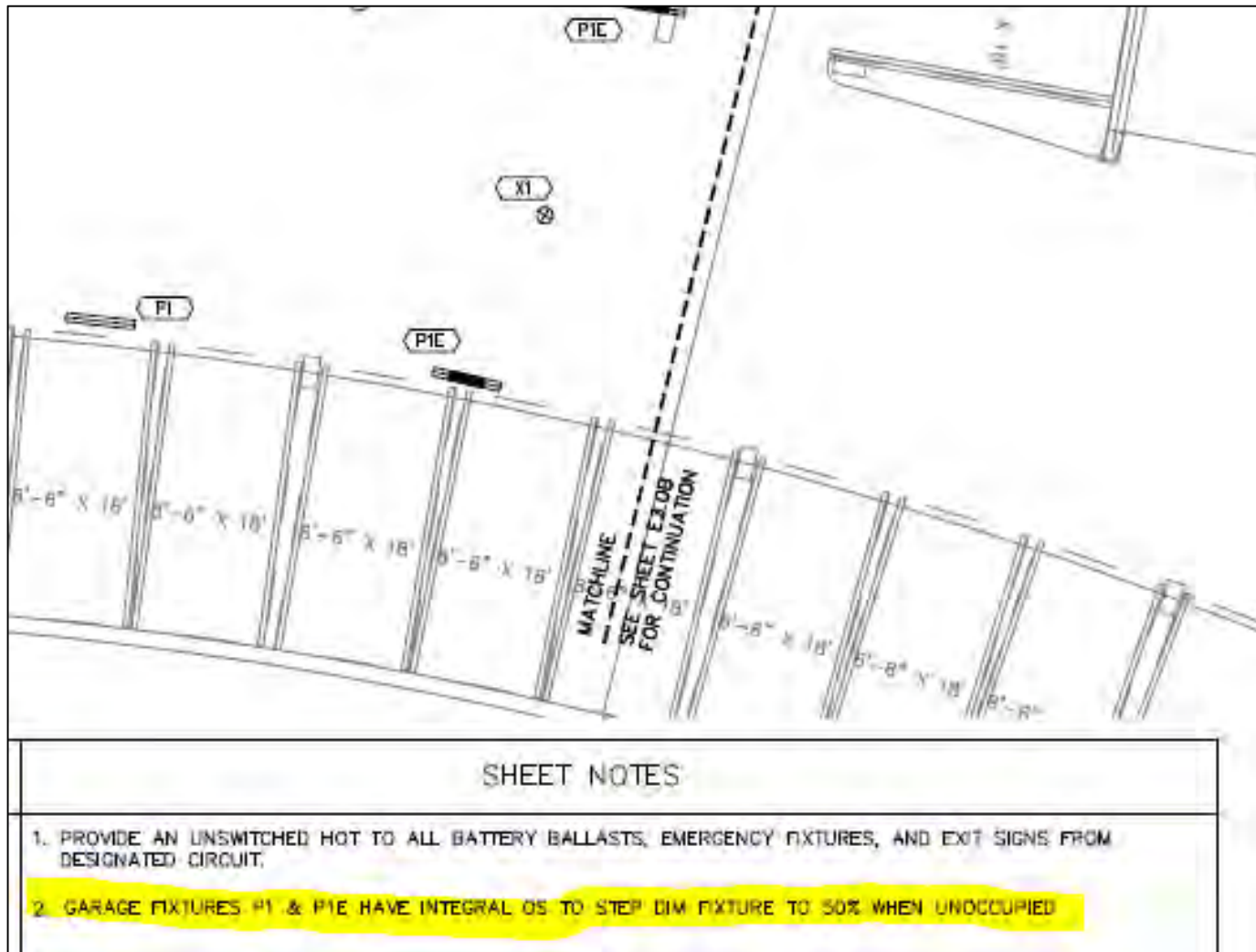
# Plan Set View: Partial-Off @ Corridors



