



**CALIFORNIA  
ENERGY**  
CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

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# Second Stakeholder Meeting for **Indoor Sources**

March 22, 2017

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# Agenda

1. Background
2. Proposed Code Changes
3. Technical and Market Barriers
4. Compliance and Enforcement
5. Cost-Effectiveness and Energy Impacts
6. Next Steps

# 1. Background

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## Introduction to Indoor Lighting Sources

- Revise prescriptive lighting power densities (LPD) for nonresidential indoor lighting systems, including task/ambient design in offices
  - There has been little change to nonresidential indoor LPD requirements since 2013 standards
- Build on ASHRAE 90.1/189.1 proposals (all LED basis)

## Relevant Code History

- Title 20 Standards
  - All General Service Lamps: 45 lpw
    - Effective January 2018
    - Excludes incandescent reflector and linear/tube lamps
  - LED lamps: 80 lpw
    - Effective July 2019
    - Larger directional and omni LED lamps.
    - Excludes tubes or dedicated LED luminaires
  - Small Diameter Directional Lamps: 70-80 lpw
    - Effective January 2018
    - Covers MR16, PAR 16, MR11, etc.



## Relevant Code History

- Energy Independence and Security Act of 2007
  - Sets a “backstop” of 45 lpw for all General Service Lamps nationally by 2020
  - General Service Lamps now includes incandescent reflector lamps (e.g. PAR, BR) and many other previously exempted lamp types (e.g. rough service, vibration service, three way)
  - Effectively bans halogen/incandescent for all these lamp types

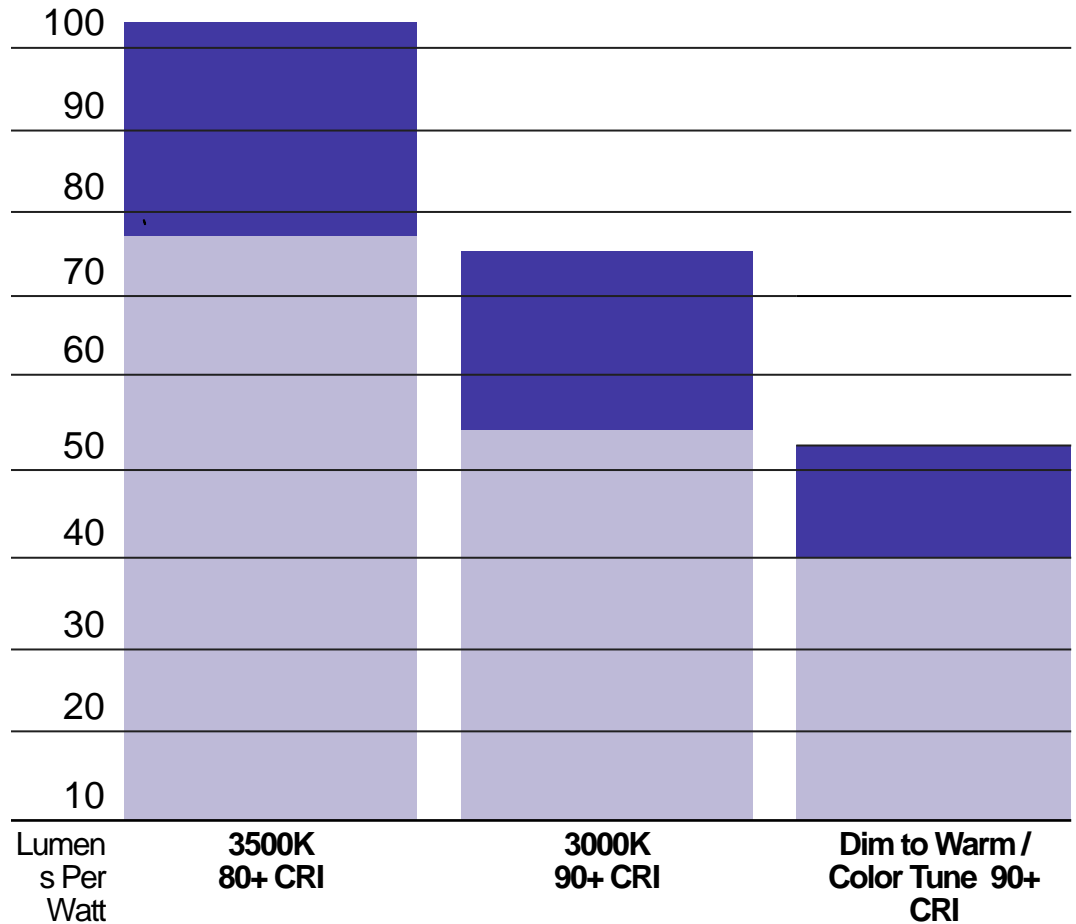


## Relevant Code History

- ASHRAE 90.1-2016 published at end of 2016
  - Mostly LED based
    - Models contained LED luminaires that had lower efficacies and lower CU's than more recent equivalent products.
- ASHRAE 189.1-2017 under development (**100% LED**)
  - LPD Proposal all LED through first public review
    - No comments on LPD values - second public review under way
- New Title 24, Part 6 LPDs are based on adopted ASHRAE 189.1
  - Improved LED efficacy
  - Remove double counting
  - More “use it or lose it” display and ornamental lighting allowances

