DLC

Stakeholder MEETING

2017

Efficacy vs. Lighting Quality: It Doesn't Have to Be a Trade-Off

Panelists

Liesel Whitney-Schulte

Moderator - DLC

Edward Bartholomew

National Grid

CJ Brockway

SparkLab

Mark Lien

IES

Efficacy vs. Quality

- Why is it an issue?
- EE Program Perspective
- Lighting Designer Perspective
- Lighting Industry Perspective
- Panel Discussion
- Audience Q&A

DLC Mission

Drive efficient lighting

- ✓ Maintaining Technical Requirements to define minimum performance
- ✓ Facilitating thought leadership and information sharing
- ✓ Delivering tools and resources to the lighting market through open dialogue and collaboration

Efficacy is just one metric

Advantages:

- A metric to differentiate efficient products
- Minimum thresholds help set the bar and drives industry to meet
- Measurable at the luminaire level

Limitations:

- Not tangible to the consumer
- Optical control is necessary for comfort, but may impair efficacy
- Does not define quality products

Additional DLC QPL Metrics

- CRI, CCT and Zonal distribution
  - Identify desirable characteristics
  - Reduce wasted light
- Rely on luminaire level data
  - Meet threshold to qualify
  - Limits ability to report quality features

V4.0 Efficacy Changes

- 3 years of technology evolution of LEDs and luminaires
- Raised efficacy for all product categories
- Introduced efficacy "Allowances"
  - First Allowances finalized with V4.2
  - High CRI, low CCT
    - 2,722 products re-listed

Efficacy Threshold Challenges

- Can be problematic for products with optical control:
  - Decorative/pedestrian outdoor lighting
  - Small aperture architectural linear products
- Received complaints
  - Some premium products believed to have sacrificed optical control to hit high efficacy target

Lighting Design - Art & Science

- Careful consideration in application
- Ideally, lighting designers on every project
  - In reality, many projects are too small, or do not have budget to support this
  - Smaller markets have fewer resources
- General users look to the DLC list as a mark of quality
  - Intended as first filter/minimum thresholds for performance

Efficacy & Quality

- How can DLC help promote both?
- Suggestions include:
  - Additional Allowances
  - Features that enhance product quality
  - Reporting of additional information/metrics/data
  - Point to resources for lighting education
  - Direct users to resources for best practices in lighting design

Panelist Perspectives

Edward Bartholomew

National Grid

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Energy Efficiency Program Perspective

Incentivizing Lighting Quality v2

Innovative energy efficiency programs that promote quality lighting design while saving energy

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Commercial Lighting |Program Manager
National Grid

contributing content:

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Lighting Designer
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Energy vs. Metrics

- Lighting energy calculations are simple
  [kW savings & kWh savings]
- Lighting metrics based on quality are complex and requires
  trained lighting professionals
  [footcandles, distribution, CRI, L70, glare control, etc]
- DLC Standards represent the “floor” of SSL lighting and controls technology
- Simple, cheap and easy solutions produce energy savings with
  sub-optimal lighting outcomes [TLED, CFLED, etc.]
- Lighting design requires the flexibility to use the appropriate lighting technology
  based on project outcomes.
- Empowering lighting professionals is the best way to enable optimal
  comprehensive solutions with better and sustained project outcomes

Quality Lighting & Energy Savings

- Lighting quality is complex and requires good decisions made by trained and experienced Lighting Professionals.
- Utilities share the same goals and values of Lighting Professionals and Designers, mainly to design good energy efficient lighting.
- Lighting Professionals can take advantage of utility lighting incentive programs that promotes quality design and exceeds code
- Customers need access to qualified lighting professionals that are committed to more than just energy savings and quick ROI, but better and persistent project outcomes through quality lighting.
- Utilities need to invest in lighting professionals by supporting the training of contractors, venders and utility partners for improved project quality

Overlap of Design and Utility Values

Designer Values:

- Improve project outcomes
- Cost effective designs
- Energy effective designs
- Visually appealing designs
- Improve the visual task performance
- Improve the occupant health outcomes
- Maintainable designs

Utility Values:

- Reduce energy use
- Cost effective efficiency
- Improve project outcomes
- Persistence of energy savings
- Early impact on project to design energy efficiency