Courtesy of Emerald City Engineers



# Plan Set View: Partial-Off @ Garage



Courtesy of Emerald City Engineers



# Challenge C

---

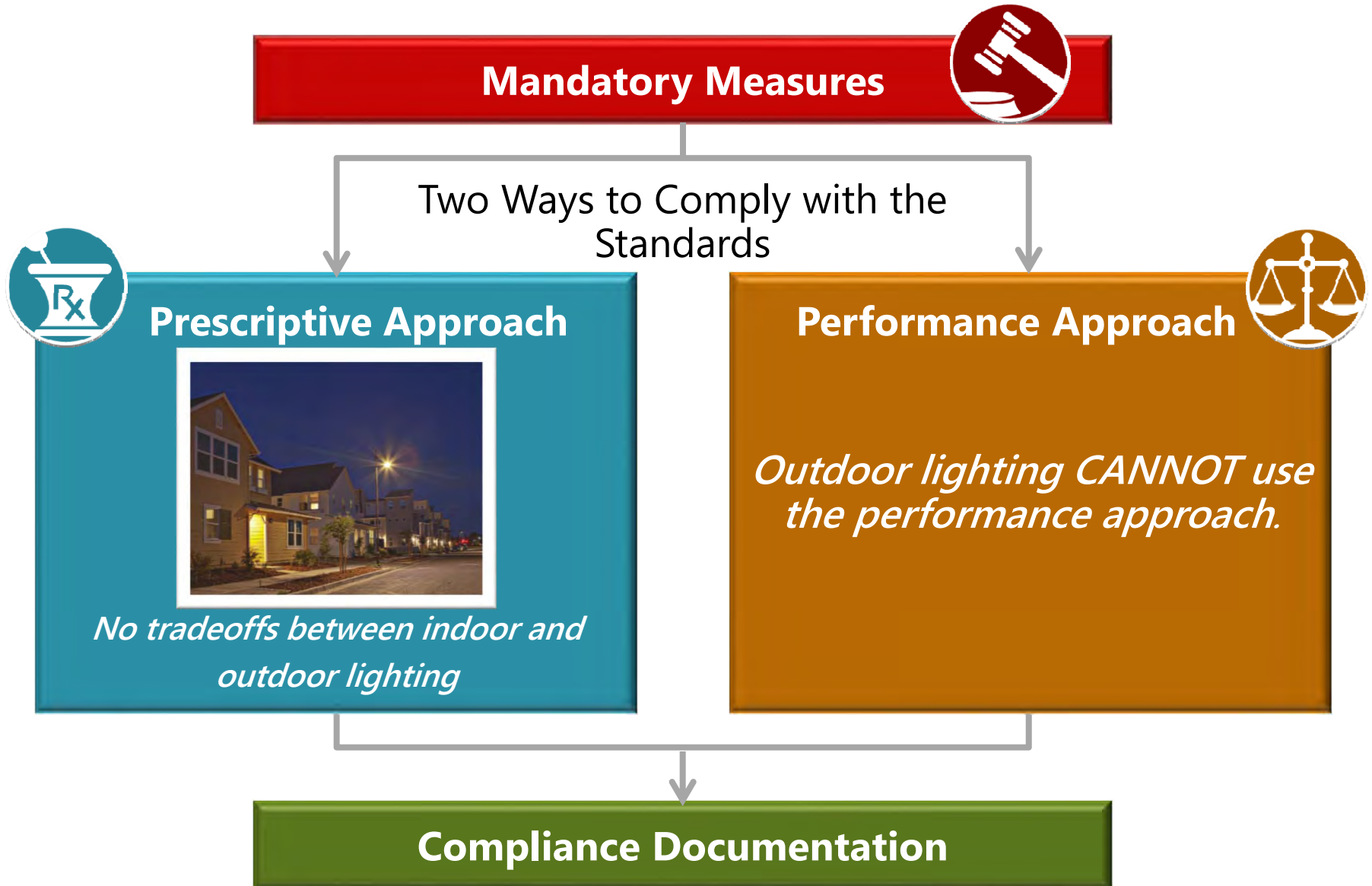
**Challenge C**

**Outdoor Lighting:  
Mandatory & Prescriptive**





# Defining the Difference





# §130.2(a)(b)(c) Control Triggers



## When Are They Triggered?

New Construction	Alterations
<ul style="list-style-type: none"><li>✦ Incandescent &gt;100 watts<ul style="list-style-type: none"><li>✧ Motion Sensor</li></ul></li><li>✦ Lamp &gt;150 watts<ul style="list-style-type: none"><li>✧ BUG</li></ul></li><li>✦ Controls<ul style="list-style-type: none"><li>✧ When not regulated by health or safety to always remain on</li></ul></li></ul>	<ul style="list-style-type: none"><li>✦ 5 fixtures <i>OR</i> <math>\geq 10\%</math> (whichever is greater) of the fixtures changed, moved or replaced<ul style="list-style-type: none"><li>✧ Mandatory controls only</li></ul></li><li>✦ <math>\geq 50\%</math> of the fixtures changed, moved or replaced<ul style="list-style-type: none"><li>✧ Mandatory Controls AND</li><li>✧ <i>Prescriptive requirements</i></li></ul></li><li>✦ Reduced Wattage Method:<ul style="list-style-type: none"><li>✧ Mandatory Controls</li></ul></li></ul>



# Lighting: Outdoor



## ✦ Lighting Zones

- ✦ Zone 0: No lights allowed
  - Dark sky
- ✦ Zone 1: Park land
- ✦ Zone 2: Rural
- ✦ Zone 3: Urban
- ✦ Zone 4: Extremely high levels that is only allowed if approved by CEC. Currently no area is allowed to use Zone 4



# Lighting: Outdoor



## ✦ Illuminated Areas

✦ The **illuminated area**: Hardscape area **10 times the luminaire mounting height**, with the luminaire in the middle of the square.

✦ **Allowed wattage: Table 140.7-A & B:**  
Reduced LPD and wattage allowances

Table 140.7-A General Hardscape Lighting Power Allowance

Type of Power Allowance	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Area Wattage Allowance	No Allowance	0.020 W/ft <sup>2</sup>	0.030 W/ft <sup>2</sup>	0.040 W/ft <sup>2</sup>	0.050 W/ft <sup>2</sup>
2013		0.035 W/ft <sup>2</sup>	0.045 W/ft <sup>2</sup>	0.090 W/ft <sup>2</sup>	0.115 W/ft <sup>2</sup>
Linear Wattage Allowance		0.15 W/lf	0.25 W/lf	0.35 W/lf	0.45 W/lf
2013		0.25 W/lf	0.45 W/lf	0.60 W/lf	0.85 W/lf
Initial Wattage Allowance		340 W	450 W	520 W	640 W
2013		340 W	510 W	770 W	1030 W



# Lighting: Outdoor



## ✦ Controls

- ✦ 130.2(a): Incandescent
  - $>100$  w = motion sensor
- ✦ 130.2(b): Lamps  $>150$  w
  - BUG (see T24 Part 11 also)
- ✦ 130.2(c):
  1. Photocontrol or something that automatically shuts off lighting when daylight
  2. Lighting controlled separately from other electrical loads



# Lighting: Outdoor



## 130.2(c)3: Lighting mounted < 24 ft. above the ground:

- ✧ Motion sensor
  - Automatic step dimming or continuous dimming when areas are vacant (through a range that includes 40-80%)

### **Exceptions:**

***Wall pack  $\leq 30$  watts;***

***Pole  $\leq 75$  watts;***

***Linear  $\leq 4$  watts per linear foot***



**Full**



**Dimmed**



# Lighting: Outdoor



Photo: WattStopper

A **part-night control** is a time or occupancy based lighting control that is programmed to reduce or turn off the lighting power to an outdoor luminaire for a portion of the night.

- ✦ **130.2(c)4:** Sales frontage, lots, and canopies:
  - ✦ Part-night control OR
  - ✦ Motion sensors
  
- ✦ **130.2(c)5:** Building facades, ornamental hardscapes, and outdoor dining:
  - ✦ Part-night control, OR
  - ✦ Motion sensor, OR
  - ✦ Centralized time-based lighting control
  - ✦ **Wall packs:** If within 24 ft of ground:
    - Motion sensor required



# Outdoor Alterations



HELPING YOU PLAY YOUR CARDS RIGHT





# 2016 Outdoor Lighting Alterations

## 2016 Outdoor Lighting

Retrofits: If housing stays intact and lighting technology is changed = repair. Replacing fixture head = alteration.

**Alteration:**  $\geq 10\%$  moved, changed, replaced fixtures: OR 5 or more fixtures per site (which ever is greater)



Requirements	NEW Reducing installed wattage by 40% method	Altering 10-50% fixtures on site	Adding to connected load OR Altering >50% fixtures on site
Meet lighting power allowances: §140.7	No	No	Yes
Incandescent >100 w controlled by motion sensor: §130.2(a)	Yes	Yes <i>For altered fixtures only</i>	Yes
Luminaries >150 w to provide cut-off (BUG): §130.2(b)	Yes	Yes <i>For altered fixtures only</i>	Yes
Photocontrol/astronomical time clock: §130.2(c)1	Yes	Yes <i>For altered fixtures only</i>	Yes
Control separately from other electrical loads: §130.2(c)2	Yes	Yes <i>For altered fixtures only</i>	Yes
Motion Sensor if within 24 ft of ground: §130.2(c)3	Yes	Yes <i>For altered fixtures only</i>	Yes
Part night OR motion sensor for Sales Frontage: §130.2(c)4	Yes	Yes <i>For altered fixtures only</i>	Yes
Part night OR motion sensor OR time-based for façade, ornamental, dining: §130.2(c)5	Yes	Yes <i>For altered fixtures only</i>	Yes

**Acceptance test technician** required when any number of controls for  $\geq 20$  fixtures being added for project



# Forms

▶ **NRCC-LTO**



HELPING YOU PLAY YOUR CARDS RIGHT



## Applying for Permit: **NRCC**

# Certificate of Compliance



- ✦ Provided with plans or equipment schedule; submitted to building department for permit
- ✦ Reviewed by counter tech or plans examiner

NRCC-LTO-01-E: *Overview of Compliance*  
NRCC-LTO-02-E: *Control Compliance*  
NRCC-LTO-03-E: *Wattage Compliance*  
NRCC-LTO-04-E: *Existing Wattage*



# NRCC-LTO-01-E: Overview of Compliance

STATE OF CALIFORNIA  
**OUTDOOR LIGHTING**  
 CEC-NRCC-LTO-01-E (Revised 04/16)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE NRCC-LTO-01-E  
 Outdoor Lighting (Page 1 of 4)

Project Name: Sample Building Date Prepared: 10/1/16

**A. General Information**

Project Address: 1230 Main St.