# LED Efficacy's for Small Aperture Luminaires

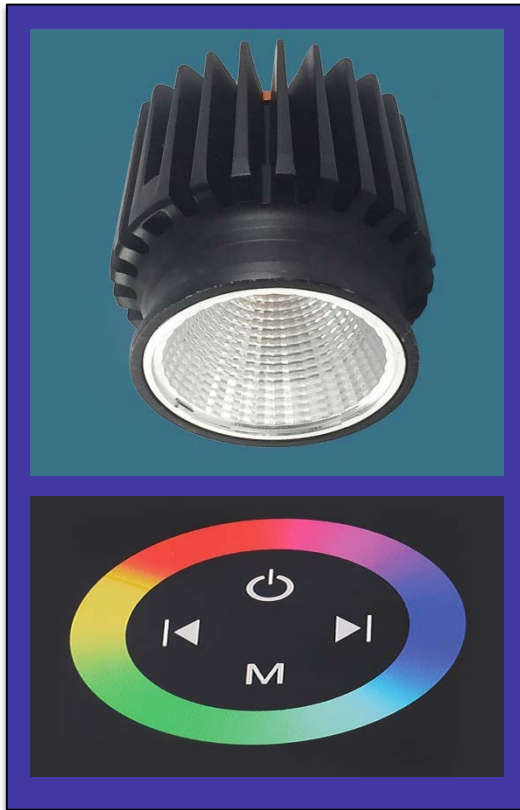
## LED Down-Light Efficacy Chromaticity and CRI





# High CRI Dim-to-Warm and Color Tuning LED Luminaires (small aperture)

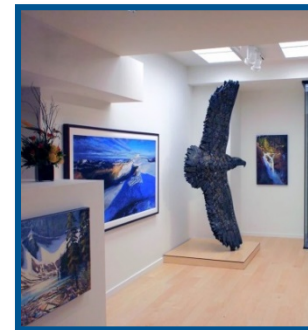
## 90+ CRI Dim to Warm and Color Tuning Luminaires



- We're finding that small aperture luminaires have significant efficacy drops when 90+ CRI and color tuning – but not finding same for larger aperture products.
  - Is this correct?
  - Will this trend be improving?
  - Is anyone aware of high efficacy versions of these products (60-70 lpw)?
- Looking for input.

## Why Are We Proposing This Code Change

- Rapid LED adoption → Museums, Dining & Hospitality, Retail
  - Exhibit Lighting (directional, casework and special effects)
  - Specialty (wall wash, coves and wayfinding)
  - General lighting (direct/indirect and downlights)
  - Other



## 2. Proposed Code Changes

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## Proposed Code Change

### Lower LPDs for all nonresidential indoor spaces

- Prescriptive change → New construction and alterations
- Complete Building Method, Table 140.6-B
  - *Allowed Power = Whole Building LPD x Building Area*
- The Area Category Method, Table 140.6-C (see Table C footnotes)
  - *Allowed Power =  $\sum$ Space LPD x Space Area + Additional Lighting Power*
- Tailored Lighting Method, Table 140.6-D, E, and G
  - *Allowed Power = General + Use\_it\_or\_lose\_it*
    - General allowance adjusted by room cavity ratio
  - *Use\_it\_or\_lose\_it = Display + Task + Ornamental*
    - Display allowance adjusted by mounting height

# Changes to Scope of Tables and Building and Space Names

## New proposed space types

- Complete Building Method (Table 140-6-B)
- The Area Category Method (Table 140-6-C)
- Tailored Lighting Method (Table 140-6-D to G)
- Space types adapted from ASHRAE 90.1/189.1

# Building and Space Category Names

Table 140.6-B Complete Building Compliance – Building Type Mapping

TITLE 24 2016 BUILDING TYPES	PROPOSED TITLE 24 2019 BUILDING TYPES	TITLE 24 2016 BUILDING TYPES	PROPOSED TITLE 24 2019 BUILDING TYPES
<del>Auditorium Building</del>	Auditorium	<del>Library Building</del>	Library
-	Civic Center	<del>Medical Building/Clinic Building</del>	Medical/Healthcare Clinic
-	Sports arena	-	Hospital
<del>Classroom Building</del>	-	<del>Office Building</del>	Office
<del>Commercial/Industrial Storage Bldg.</del>	Warehouse	<del>Parking Garage Building</del>	Parking Garage
<del>Convention Center Building</del>	Convention center	<del>Religious Facility Building</del>	Religious Facility
<del>Financial Institution Building</del>	Financial Institution	<del>Restaurant Building</del>	Restaurant
<del>General Commercial/Industrial Bldg.</del>	Industrial/ Manufacturing facility	<del>School Building</del>	School and/or university
-	Service facility	<del>Theater Building</del>	-
-	Courthouse	-	Motion picture theater
<del>Grocery Store Building</del>	Grocery Store	-	Performing arts theater
-	Retail Store	<del>All others buildings</del>	All other buildings