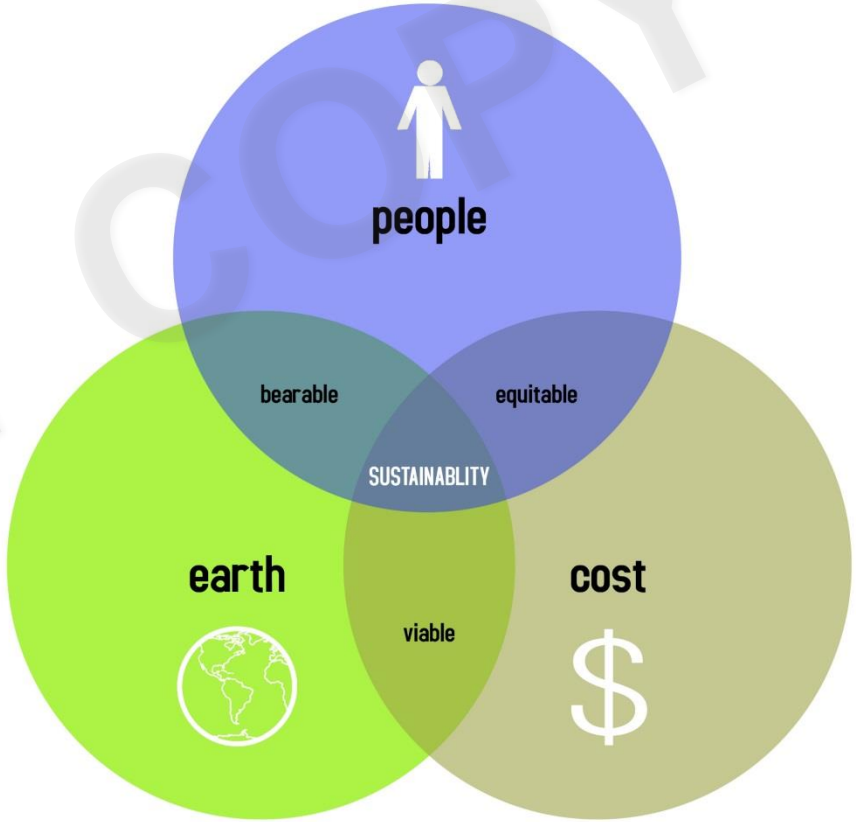
Sustainability Values
Intersection of Utility and Design

Design:

- Provide correct light levels for the task
- Design within the client's project budget
- Provide maintainable long term energy efficiency
- Always keeping the end user's needs in mind

Utility:

- Meet IES Illumination recommendations
- Provide $$$ to offset incremental costs
- Advocate for long term energy efficiency
- Facilitate a better end product for the customer



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Whom do you trust?

- Is it possible that this all comes down to that one simple question?
- Energy Utilities are in a unique position relative to this decision because they have both the market position and available funds to back up their opinions.
- If Basic Code Compliance is the path of least resistance, how big does the dangling carrot have to be to change the direction of the lighting industry? And what form should it take?

Where is the line drawn between "Quality" and "Not Quality"?

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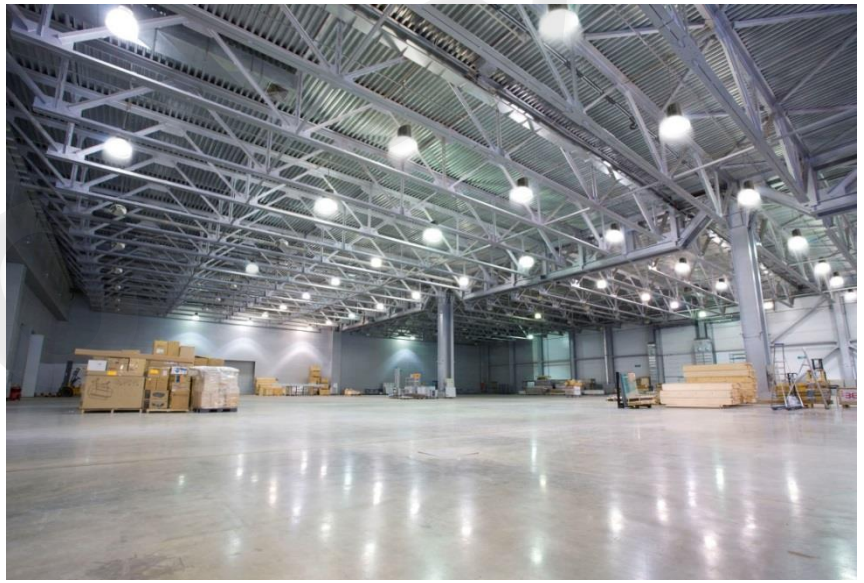
This is arguably the most subjective decision in the lighting industry!