Phase of Construction:  New Construction  Addition

Outdoor Lighting Zone (LZ)  LZ-1

I have confirmed with the AHJ which LZ applies to this site. For default

STATE OF CALIFORNIA  
**OUTDOOR LIGHTING**  
 CEC-NRCC-LTO-01-E (Revised 04/16)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE NRCC-LTO-01-E  
 Outdoor Lighting (Page 3 of 4)

Project Name: Sample Building Date Prepared: 10/1/16

**I. Outdoor Lighting Schedule and Field Inspection Energy Checklist**

Luminaire Schedule		Installed Watts				Location	Cutoff	Field Inspector		
01	02	03	04		05	06	07	08		
Name or Item Tag	Complete Luminaire Description	Watts per Luminaire	How wattage was determined		Number of Luminaires	Total Installed Watts in this area (03 x 05)	Primary Function area in which these luminaires are installed (Outdoor Lighting Zone)	BUG Rating	Pass	Fail
			CEC Default from NAB	According to §130.0(c)						
OL1	90 W LED Pole Light	90	<input type="checkbox"/>	<input checked="" type="checkbox"/>	5	450	Hardscape	UH:		
								UL:		
								FVH:		
								BVH:	<input type="radio"/>	<input type="radio"/>
								FH:		
								BH:		

and signed.)

NRCA-LTO-02-A - Must be submitted for outdoor lighting controls.

**F. Schedule of Luminaires Exempt from the Outdoor Lighting Power Factor**

01	Name or Symbol	Description of exempt luminaire
N/A		

			<input type="checkbox"/>	<input type="checkbox"/>			0			
INSTALLED WATTS PAGE TOTAL:							450	Enter sum total of all pages (Sum Total INSTALLED Outdoor lighting wattage) into NRCC-LTO-01-E, Page 1		450



# NRCC-LTO-02-E: Controls

STATE OF CA  
**OUTDO**  
 CEC-NRCC-L  
 CERTIFICA  
 Outdoor L  
 Project Name: g

STATE OF CALIFORNIA  
**OUTDOOR LIGHTING CONTROLS**  
 CEC-NRCC-LTO-02-E (Revised 08/16)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE

NRCC-LTO-02-E

Outdoor Lighting Controls

(Page 2 of 3)

Project Name: Sample Building

Date Prepared: 10/1/16

## B. Mandatory Outdoor Lighting Control Schedule and Field Inspection Checklist

Outdoor Lighting Control Schedule			Standards Complying With (✓ all that apply, or leave empty if Exempted)					✓ if Acceptance Test Required	Field Inspector		
01	02	03	04	05	06	07	08	09	10	11	
Location and Application of Luminaires Being Controlled	Type/ Description of Lighting Control (i.e. outdoor motion sensor, outdoor photocontrol, outdoor astronomical time- switch control, automatic scheduling control, part-night outdoor lighting control)	# of Units	§130.2(a)	§130.2(c)1	§130.2(c)2	§130.2(c)3	§130.2(c)4	§130.2(c)5		Pass	Fail
Pole Lights at parking lot	Photocontrol	1		*	*				<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
									<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
									<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
									<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
									<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
									<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>
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CA Building Energy Efficiency Standards - 2016 Nonresidential Compliance

August 2016



# NRCC-LTO-03-E: Wattage Allowances

STATE OF CALIFORNIA  
**OUTDOOR LIGHTING POWER ALLOWANCES**  
CEC-NRCC-LTO-03-E (Revised 01/16)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE

NRCC-LTO-03-E

Outdoor Lighting Power Allowances

(Page 1 of 4)

Project Name: Sample Building

Date Prepared: 10/1/16

## A. OUTDOOR LIGHTING POWER ALLOWANCE SUMMARY

1. General Hardscape Lighting Power Allowance (Site Total from Section B of NRCC-LTO-03-E)				1.	644			
2. Additional Specific "use it or lose it" Lighting Power Allowances listed in each of these cells shall be identical to total allowed watts determined in Section C-1 to C-4 of NRCC-LTO-03-E.								
PER APPLICATION from Section C-1	+	PER UNIT LENGTH (SALES FRONTAGE) from Section C-2	+	PER HARDSCAPE AREA (ORNAMENTAL LIGHTING) from Section C-3	+	PER SPECIFIC AREA from Section C-4.	=	
0		0		0		0		2. 0
3. Sum Total ALLOWED Outdoor Lighting Wattage (add rows 1 and 2)								3. 644

## B. GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE FROM TABLE 140.7-A

Area Wattage Allowance (AWA)				Linear Wattage Allowance (LWA)			Initial Wattage Allowance (IWA)	Total General Hardscape Lighting Allowance
01	02	03	04	05	06	07	08	09
Name of Area	Illuminated Hardscape Area	AWA Per Square Foot	AWA (B02 x B03)	Perimeter Length of General Hardscape	LPA per Linear Foot	LWA (B05 x B06)	IWA (Watts)	B04 + B07 + B08
Parking Lot	1000	0.04	40	240	.35	84	520	644
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
			0				0	
						TOTAL	644	



# NRCC-LTO-04-E: Existing Wattages

STATE OF CALIFORNIA <b>OUTDOOR LIGHTING EXISTING CONDITIONS</b> CEC-NRCC-LTO-04-E (Revised 04/16)		CALIFORNIA ENERGY COMMISSION	
CERTIFICATE OF COMPLIANCE		NRCC-LTO-04-E	
Outdoor Lighting Existing	STATE OF CALIFORNIA <b>OUTDOOR LIGHTING EXISTING CONDITIONS</b> CEC-NRCC-LTO-04-E (Revised 04/16)	CALIFORNIA ENERGY COMMISSION	
Project Name: Sample Building			

## B. Existing Luminaire Schedule

Name of the space with the alteration:						
01	02	03	04		05	06
Name or Item Tag	Luminaire Description	Wattage per Luminaire	How Wattage was Determined		Quantity of Luminaires	Total Wattage (Quantity x Wattage per Luminaire) (Cell 03 x Cell 05)
			CEC default from NA8	According to §130.0(c)		
OL1	250 w HID	260	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6	1,560.00