# Building and Space Category Names (continued)

Table 140.6-C Area Category Compliance – Building Type Mapping

TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA	TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA
Auditorium Area	Auditorium	-	Bar/lounge or leisure
Auto Repair Area	Auto Repair and Maintenance	-	Cafeteria/fast food
Beauty Salon Area	Beauty Salon	-	Family
Civic Meeting Place Area	Civic Meeting Place	Electrical, Mechanical, Telephone Rooms	Electrical, Mechanical, Telephone Rooms
Classroom, Lecture, Training, Areas	Classroom, Lecture, Training	Exercise Center, Gymnasium Areas	Exercise /Fitness Center & Gymnasium
Commercial and Industrial Storage Areas (conditioned and unconditioned)	<b>Commercial/Industrial Storage (Warehouse)</b>	-	<b>Museum</b>
Commercial and Industrial Storage Areas (refrigerated)	Low Bay	Exhibit, Museum Areas	Exhibition/Display
-	High Bay	-	Restoration room
-	Precision?	Financial Transaction Area	Financial Transaction
Convention, Conference, Multipurpose and Meeting Center Areas	Convention, Conference, Multipurpose and Meeting Center	General/Commercial & Industrial Work Areas	<b>General/Commercial &amp; Industrial Work</b>
Corridor, Restroom, Stair, Support Areas	Restrooms	—— Low Bay	Low Bay
Dining Area	<b>Dining</b>	—— High Bay	High Bay

# Building and Space Category Names (continued)

Table 140.6-C Area Category Compliance – Building Type Mapping (*continued*)

TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA	TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA
		-	<b>Medical and Clinical Care</b>
— Precision	Precision	-	Exam/treatment room
Grocery Sales Area	See Merchandise sales	-	Pharmacy
<b>Library Area</b>	<b>Library</b>	<b>Office Area</b>	<b>Office</b>
— Reading areas	Reading	— > 250 square feet	> 250 square feet
— Stack areas	Stacks	— ≤ 250 square feet	≤ 250 square feet
<b>Lobby Area</b>	Main Entry Lobby	— NA	Open plan
— Hotel Lobby	-	<b>Parking Structure</b>	<b>Parking Structure</b>
— Main entry lobby	-	— Parking Area	Parking Zone
Locker/Dressing Room	Locker-room	— Dedicated Ramps	Dedicated Ramps
Lounge Area	Lounge, Breakroom, or Waiting	— Daylight Adaptation Zones <sup>9</sup>	Daylight Adaptation Zones <sup>9</sup>
Malls and Atria	Concourse and Atria	<del>Religious Worship Area</del>	Religious Worship
Medical and Clinical Care Area	<b>Medical and Clinical Care</b>	<del>Retail Merchandise Sales, Wholesale Showroom Areas</del>	



# Building and Space Category Names (continued)

Table 140.6-C Area Category Compliance – Building Type Mapping (*continued*)

TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA	TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA
-	<b>Merchandise Sales</b>		
-	Grocery Sales	<del>Transportation Function Area</del>	<b>Transportation Functions</b>
-	Retail Merchandise	— Concourse & Baggage	Transportation Baggage
-	Fitting Room	— Ticketing	Transportation Ticketing
<b>Theater Area</b>	<b>Theater</b>	Videoconferencing Studio	Videoconferencing Studio
— Motion picture <del>Theater Area</del>	Motion picture	Waiting Area	Waiting Area
— Performance <del>Theater Area</del>	Performance	All other areas	All other
Hotel Function Area	-		
Kitchen, Food Preparation Areas	Kitchen and/or Food Preparation		
Laboratory Area,	Laboratory		
Laundry Area	Laundry		

## Building and Space Category Names (continued)

Table 140.6-C Area Category Compliance – Building Type Mapping  
ASHRAE/IES 90.1 New Function Areas

TITLE 24 2016 PRIMARY FUNCTION AREA - NA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA	TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA
-	Audience Seating	-	Physical therapy room
-	Copy/Print Room	-	Recovery room
-	<b>Healthcare Facility (Hospital)</b>	-	<b>Sports Arena—Playing Area</b>
-	Exam/treatment room	-	Class I facility
-	Imaging room	-	Class II facility
-	Medical supply room	-	Class III facility
-	Nursery		
-	Nurse's station		
-	Operating room		
-	Patient room		