- Your answer likely has a lot to do with what you do for a living because that affects your point of view:
  - **Lighting Designer:** *What best serves the project/task/occupants*
  - **Electrical Contractor:** *What is well constructed and easy to install*
  - **Distributor:** *What moves the most volume at the best margin*
  - **Manufacturer:** *What sells and satisfies the customer and your reputation*
  - **Utility Company:** *What saves energy at the least costs*

Technology vs. Design



Task Appropriate

Correct Lumen Output

Directed and Efficient

Energy Efficiency Lighting Programs Goals

Utility efficiency programs should promote lighting (re)design to achieve substantial lighting energy savings while maintaining quality lighting goals. The aim of these programs are to have an early and deep impact on lighting (re)design projects, ensuring that energy efficiency and quality are equally considered from the beginning and supported until the end of a project, and beyond.

Utility Solutions:
Meeting our Future Savings Goals

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To sustain the energy savings goals of lighting energy savings utilities will need to advocate four strategies:

1. **Advanced Lighting Design**
2. **Advanced Lighting Controls**
3. **Code-Based Performance Programs**
4. **Outcome-Based Building Performance based on Operational Energy Data**

All of these strategies require engaging *Design Professionals*

Customer Benefits of Code-Based Design Programs

- Deep energy savings with ***Lighting (Re)Design*** beyond one-for-one fixture replacement
- Better and ***predictable ROI*** with incentives for controls
- *Better designed lighting that is "**Right Sized**" for the project*
- Improved ***contractor competency*** for Code Based (Re)Design solutions
- Reduced impact of ***"Value Engineering"*** on projects with controls
- Motivated trade allies including ***Architects, Lighting Designers, Engineers, Lighting Mfgs and Mfg. Reps.*** To participate in efficiency programs

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Lighting Training improves Project Outcomes