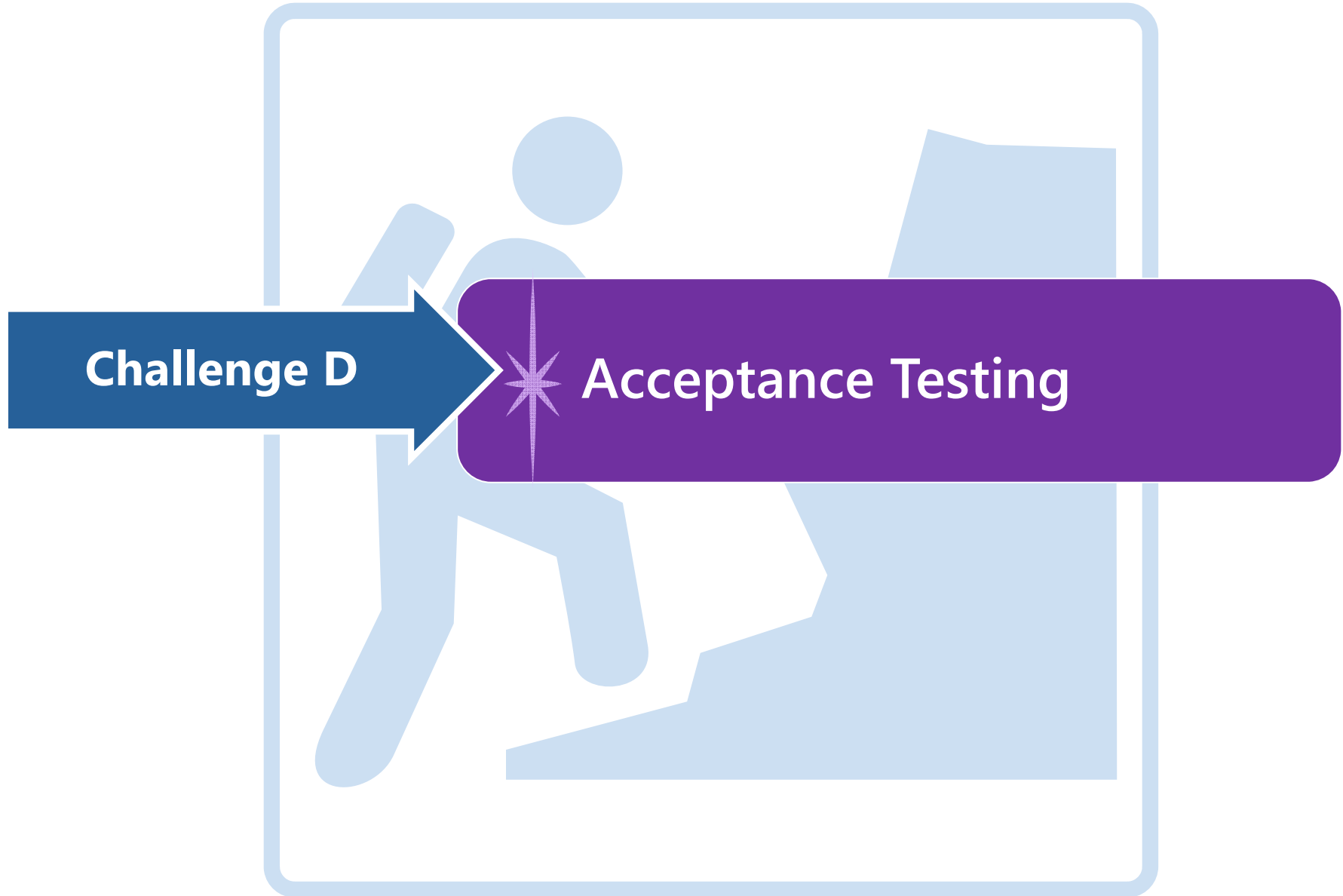
OL1	250 w HID	260	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6	1,560.00
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>		

<b>Total Installed Watts:</b>						1560
<b>Allowed Lighting Power</b>						
If the percentage of existing luminaires being altered (from Box 3, page 1) is less than 50%, then enter the Total Installed Watts in the box to the right.						
If the percentage of existing luminaires being altered is 50% or more, multiply the Total Installed Watts by a multiplier of 0.60 and enter the adjusted value in the box to the right.						
Enter this value in compliance document NRCC-LTO-01-E, Table C, cell 01 (Allowed Outdoor Lighting Wattage). Alternatively, NRCC-LTO-03-E can be used to determine the Allowed Outdoor Lighting Wattage based on the square footage of each hardscape area and the specific application of the lighting.						936 Watts



# Challenge D

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# CLCATT Training



*..both hands-on experience and theoretical training such that Acceptance Test Technicians demonstrate their ability to apply the Building Energy Efficiency Standards acceptance testing and documentation requirements to a comprehensive variety of lighting control systems and networks that are reflective of the range of systems currently encountered in the field.*

§10-103-A

**CALCTP:** [www.calctp.org](http://www.calctp.org)  
**NLCAA:** [www.nlcaa.org](http://www.nlcaa.org)

- ✦ Training includes theoretical and hands-on training
- ✦ Participants have at least 3 years of verifiable professional experience with lighting controls
- ✦ Written and practical exams are required





# Acceptance Test Technician

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## Certified Lighting Controls Acceptance Test Technicians (CLCATT)

- ✦ Acceptance tests expanded
  - ✦ Automatic Daylighting Controls
  - ✦ Indoor Shut-off controls
  - ✦ Demand Response Controls
  - ✦ Outdoor Shut-off Controls
  - ✦ Outdoor Motion Controls

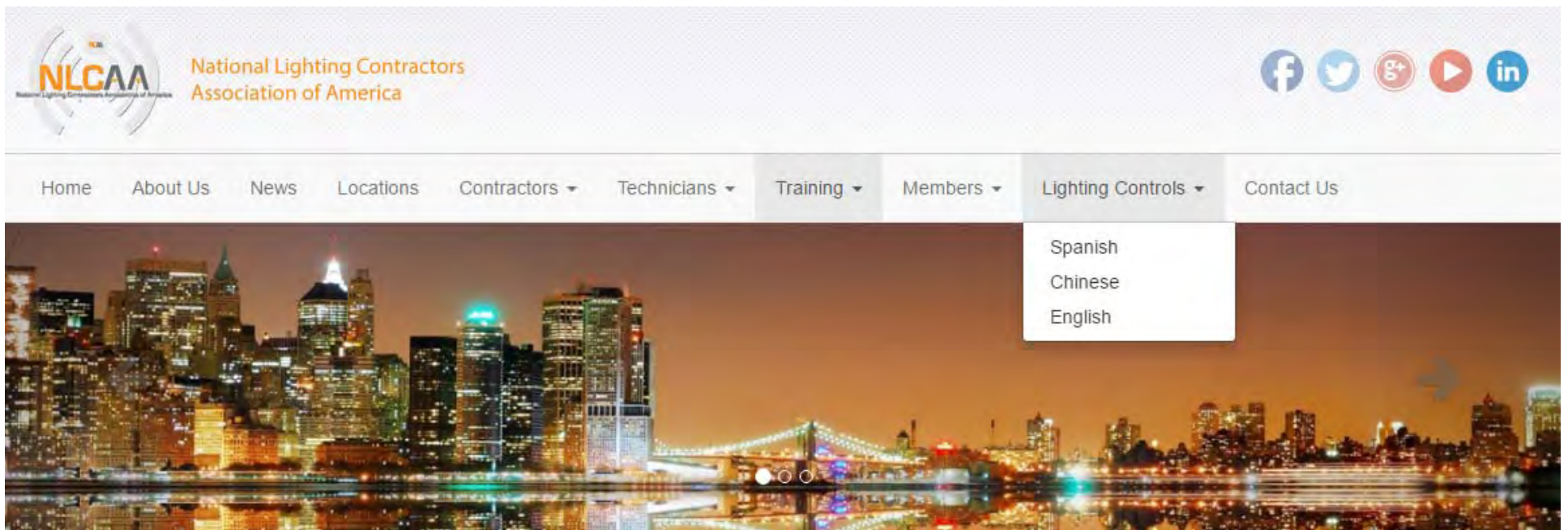


CALCTP

<https://www.calctp.org/acceptance-technicians>



www.NLCAA.org



- ✦ Free online overview of Mandatory Controls in 3 different languages
- ✦ 32 hour online class available (fee required) approved for continuous education units for electrical certification through CORP Training System
  - ✦ <https://www.californiaelectricaltraining.com/courses/32-hours-online-class/general-electricians-2016-part-6-mandatory-lighting-control-code-changes-1>