# Building and Space Category Names (continued)

Table 140.6-D Tailored Compliance – Primary Function Area Mapping

TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA	TITLE 24 2016 PRIMARY FUNCTION AREA	PROPOSED TITLE 24 2019 PRIMARY FUNCTION AREA
Auditorium Area	-	-	Main entry Lobby:
Civic Meeting Place	-	Religious Worship	Religious Worship
Convention, Conference, Civic, Multipurpose, & Meeting Center	Convention, Conference, Civic, Multipurpose, & Meeting Center	-	<b>Retail Sales</b>
Dining area	Dining room/Foodservice	-	<ul style="list-style-type: none"> <li>Grocery &amp; Food Market</li> </ul>
Exhibit Museum Area	Museum & Exhibit, presentation	<del>Retail Merchandise Sales, &amp; Showroom Areas</del>	<ul style="list-style-type: none"> <li>Merchandise &amp; Showrooms</li> </ul>
Financial Transaction Area	-	<del>Theater</del>	<b>Theater</b>
Grocery Store Area	-	<ul style="list-style-type: none"> <li>Motion picture</li> </ul>	<ul style="list-style-type: none"> <li>Motion picture</li> </ul>
-	<b>Hotel</b>	<ul style="list-style-type: none"> <li>Performance</li> </ul>	<ul style="list-style-type: none"> <li>Performance</li> </ul>
-	<ul style="list-style-type: none"> <li>Lobby</li> </ul>	Transportation Function Area	-
Hotel Function Area	<ul style="list-style-type: none"> <li>Ballroom/Events</li> </ul>	<del>Waiting Area</del>	
<ul style="list-style-type: none"> <li>Hotel Lobby</li> </ul>	-		

*Tailored Compliance reduced from fourteen to eight categories*

## Proposed Code Change

- Majority of analysis builds upon analysis conducted for ASHRAE 90.1 and ASHRAE 189.1.
  - Primarily lumen method
  - Detailed models created for a subset of space types
- Detailed models
  - Using AGI32 detailed radiosity models reviewed by professional lighting designers
- Any issues with this approach?
- Any specific applications that should use AGI32?
- Any that should use lumen method?

## Proposed Code Change: Assumptions and Criteria

- Designs based upon meeting IES Recommended practice and Lighting Handbook (10<sup>th</sup> ed.) and feedback from lighting designers.
- Color quality and color temperature are appropriate to the applications
  - High (90+) CRI applied to hospitality, retail, museum, religious – to reflect high CRI of incumbent sources (i.e. incandescent)
  - Dim to warm specifically applied to hospitality (restaurants, hotels) museum, religious buildings and patient rooms
  - Lowest CRI is 80+ for spaces where color quality is not critical
  - Low CCT (warm color) sources applied to spaces where people sleep (guest rooms, patient rooms, hospital corridors etc.)

## Proposed Code Change: Simplify Section 130.0(c) Luminaire Classification and Power

- Luminaires with line voltage lamp holders, not including hardwired ballasts or drivers, remove minimum wattage and replace with labeled wattage of the luminaire
  - Add an exception to requirement for labeling altered luminaires in retrofits:  
rated wattage = lamp wattage if lamp has a rated life  $\geq 25,000$  hours
- Track lighting wattage: current limiter wattage or greater of 30 W/linear foot and installed wattage
- Removed 12.5 W/linear foot of track for systems with current limiter  
Installed wattage is wattage of current limiter

## Proposed Code Change: Simplify Section 130.0(c) Luminaire Classification and Power

- Added language about modular LED wattage rating – borrow ASHRAE language.
  - Wattage of modular LED based on maximum wattage of LED driver
  - Hard-wired luminaires would not be affected; only modular snap-on, linear, etc. LEDs

## Proposed Code Change: Simplify Section 110.9 Mandatory Requirements for Lighting Controls

- Remove Section 110.9(c) Track Lighting Integral Current Limiter
- Remove of Section 110.9(d) Track Lighting Supplementary Overcurrent Protection Panel
- Does a UL 1077 rating provide sufficient coverage of the rating of Track Lighting Integral Current Limiters and Supplementary Overcurrent Protection Panels?
- What is missing from UL 1077 that is provided by Section 119(c), (d)?
- Is there a value in maintaining a CEC database for Track Lighting Integral Current Limiters or Supplementary Overcurrent Protection Panels?