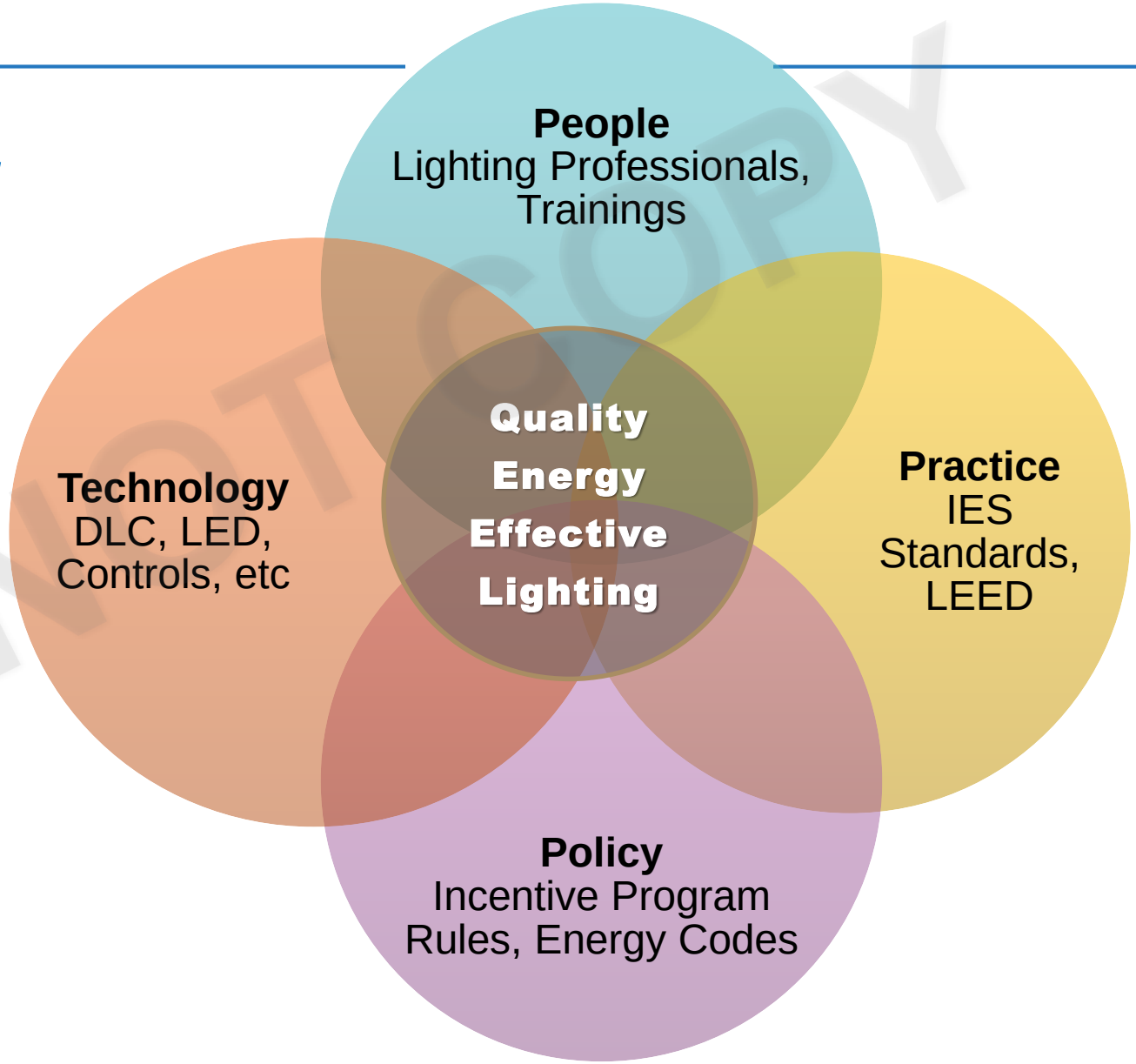
Training is the great “equalizer” improving contractor skills, which improves project outcomes:

- Reliable installations
- (Re)Designs based on meeting lighting criteria not just simple ROI