# CALCTP Updates: Coming Soon!

## ✦ **Installer Updates – Version 6.0**

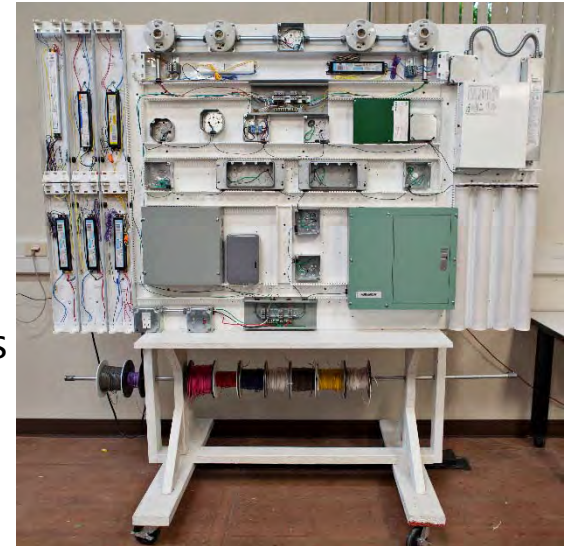
- ✦ Update existing seven modules to ensure content addresses installation of all regulated lighting controls, components and associated procedures included in the 2016 iteration of Title 24.

## ✦ **Acceptance Testing Course for Field Technicians**

- ✦ Develop new curriculum and laboratory exercises (4 hours, minimum) to address lighting control acceptance requirements per Title 24 2013

## ✦ **Building Operator Program**

- ✦ Lighting Design and Anatomy
- ✦ Lighting Control Strategies & Systems
- ✦ Building Codes and Compliance Requirements
- ✦ Understanding your Building and Its Lighting Systems
- ✦ Lighting System Maintenance
- ✦ Troubleshooting





# Alterations



HELPING YOU PLAY YOUR CARDS RIGHT



# Mandatory Controls §130.1



Acceptance testing not required for alteration projects where controls added to control 20 or less luminaires for entire project.



# Forms

- ▶ **NRCI**
- ▶ **NRCA**



HELPING YOU PLAY YOUR CARDS RIGHT





Construction: **NRCI**

## Certificate of Installation



- ✦ Provided by installing contractor or General Contractor during construction and posted on site.
- ✦ Reviewed by Building Inspector.
- ✦ Belong to the Building Owner.





# NRCI-LTI-01-E: Indoor Lighting

STATE OF CALIFORNIA		CALIFORNIA ENERGY COMMISSION		
INDOOR LIGHTING		NRCI-LTI-01-E		
CEC-NRCHLTI-01-E (Revised 01/16)		(Page 1 of 2)		
CERTIFICATE OF INSTALLATION				
Indoor Lighting		Permit Number:		
Project Name:	Enforcement Agency:	City:		
Project Address:	Zip Code:			
<b>GENERAL INFORMATION</b>				
DATE OF BUILDING PERMIT:		PERMIT #:		
BUILDING TYPE	<input type="checkbox"/> Nonresidential	<input type="checkbox"/> High-Rise Res (Common Area)	<input type="checkbox"/> Hotel/Motel (Common Area)	
PHASE OF CONSTRUCTION	<input type="checkbox"/> New Construction	<input type="checkbox"/> Addition	<input type="checkbox"/> Alteration	<input type="checkbox"/> Unconditioned
<b>SCOPE OF RESPONSIBILITY</b>				
Enter the date of approval by enforcement agency of the Certificate of Compliance that provides the specifications for the energy efficiency measures for the scope of responsibility for this Installation Certificate.			Date:	
In the table below identify all applicable construction documents that specify the requirements for the scope of responsibility reported by this Installation Certificate (continued).				
Document Title or Description	Applicable Sheets or Pages, Tables, Schedules, etc.	Date Approved By the Enforcement Agency		
Packing Slips	Controls installed			
Cutsheets	Fixtures installed			



## Building Inspection: **NRCA**

# Certificate of Acceptance



- ✦ Provided by Acceptance Test Technician.
- ✦ Made available BEFORE building inspector arrives for final.
- ✦ Belong to the Building Owner



# NRCA-LTI-01-E: Indoor Lighting Controls

## NLCAA

## CALCTP

STATE OF CALIFORNIA  
PROJECT SUMMARY  
CALIFORNIA ENERGY COMMISSION



(<https://www.calctp.org/>)

Log off

### PROJECT INFORMATION

**Project Name:** Futures In Education\_J#200890  
**Enforcement Agency:** City of Irvine  
**Permit Number:** 00628802-SBPT  
**Project Address:** 2302 Martin Street, Suite 100  
**City:** Irvine  
**Zip Code:** 92612  
**Project Number:** 1503-00020  
**Acceptance Test Employer:** Michael Scalzo - ETT-1501-00010  
**Acceptance Test Technician:** Michael Scalzo - ATT-1501-00009

### FORMS INCLUDED

- NRCA-LTI-02-A
- NRCA-LTI-03-A
- NRCA-LTI-04-A
- NRCA-LTO-02-A

### TESTED AREAS

#	FORM	BUILDING	FLOOR	ROOM
1	Occupancy Sensor Acceptance Test	2302	1	101
2	Automatic Daylight Continuous Dimming Lightmeter	2302	1	101
3	Occupancy Sensor Acceptance Test	2302	1	102
4	Automatic Daylight Continuous Dimming Lightmeter	2302	1	102
5	Occupancy Sensor Acceptance Test	2302	1	103
6	Automatic Daylight Continuous Dimming Lightmeter	2302	1	103
7	Occupancy Sensor Acceptance Test	2302	1	104
8	Automatic Daylight Continuous Dimming Lightmeter	2302	1	104
9	Occupancy Sensor Acceptance Test	2302	1	106
10	Automatic Daylight Continuous Dimming Lightmeter	2302	1	106
11	Occupancy Sensor Acceptance Test	2302	1	107
12	Occupancy Sensor Acceptance Test	2302	1	105
13	Automatic Daylight Continuous Dimming Lightmeter	2302	1	105
14	Occupancy Sensor Acceptance Test	2302	1	108
15	Occupancy Sensor Acceptance Test	2302	1	109
16	Occupancy Sensor Acceptance Test	2302	1	110
17	Occupancy Sensor Acceptance Test	2302	1	111
18	Occupancy Sensor Acceptance Test	2302	1	112
19	Occupancy Sensor Acceptance Test	2302	1	113
20	Occupancy Sensor Acceptance Test	2302	1	114

\*Sample untested areas are attached in different document.