## Proposed Code Change:

### Simplify SECTION 130.4 (b) Lighting Control Installation Certificate

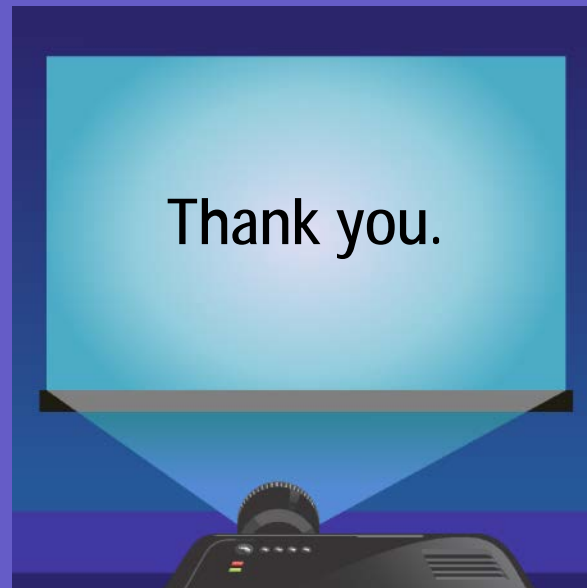
- Remove Section 130.4(b)3 Track Lighting Integral Current Limiter Inspection
- Remove of Section 130.4(b)4 Track Lighting Supplementary Overcurrent Protection Panel Inspection
- Does inspection require a separate form or is this just part of the installed lighting wattage table?
- Is additional savings benefit lost by removing this specification?

# Feedback



Let's move on to...

# Technical and Market Barriers



- Bernard Bauer L.C., Integrated Lighting Concepts
- Jon McHugh, McHugh Energy
- Mike McGaraghan, Energy Solutions
- Chris Uraine, Energy Solutions

# 3. Technical and Market Barriers

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## Technical and Market Barriers

- Lowered LPDs will make it tougher for architects to trade-off excess wattage with HVAC and envelope
  - Design community will need to look at the other parts of the envelope instead of relying on lighting
  - Potential solution to barrier → Outreach to architects to make them aware that they will not be able to trade-off additional wattage or will have less wattage to trade-off

## Technical and Market Barriers

- High first costs
  - LEDs are cost-effective but have higher first costs
  - Large projects might not be able to afford higher first costs even though they save money long-term
  - Possible solutions → Allowing flexibility in code: example is allowing the wattage of screw-in bulbs to be used (as long as life-time is 25,000 hours or more).

## Technical and Market Barriers

- LEDs cannot replace every application
  - Perception is that LEDs cannot be used in every application
  - Possible solutions → Educate contractors, building owners, etc. that **high quality** LEDs **can** be used in every applications

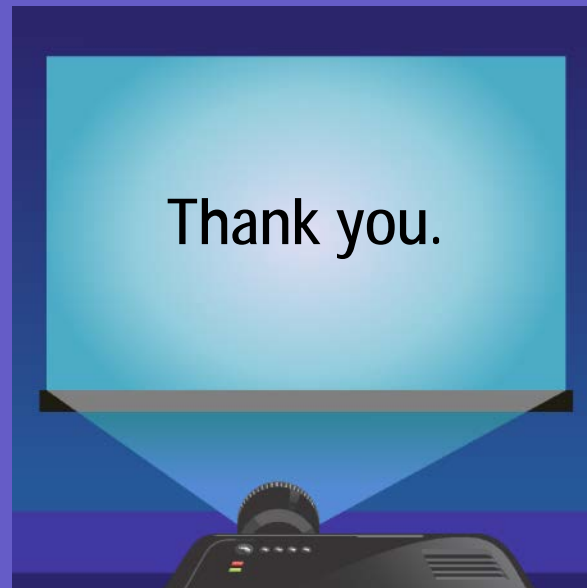
# Did we capture technical and market barriers?





Let's move on to...

# Compliance and Enforcement



- Bernard Bauer L.C., Integrated Lighting Concepts
- Jon McHugh, McHugh Energy
- Mike McGaraghan, Energy Solutions
- Chris Uraine, Energy Solutions

# 4. Compliance and Enforcement

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# Compliance Process



## Design Phase

- Designer identifies which method(s) of compliance will be used: tailored, area, complete building
- Designer identifies if track lighting will be used
- The following compliance worksheets are completed and signed ensuring the system design specifications comply with the new code requirement:
  - Certificate of Compliance for Indoor Lighting
  - Indoor Lighting Power Allowance
  - Tailored Method
  - Line-Voltage Track Lighting

# Compliance Process



## Permit Application Phase

- Plans examiner reviews all applicable compliance worksheets and compares to construction documents to verify system design specifications are consistent
- Plans examiner may provide correction comments to the designer to resolve any issues

# Compliance Process



## Construction Phase

- Facility is constructed per design specifications
- Lighting installer completes the following Certificate of Installations:
  - Certificate of Installation for Indoor Lighting
  - Certificate of Installation for Track lighting Integral Current Limiter or Supplementary Overcurrent Protection Panel
- Certificate of Installations are required to be submitted or posted at the building site prior to functional testing and completion of the Certificate of Acceptance

# Compliance Process



## Inspection Phase

- Building inspector reviews Certificates of Installation in the field and issues certificate of occupancy
- Building inspectors can use notes from plans examiners to identify top field verification priorities

## Compliance and Enforcement Barriers

- Lowered LPDs will make it tougher for architects to trade-off excess wattage with HVAC and envelope
  - Design community will need to look at the other parts of the envelope instead of relying on lighting
  - Potential solutions to barrier:
    - Outreach to architects to make them aware that they will not be able to trade-off additional wattage or will have less wattage to trade-off

## Discussion



- Did we capture compliance and enforcement barriers?