- More accurate cost estimates
- Improved project outcomes
- Happier customers

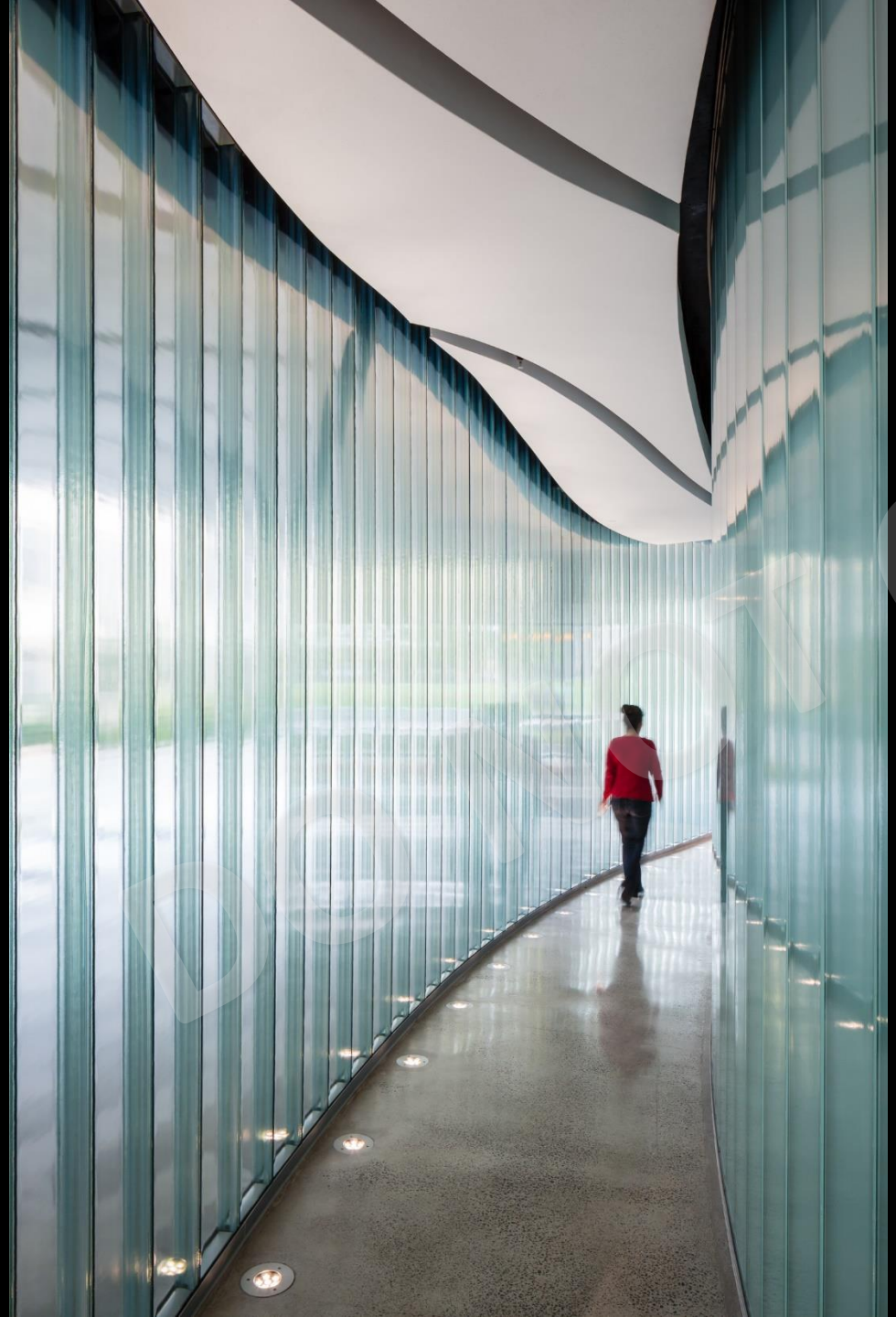
Utilities should offer trainings for “Trade Allies” on codes & standards, as well as best practices.