## LIGHTING CONTROL ACCEPTANCE DOCUMENT

Compass Manufacturing Services\_J#199528  
 48133 Warm Springs Blvd., Fremont 94539  
 CITY OF FREMONT  
 BLD2015-02734

### Construction Inspection

#### Automatic Shut-off Controls: Automatic Time Switch Control and Occupant Sensor

Intent: Lights are turned off or set to a lower level when not needed per Section 110.9(a) & 130.1(c).

#### Guidance

This acceptance test form must be filled out for all newly-installed lighting control systems of the following types:

- I. Automatic Time Switch Controls
- II. Occupancy Sensors
- III. Partial-OFF occupancy sensors
- IV. Partial-ON occupancy sensors (only if used to claim a Power Adjustment Factor)
- V. Occupancy Sensors serving small zones in large open plan offices (only if used to claim a Power Adjustment Factor)

For automatic daylighting controls use acceptance test form NRCA-LTI-03-A; for demand responsive lighting controls, use acceptance test form NRCA-LTI-04-A.

The tests on this certificate are required by Section 140.6(a)2 and 130.4(a) of the Building Energy Efficiency Standards 2013. The tests themselves are described in Sections 140.6(a)2 and in Reference Appendix NA7.6.

#### A. Construction Inspection

Fill out Section A to cover spaces 1 through 3 that are functionally tested under Section B.



# NRCA-LTI-02-E: Indoor Lighting Controls

## NLCAA

## CALCTP

Instruments needed to perform tests include, but are not limited to: hand-held amperage meter, power meter, or light meter

### 1: Automatic Time Switch Controls Construction Inspection—confirm for all listed in Section B

a. All automatic time switch controls are programmed for (check all):

- Weekdays  Weekend  Holidays

b. Document for the owner automatic time switch programming (check all):

- Weekday settings  Weekend settings  Holidays settings  Set-up settings
- Preference program setting
- Verify the correct time and date is properly set in the time switch
- Verify the battery is installed and energized  Override time limit is no more than 2 hours
- Occupant Sensors and Automatic Time Switch Controls have been certified to the Energy Commission in accordance with the applicable provision in Section 110.9 of the Standards, and model numbers for all such controls are listed on the Commission database as Certified Appliance and Control Devices

### 2. Occupancy Sensor Construction Inspection—confirm for all listed in Section B

- Occupancy sensors are not located within four feet of any HVAC diffuser
- Ultrasonic occupancy sensors do not emit audible sound 5 feet from source

### B. Representative Spaces Selected

For every space in the building, conduct functional tests I through V below if applicable. If there are several geometrically similar spaces that use the same lighting controls, test only one space and list in the cells below which "untested spaces" are represented by that tested space. EXCEPTION: For buildings with up to seven (7) occupancy sensors, all occupancy sensors shall be tested. (NA7.6.2.3)

#### Functional Test

Tested/space/room name: Office 19

STATE OF CALIFORNIA  
LIGHTING CONTROL ACCEPTANCE DOCUMENT  
CEC-NRCA-LTI-02-A (REVISED 06/14)  
CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF ACCEPTANCE - NRCA-LTI-02-A		
Occupancy Sensor Acceptance Test		
Project Name: Futures In Education_J#200890	Enforcement Agency: City of Irvine	Permit Number: 00626602-SBPT
Project Address: 2302 Martin Street, Suite 100	City: Irvine	Zip Code: 92612
Building: 2302	Floor: 1	Room: 101

Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance. Enforcement Agency Use: Checked by/Date:

<b>A.- Construction Inspection</b>	
Occupancy Sensor Construction Inspection — confirm for all listed in Section B	
<input checked="" type="checkbox"/>	Occupancy sensors are not located within four feet of any HVAC diffuser
<input checked="" type="checkbox"/>	Ultrasonic occupancy sensors do not emit audible sound 5 feet from source
<input checked="" type="checkbox"/>	Occupant Sensors and Automatic Time Switch Controls have been certified to the Energy Commission in accordance with the applicable provision in Section 110.9 of the Standards, and model numbers for all such controls are listed on the Commission database as Certified Appliance and Control Devices

**B.- Functional Testing of Lighting Controls**  
For every space in the building, conduct functional tests I through V below if applicable. If there are several geometrically similar spaces that use the same lighting controls, test only one space and provide an attached page listing "untested areas" which are represented by the tested space.

EXCEPTION: For buildings with up to seven (7) occupancy sensors, all occupancy sensors shall be tested. (NA7.6.2.3)

**Functional Test**  
Confirm compliance (Y/N) for all control System types (I-V) present in each space:

<b>2.- Occupancy Sensors</b>		
Step 1: Simulate an unoccupied condition		
a	Lights controlled by occupancy sensors turn off within maximum of 30 minutes from start of an unoccupied condition per Standard Section 110.9 (b)	Yes
b	The occupant sensor does not trigger a false "on" from movement in an area adjacent to the controlled space or from HVAC operation	Yes
Step 2: Simulate an occupied condition		
a	Status indicator or annunciator operates correctly	Yes
b	Lights controlled by occupancy sensors turn on immediately upon an occupied condition OR sensor indicates space is "occupied" and lights may be turned on manually	Yes
Step 3: System returned to initial operating conditions		Yes

<b>C.- Testing Results</b>	PASS / FAIL
II Occupancy Sensor (On Off Control) (all answers must be Y).	Pass

<b>D.- Evaluation</b>	
Pass	PASS: All applicable Construction Inspection responses are complete and all applicable Equipment Testing Requirements responses are positive (Y - yes)



# Next Steps



HELPING YOU PLAY YOUR CARDS RIGHT



A new website developed by the Statewide Codes & Standards Program to help you meet the requirements of Title 24, Part 6

We offer **FREE**



A variety of tools to help you identify the forms, installation techniques, and building energy standards relevant to building projects in California



Classroom and online trainings on Title 24, Part 6.



Fact Sheets, Trigger Sheets, Checklists, and FAQs to help you understand when Title 24, Part 6 is “triggered” and how to correctly comply when it is



visit us at  
[www.EnergyCodeAce.com](http://www.EnergyCodeAce.com)



**MECHANICAL: Mandatory Requirements**

Color background indicates code language:  no change  revised  NEW for 2016

Measure	T-24 Section	Notes
<b>Systems &amp; Equipment</b> <i>§110.0 has added new language regarding conformance to Title 20</i>	110.0(b)	Altered language regarding certification of manufactured systems, equipment, appliances and building components needing to meet Title 20 requirements (appliances), or certification requirements per Title 24, Part 6 (not considered an appliance) and that it is the responsibility of the manufacturer.
<b>Heating Equipment Efficiency</b>	110.2(a)	Table 110.2-B: Heating mode water and groundwater source heat pumps COP minimum values (1/1/2017). Table 110.2-E: SPVHP and PTHP COP minimum values (1/1/2017). Table 110.2-J: Oil-fired unit heater minimum efficiency increased to 81% E <sub>c</sub> (1/1/2017). Table 110.2-K: Boiler minimum efficiencies to change 3/2/2020.
<b>Cooling Equipment Efficiency</b>	110.2(a)	Table 110.2-A: Air conditioners: air cooled and water cooled IEER minimum values (1/1/2016). Table 110.2-B: Air and water cooled heat pumps IEER and EER minimum values (1/1/2016). Table 110.2-D: Air and water cooled chillers Path A and B minimum efficiencies (1/1/2017). Table 110.2-E: Cooling mode PTAC, PTHP and SPVAC EER minimum values (1/1/2017). Table 110.2-G: Evaporative cooling towers added.
<b>Space Conditioning Equipment</b>	110.2(b-f)	No Change
<b>Service Water Heating Systems &amp; Equipment</b>	110.3(a)(b)	No Change. NOTE: Temperature control listed in ASHRAE Handbook HVAC Applications Guide volume 2011 is Table 3 (as is stated within Standards); in volume 2015 it can be found in Chapter 50, Table 19.
<b>Installation</b>	110.3(c)7	Isolation valves. Instantaneous water heaters with an input rating greater than 6.8 kBtu/hr (2 kW) shall have isolation valves on both the cold water supply and the hot water pipe leaving the water heater, and hose bibbs or other fittings on each valve for flushing the water heater when the valves are closed.
<b>Pool &amp; Spas</b>	110.4(a)(b)	No Change
<b>Pilot Lights</b>	110.5(a-d)	No Change
<b>Ventilation</b>	120.1(a-e)	No Change