# 5. Cost-Effectiveness and Energy Impacts

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- Definition of Baseline and Proposed Conditions

### Baseline Conditions

- LPD minimally compliant with 2016 Title 24 area category LPDs.
- or industry standard practice for areas where T-24 does not currently have an LPD requirement.
- Hours of operation based on 2016 ACM schedules.
- Energy costs based on TDV multipliers multiplied by ACM operating schedules.

### Proposed Conditions

- LPD compliant with proposed 2019 code change for area category LPDs.
- Whole building LPDs based on weighted average area LPDs.
- Hours of operation based on 2016 ACM schedules.
- Energy costs based on TDV multipliers multiplied by ACM operating schedules.

# TDV Costs by Application (15 Year Present Valued Savings) Schedule from ACM

BldgType	All	All	Avg Statewide	Avg Statewide
	kWh/W	Peak W/ W	TDV kBtu/W	15 yr PV\$/W
<b>//Complete Building</b>				
Auditorium Building	3.37	0.65	100.10	\$8.91
Classroom Building	2.11	0.34	60.19	\$5.36
Commercial and Industrial Storage Building	1.74	0.07	44.88	\$3.99
Convention Center Building	3.37	0.65	100.10	\$8.91
Data Center Buildings	3.15	0.20	84.04	\$7.48
Financial Institution Building	2.32	0.28	64.15	\$5.71
General Commercial or Industrial Work Building	2.83	0.29	77.21	\$6.87
Grocery Store Buildings	3.52	0.53	100.54	\$8.95
Library Building	2.32	0.28	64.15	\$5.71
Medical Building/Clinic Building	2.89	0.29	77.89	\$6.93
Office Building	2.32	0.28	64.15	\$5.71
Parking Garage Building	6.75	0.98	191.26	\$17.02
Religious Facility Building	3.37	0.65	100.10	\$8.91
Restaurant Building	4.79	0.84	140.40	\$12.50
School Building	2.11	0.34	60.19	\$5.36
Theater Building	3.37	0.65	100.10	\$8.91
All Other Buildings	2.32	0.28	64.15	\$5.71

# Cost Effectiveness Analysis – Worst case scenario including maintenance costs

## 2 X 2 LED vs 2 X 2 Fluorescent Troffer

### Proposed: LED

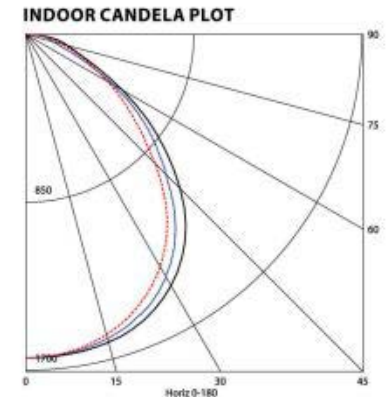
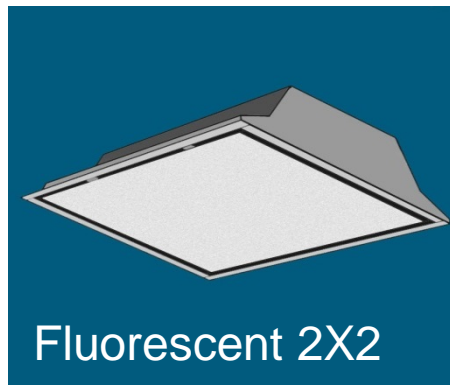
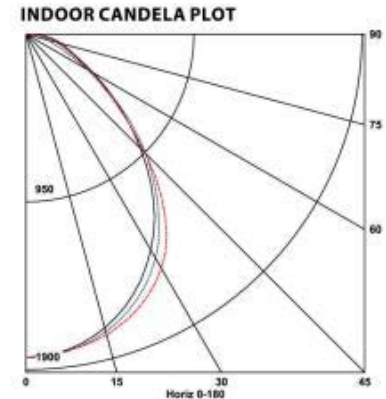
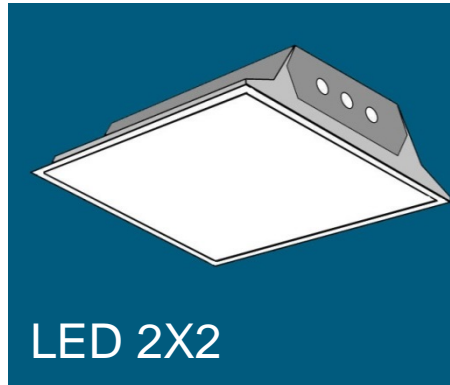
- Watts = 42W
- Lumens = 4265L fixture
- Dimming = Yes (*standard offering*)
- First Cost= \$130.00 (integral light source)
- Annual Maintenance = \$0.00