Summary

*Quality lighting is achieved through empowering **people**, not technology, practice or policy alone.*



Lighting Designer Perspective



CJ Brockway, IALD, LC

SPARKLAB

- ***QUALITY SPACE-MAKING***
- ***CASE STUDY***
- ***WORKSPACE DESIGN TRENDS***

University of San Francisco
with NBBJ

Tableau Northedge
with Luma and Gensler

McKinstry Innovation Center with NBBJ

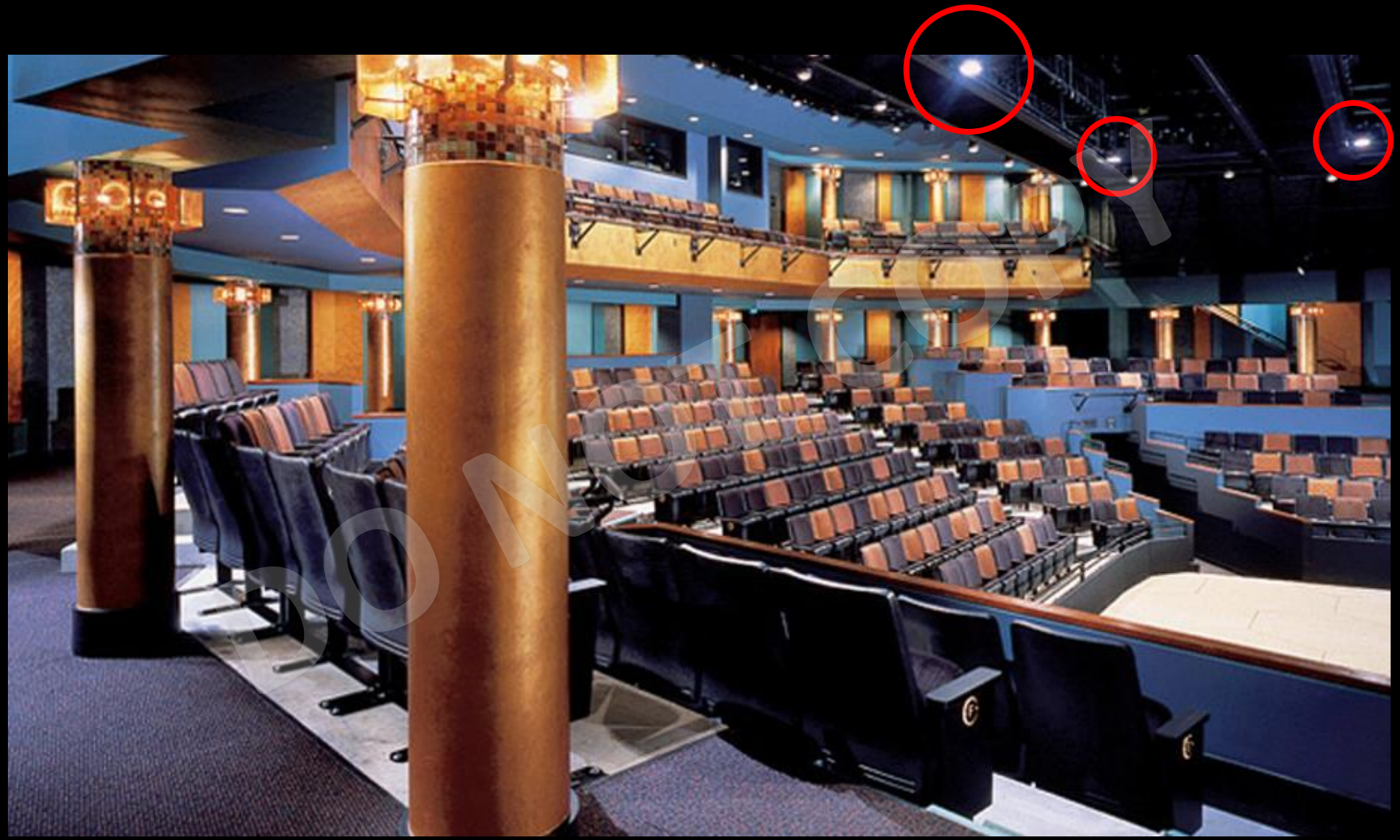
1201 3rd Avenue, Seattle
with NBBJ

Palo Alto Medical Foundation with NBBJ


University Medical Center, New Orleans, with NBBJ

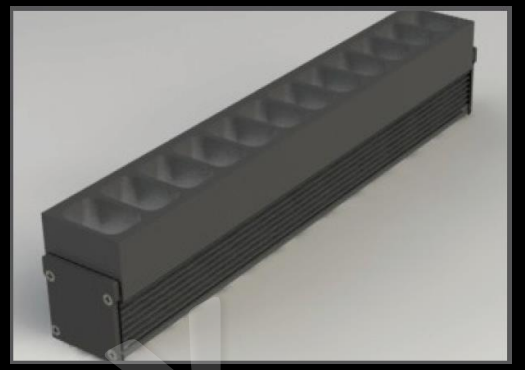
Case Study – ACT Theatre Work Lights

Case Study – ACT Theatre Work Lights



Before


DO NOT COPY
After



BOCA FLASHER
LED Lighting Systems, Technologies & Manufacturing

HPNLS-HO
SPECIFICATION SHEET

DATE:_____ TYPE:_____
PROJECT:_____
CUSTOMER:_____

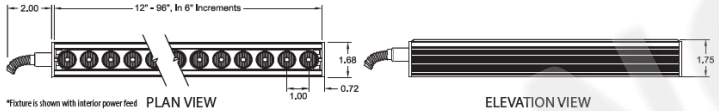
Line Voltage
Linear LED Strip Fixture

Dimmable solid color line voltage fixture fabricated with a variety of options.

The Boca HPNLS-HO is a small profile fixture well suited for many lighting situations where both space and locating transformers are concerns. This line voltage version* eliminates the need for secondary transformers, making installation contractor friendly. Boca's CleanDim® technology ensures even dimming from 0-100%. The HPNLS-HO can be fabricated with a range of optics and color temperature choices, affording a multitude of distribution and effect options. The housing is anodized aluminum with a durable finish making it weather and abrasion resistant. It is UL Listed for dry, damp or wet location (model dependent).