# RESOURCES

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- ✦ California Energy Commission: Building Energy Efficiency Standards
  - ✧ <http://www.energy.ca.gov/title24/>
- ✦ Southern California Edison
  - ✧ <http://www.sce.com/b-sb/energy-centers/energy-centers.htm>
- ✦ San Diego Gas and Electric
  - ✧ <http://www.sdge.com/business/learn-and-save>
- ✦ Pacific Gas and Electric Company
  - ✧ <http://www.pge.com/mybusiness/edusafety/training/>
- ✦ IES – Illuminating Engineering Society
  - ✧ <http://www.ies.org/>







# CLTC Resources: Available now!

## What's New in 2016 Code?

LIGHTING BEST PRACTICES

**WHAT'S NEW IN THE 2016 CODE?**  
**NONRESIDENTIAL LIGHTING**  
Key Changes to mandatory and prescriptive lighting requirements in California's 2016 Building Energy Efficiency Standards

California's new nonresidential Building Energy Efficiency Standards take effect on January 1, 2017. The 2016 Standards focus on several key areas to improve the energy efficiency of newly constructed buildings, additions and alterations to existing buildings. California's Standards now align with ASHRAE 90.1 2013 standards and include more stringent lighting power density limits for many indoor and outdoor spaces. Updates enhance and simplify many aspects of the 2013 requirements including indoor lighting control requirements for new construction and alterations. This publication offers an overview of important updates contained in the 2016 nonresidential lighting energy efficiency standards.

### MAJOR CHANGES

- REDUCTION TO LIGHTING POWER DENSITY VALUES**  
Lighting power density allocations have been reduced for many indoor and outdoor spaces including spaces in auditoriums, libraries, and schools. Reductions affect building, area and task-level methods of compliance.
- UPDATED POWER ADJUSTMENT FACTORS**  
The 2016 Standards contain two new power adjustment factors (PAF) that address institutional tuning and daylight harvesting. Three other PAF have been eliminated.
- MULTILEVEL LIGHTING & OCCUPANCY CONTROLS**  
Multilevel lighting control requirements have been simplified. In addition, spaces that utilize certain types of occupancy controls are no longer required to also include multilevel control. Other occupancy control requirements are now to apply in practice.
- ALTERATIONS**  
The line between maintenance and retrofit has been redrawn. More projects are now exempt from alteration requirements. Those that are required to comply now have more options, including some with reduced control requirements.

This guide is not intended to be used in lieu of California's Building Energy Efficiency Standards, and it is not a substitute for the code itself. Please visit [www.energy.ca.gov/standards](http://www.energy.ca.gov/standards) to download the official 2016 Title 24 Building Energy Efficiency Standards, Energy Reference Appendices, and the Nonresidential Compliance Manual.

CALIFORNIA LIGHTING TECHNOLOGY CENTER - UNIVERSITY OF CALIFORNIA, DAVIS - CLTC.UCDAVIS.EDU

LIGHTING BEST PRACTICES

**WHAT'S NEW IN THE 2016 CODE?**  
**RESIDENTIAL LIGHTING**  
Changes to mandatory lighting requirements in California's 2016 Building Energy Efficiency Standards

California's new residential Building Energy Efficiency Standards take effect on January 1, 2017. The 2016 Standards focus on several key areas to improve the energy efficiency of newly constructed buildings, additions and alterations to existing buildings. The most significant efficiency improvements address attic, walls, water, heating and lighting. The California Energy Commission estimates that the 2016 standards will deliver approximately 281 gigawatt-hours of electricity savings annually and reduce statewide greenhouse gas emissions by 160,000 metric tons. This is enough electricity to power 900,000 California homes each year. These standards represent a major step towards meeting California's residential Zero Net Energy (ZNE) goal by the year 2020. Updates enhance and simplify previous requirements and lay the foundation for additional efficiency improvements slated for 2019 code. This publication offers an overview of important requirements and major updates to the 2016 residential lighting energy efficiency code.

### MAJOR CHANGES

- ALL HIGH EFFICACY LIGHTING**  
Indoor and outdoor lighting for new homes must be high efficacy.
- JAB UPDATED**  
Joint Appendix JAB regulations now contain requirements for more types of residential high efficacy lamps and luminaires. In the 2013 Standards, JAB regulations only applied to LED sources.
- SIMPLIFIED CONTROL REQUIREMENTS**  
Lighting control requirements for indoor spaces are now simpler. Control requirements are based, in nearly all cases, on the type of lamp or luminaire installed, not the space.

This guide is not intended to be used in lieu of California's Building Energy Efficiency Standards, and it is not a substitute for the code itself. Please visit [www.energy.ca.gov/standards](http://www.energy.ca.gov/standards) to download the official 2016 Title 24 Building Energy Efficiency Standards, Energy Reference Appendices, and the Nonresidential Compliance Manual.

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LIGHTING BEST PRACTICES

**WHAT'S NEW IN THE TITLE 20 CODE?**  
**LIGHTING APPLIANCE EFFICIENCY REGULATIONS**  
Changes to California's lighting appliance requirements

The California Energy Commission adopted new standards updating the 2015 Appliance Efficiency Regulations (Title 20) for lighting appliances. Updates will take effect in two tiers with Tier 1 effective January 1, 2018 and Tier 2 effective July 1, 2019. Notably, this update adds standards for small-diameter directional lamps. The updated regulations incorporate elements of lighting product quality for both general service LED lamps and small-diameter directional lamps in addition to the traditional lighting appliance efficiency standards previously included in the regulations. The addition of these new standards will require revisions in the California Appliance Efficiency Database product certification process, as well as updates to product labeling requirements for lamp marking, marketing material, and product packaging.

### MAJOR CHANGES

- UPDATES TO LAMP REGULATIONS AND CATEGORIES**  
**General service LED lamps** are now regulated as a separate category from other light sources in the general service lamp category. New requirements include specific performance metrics and corresponding test methods to quantify product performance in an industry recognized manner.  
**Small diameter directional lamps** with a diameter of 2.25 inches or less that are equipped with ANSI compliant base-types of the E26 base type are now regulated. New requirements apply to both low- and line-voltage lamps.  
**Portable luminaires** that are equipped with a socket requiring a general service lamp must be packaged with a compact fluorescent lamp or LED lamp that adheres to the updated lamp requirements.
- CALIFORNIA APPLIANCE EFFICIENCY DATABASE**  
The appliance database filing structure that manufacturers use to submit products for listing with the California Energy Commission will include new product categories and performance metrics starting January 1, 2019.
- PRODUCT LABELING**  
Manufacturers must test and verify their products with the updated regulations before including claims of dimmability, incandescent lamp equivalence, wattage equivalence, decorative lamp burner output, or compliance with the Voluntary California Quality LED Lamp Specification in their lamp marking, marketing material, and package labeling.