### Base: Fluorescent

- Watts = 48W
- Lumens = 4312L fixture (5600 lamp)
- Dimming = NO (*except as adder*)
- First Cost= \$110.00 (*includes lamps*)
- Maintenance = \$5 labor + \$40 lamps, 4 yr period
- PV Maintenance = \$106

### Comparison

- Power reduction 9%
- Incremental cost \$32
- Retail PV cost per W (over 15 years) = \$8.91/W
- Total savings = PV \$8.91/W x 6 Watts = PV \$53
- B/C ratio =  $(\$53 + \$106) / \$32 = 4.9$



# Cost-effectiveness Analysis with “High CRI” lamps (Worst Case Scenario)

## TRACK: LED Versus INCANDESCENT



### Comparison

Power reduction 38-11 = 27 Watts

Percent Power Reduction =  $27/38 = 71\%$

Incremental cost =  $\$60 - 35 = \$25$

Retail PV cost per W (over 15 years) =  $\$8.91/W$

Total PV Cost Savings =  $PV \$8.91/W \times 27 W = PV\$240$

PV Maintenance Cost Savings =  $\$200 - \$51 = PV\$149$

B/C ratio =  $(\$240 + \$149)/\$25 = 15.6$

### Proposed: LED

Watts = 11.0 W or 12.5 W or 18.5 W

Lumens = 540L or 795L or 1,000L

Color/CRI = 3000K / 95+- CRI

Dimming = Yes (*most lamps*)

First Cost =  $\$60.00$  (*fixture & lamp*)

Lamping = 25,000 Hours

Maintenance cost =  $\$5$  labor +  $\$30$  lamp, 7.4 years

PV Maintenance cost =  $PV\$ 51$

### Base: Halogen IR

Watts = 38 W or 48 W or 60 W

Lumens = 520L or 850L or 1,050L

Color/CRI = 2850K / 100 CRI

Dimming = Yes (*inherent design*)

First Cost =  $\$35.00$  (*fixture & lamp*)

Lamping = 1,500 to 2,500 Hours

Maintenance cost =  $\$5$  labor +  $\$5$  lamp, 0.6 years

PV Maintenance cost =  $PV \$200$

# High Bay Cost-effectiveness Analysis including maintenance costs

## LED Versus METAL HALIDE - HIGH BAY



LED High Bay



MH High Bay

### Comparison

Power reduction  $452 - 200 = 252$  Watts

Percent Power Reduction =  $252/452 = 55\%$

Incremental cost =  $\$480 - \$240 = \$240$

Retail PV cost per W (over 15 years) =  $\$8.91/W$

PV Cost Savings = PV  $\$8.91/W \times 252 W = PV\$2,245$

PV Maintenance Cost Savings = PV $\$70$

B/C ratio =  $(\$2,245 + \$70) / \$240 = 9.6$

### Proposed: LED

Watts = 200 W (LED & driver)

Lumens = 21,600 (useable maintained)

Color/CRI = 4000K / 70+CRI

Dimming = Yes (available option)

First Cost =  $\$480.00$  (integral source)

Lamping = 80,000+ Hours

Maintenance Cost =  $\$0.00$ , 23 year life

### Base: Metal Halide

Watts = 452 W (lamp & ballast)

Lumens = 21,800 (useable maintained)

Color/CRI = 4000K / 65CRI

Dimming = No (possible but not practical)

First Cost =  $\$240.00$  (includes lamp)