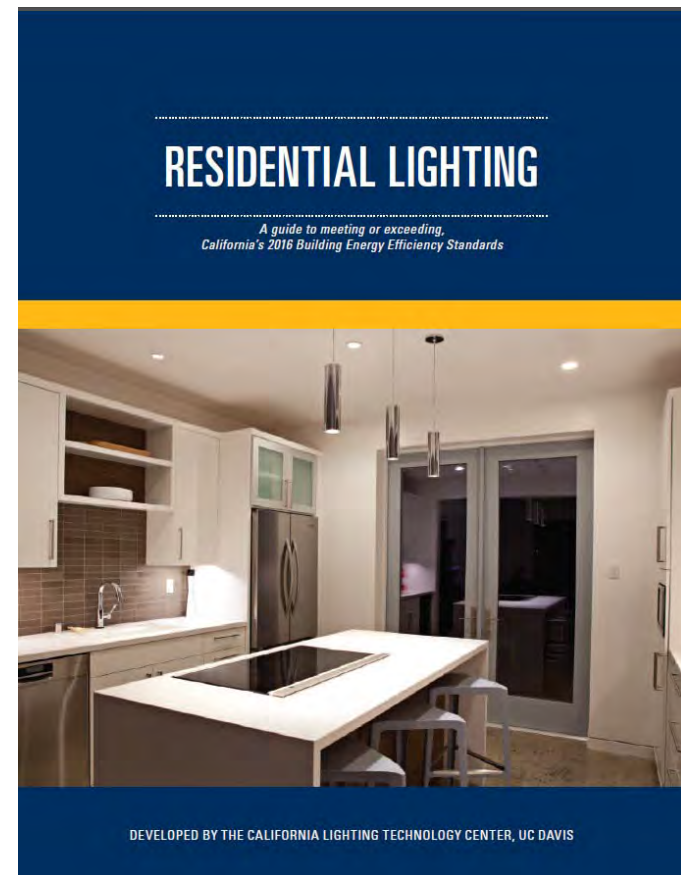
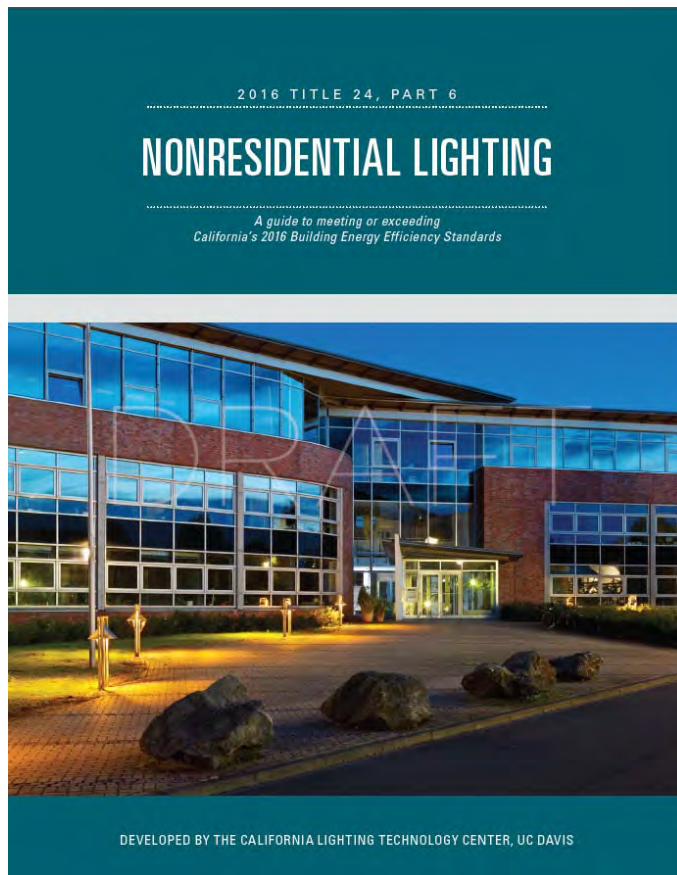
This guide is not intended to be used in lieu of California's Building Energy Efficiency Standards, and it is not a substitute for the code itself. Please visit [www.energy.ca.gov/standards](http://www.energy.ca.gov/standards) to download the official 2016 Appliance Efficiency Regulations and visit [www.energy.ca.gov/standards](http://www.energy.ca.gov/standards) for General Service LED Lamps and Small-Diameter Directional Lamps.

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# CLTC Resources: Coming Soon!

## 2016 Nonresidential and Residential Guides





2013 TITLE 24, PART 6  
**LIGHTING FOR OFFICE APPLICATIONS GUIDE**  
NOW AVAILABLE FOR DOWNLOAD

2013 TITLE 24, PART 6 LIGHTING FOR OFFICE APPLICATIONS GUIDE



WHO WE ARE

Accelerating the development and commercialization of energy-efficient lighting and daylighting technologies.

[Read More](#)



TITLE 24 BUILDING ENERGY EFFICIENCY STANDARDS

Residential Lighting Retail Lighting  
Office Lighting The Relationship of

LATEST PUBLICATIONS

2013 Title 24, Part 6 Lighting for Office Applications Guide

Title 24: Retail Lighting Class Presentations

2013 Title 24, Part 6 Retail Lighting Guide

CEC awards Bosch-led team \$2.8 million to demonstrate commercial-scale energy grid, including lighting and controls

High Color Rendering Can Enable Better Vision without Requiring More Power

Technology Definitions For Multi-Tenant Light Commercial Buildings Market Survey

Part 1 with Michael Siminovitch from the CLTC: Exploring the Urban Fabrics of Light

LATEST NEWS

High Color Rendering Can Enable Better Vision without Requiring More Power

A new article advocating for high color rendering in consumer lighting products and the policies...

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CLTC Hosted University of California Global Climate Leadership Council Meeting  
CLTC hosted the University of California Global Climate Leadership Council meeting on February 25...

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2013 Title 24, Part 6 Lighting for Office Applications Guide  
The California Lighting Technology

UPCOMING EVENTS

TITLE 24 PART 6 ESSENTIALS – STANDARDS & TECHNOLOGY FOR OFFICE LIGHTING

04/15/2015

This course covers the latest Title 24, Part 6 code requirements for office lighting.

[Read More](#)

TITLE 24 PART 6 ESSENTIALS – STANDARDS & TECHNOLOGY FOR OFFICE LIGHTING

04/22/2015

This course covers the latest Title 24, Part 6 code requirements for office



# Upcoming CLTC Classes

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**November 8/9**

**SCE Energy Education Center, Irwindale, CA**

**Office/Residential Lighting:  
Title 24 and Technology Update**

**[Register Here!](#)**