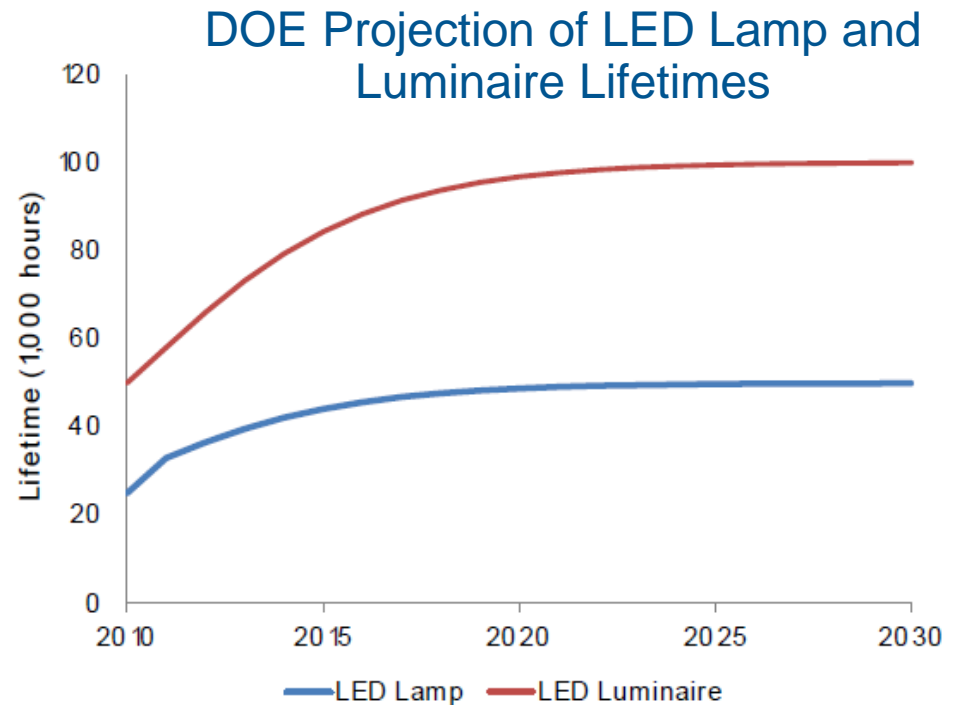
Lamping = 15,000 hr (at 75% of 20khr lamp life)

Maint. Cost =  $\$10$  labor +  $\$20$  lamp, 4.5 yr period

PV Maintenance cost = PV  $\$70$

## Cost-Effectiveness Analysis – Incremental Maintenance Costs

- Legacy products: use manufacturer's data for lamp lifespan.
- Assume luminaires last 15 years except retail.
- For retail, shorter 7 year lifespan.
- Are 15 year and 7 year reasonable assumptions?
- Should DOE's projection of increased lifespan of LEDs by 2020 be used to assume lower lamp lumen depreciation for LEDs?



Data from Figure E.1 *LED Lamp and Luminaire Lifetime Projections*. Navigant Prepared for USDOE. **Energy Savings Forecast of Solid-State Lighting in General Illumination Applications**. August 2014. <http://www.energy.gov/sites/prod/files/2015/05/f22/energysavingsforecast14.pdf>

# Feedback





1. Are 15 years (all applications except retail) and 7 years (retail) reasonable lifespan assumptions?

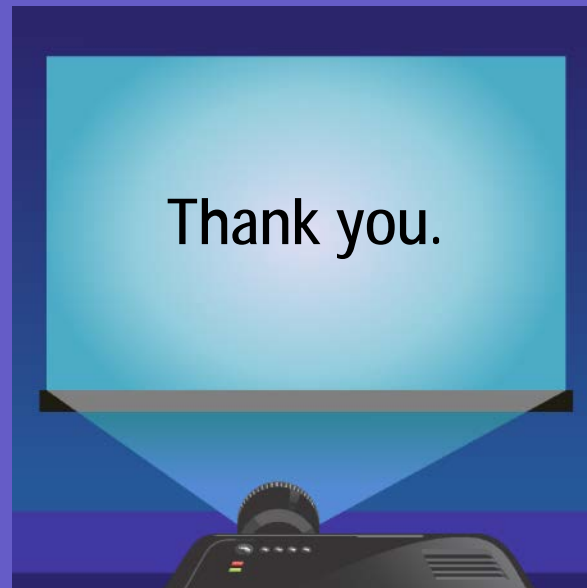
- a. Way too high
- b. A little too high
- c. About right
- d. A little too low
- e. Way to low
- f. I don't know

If you answered (ref to Q1), please note your thinking in (2-1) 1B below.

**[for Reference pod]**

# Let's move on to...

## Next Steps



- Bernard Bauer L.C., Integrated Lighting Concepts
- Jon McHugh, McHugh Energy
- Mike McGaraghan, Energy Solutions
- Chris Uraine, Energy Solutions

# 6. Next Steps

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## Next Steps

- Please fill out Indoor Sources online survey
  - <https://www.surveymonkey.com/r/Title24Part6IndoorLightSources>
- Please send any additional feedback within 2 weeks to:
  - CASE Author (see contact info at end of this presentation)
  - [Info@title24stakeholders.com](mailto:Info@title24stakeholders.com)
- Keep an eye on [Title24Stakeholders.com](http://Title24Stakeholders.com) for:
  - Presentations from today's meeting
  - Draft Code Change Language
  - Notes from today's meeting
  - Draft CASE Report (will be posted in April)

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# Thank you.

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Water & Power



# Appendix

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## References

- [Title24Stakeholders.com](http://Title24Stakeholders.com)
- [EnergyCodeAce.com](http://EnergyCodeAce.com)
  - See [Reference Ace](#) for 2016 Standards, Appendices, and Compliance Manuals
- [California Energy Commission 2019 Standards Webpage](#)