* Patent Pending

Diagrams & Dimensions

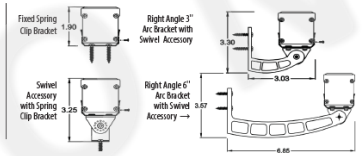


*Fixture is shown with interior power feed PLAN VIEW ELEVATION VIEW

Key Features

- Compact, variable light fixture for dry, damp or wet location use
- Fixture comes in 6" increments (12" minimum)
- Many options in optics, color temperature, and accessories to suit a range of projects, call factory for additional options
- Three different types of lenses
- Uses standard line voltage dimmers
- Fixtures are compatible with both forward and reverse phase dimming
- Clear anodized aluminum or black finish check factory for availability
- Contact Boca Flasher for tips with custom installations
- Total linear feet per power feed: 40ft

Mounting Information



Technical Specifications

WATTAGE	INPUT VOLTAGE	INPUT CURRENT	CONTROL	POWER CABLE	LED SPACING	LENGTH
16 watts per linear ft	90-120VAC or 230-277VAC	148mA RMS per linear foot	standard line voltage forward or reverse phase dimming	UL standard 6ft	1" on center	6" increments, (12" minimum) allow 1/4" for each end cap and 2" for power feed cable
TOTAL WIDTH	**TOTAL HEIGHT**	**MOUNTING**	**COLOR OPTIONS**	**OPTICS AVAILABLE**	**RATING**	**COLOR RENDERING INDEX (CRI)**
1.68"	not including clip 1.75"	fixed, swivel, 3" arc or 6" arc	2700K, 3000K, 3500K, 4000K, 5000K, amber, red, green, blue	10°, 30°, 60°, 10°x60°, 30°x60°, 120°	IP65, IP68	90+ CRI

Project Specifications

HPNLS – HO – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

Color Options: 2700K, 3000K, 3500K, 4000K, 5000K, amber, red, green, blue
Optic: 10°, 30°, 60°, 10°x60°, 30°x60°, 120°
Voltage: 90-120VAC = 120V 230-277VAC = 277V
Finish: Clear Anodized Aluminum = A Black= B
Location: Interior = I Exterior (IP65) = E Wet (IP68) = W
Mounting: Fixed = F Swivel = S 3" Arc Swivel = 3Arc 6" Arc Swivel = 6Arc
Lens: Clear = C Diffused Lens = D Satin Ice White = SI* *Interior Use Only
Options: Hexcell Louver = HL* Square Baffle = SB Slanted Baffle = SSB Kicker Baffle = SKB *Cannot be used with Satin Ice White or 120° optic

IP65 DAMP LISTING IP68 WET LISTING CE UL RoHS COMPLIANT

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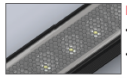
LED Lighting Systems, Technologies & Manufacturing

HPNLS-HO
ADDITIONAL OPTIONS

DATE:_____ TYPE:_____
PROJECT:_____
NAME:_____

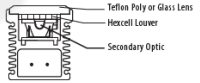
HEXCELL LOUVER



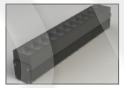
Key Features:

- Economical solution to off axis glare issues
- Louver is located flush to secondary optic, preventing unwanted striation
- Louver cannot be utilized when no optic (120°) is specified
- Louver is behind lens to ensure no damage is done during installation or after. This also ensures no dust build-up.
- Louver ships pre-fitted making on site fixture installation easy
- No unsightly clips, screws, or brackets
- Can be used with other baffles
- Adds nothing to overall height
- Additional charges apply - consult your local sales rep for more information.
- To specify add *"HL"* in options box

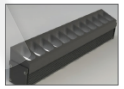
Diagram:



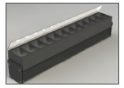
Baffle - Square Design



SB - Square Baffle



SSB - Sq. Slanted Baffle

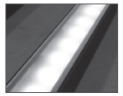


SKB - Sq. Kicker Baffle

Key Features

- Design cuts off light at 90°
- Baffles are lightweight black PVC with non-reflective surfaces to avoid glare from interior sections
- One piece baffle slides onto the extruded housing making installation easy
- Minimal profile size increases - consult factory for more information.
- *SB* Only adds .75" to overall height *SSB* adds .90" to overall height *SKB* adds 1.625" to overall height
- Additional charges apply - consult your local rep for more information.
- To specify add *"SB"* or *"SSB"* for slanted version or *"SKB"* for kicker version in options box

Lens Options



Diffused

Key Features:

- Interior or exterior use
- Lens is 1/8" (.09) thick and adds 1/16" to overall height of fixture. Call factory for more information
- 87% transmission
- Additional charges apply - consult your local sales rep for more information.
- To specify add *"D"* in lens box

Satin Ice White

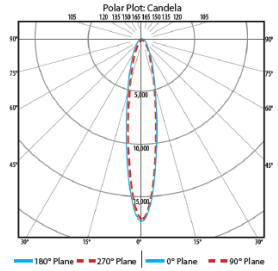
Key Features:

- **Interior use only**
- Best for direct view use
- Lens is 1/4" (.24) thick and adds 1/8" to overall height of fixture. Call factory for more information
- 42% transmission
- Additional charges apply - consult your local sales rep for more information.
- To specify add *"SI"* in lens box

Luminaire Information

FIXTURE TYPE: 3000°K, 10° optic, 120V, 48"

Candela Distribution



Center Beam Candle Power & Illumination Information

Distance	Foot Candles
2ft	4290.0
3ft	1906.6
4ft	1072.5
5ft	686.4
6ft	476.6
7ft	350.2
8ft	268.1
9ft	211.9
10ft	1716.0
12ft	119.2

Total Lumen Output: 3077 Lumens for 4ft
Luminaire Efficacy: 45.4 Lumens per watt

For lux multiply fc by 10.76
fc reading taken at 100% capacity (no dimming)

Photometric information obtained 8-5-11 from LTL

RoHS COMPLIANT CE UL

Want a rebate?

An **LM79** report measures the performance (light) of LED-based luminaires based on specific and collective components which include drive current (mA), CCT (color temperature), watts, efficiency and distribution.

LM79 requires complete luminaire testing. It does not cover external operating circuits or external heat sinks (e.g. LED chips, LED packages and LED modules). Uses absolute photometry rather than relative photometry.

- from Acuity Description

BOCA FLASHER
LED Lighting Systems, Technologies & Manufacturing

BOCA FLASHER
WWW.BOCAFLASHER.COM
TEL: (561)-989-5338
FAX: (561)-982-8323

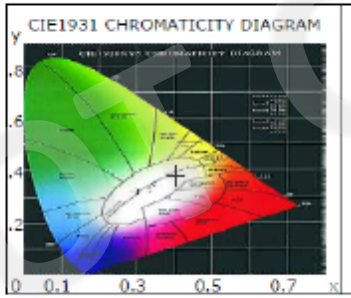
Product Information

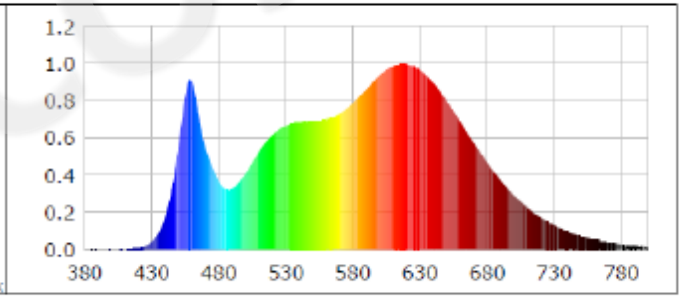
Product Category: HPNLS-HO
Product Spec: 60 DEGREE
Manufacturer: Boca Flasher
Product Type: 1FT
Product Number: 1

CIE Colorimetric Parameters

Chromaticity coordinates: x=0.4042 y=0.3832 u(u')=0.2381 v=0.3386 v'=0.5079
CCT: Tc=3461K (duv=-0.00312)
Color Ratio: R=0.227 G=0.734 B=0.039
Peak Wavelength: 617nm
Half Bandwidth: 168.7nm
Dominant Wavelength: 582.5nm
Color Purity: 0.363
Color Render Index: Ra= 95.2, CRI= 93.5

R1 =98	R2 =99	R3 =98	R4 =96	R5 =96	R6 =95	R7 =92	R8 =88
R9 =75	R10=99	R11=97	R12=75	R13=99	R14=99	R15=96	





Photometric Parameters

Luminous Flux: 906.48 lm
Efficiency: 59.17 lm/W
Radiant Power: 3.139 W

Electric Parameters

Voltage: 120.00V
Current: 0.1600A
Power: 15.32W
Power Factor: 0.7950
Frequency: 59.99Hz

Test Information
Scan Range: 380nm~800nm:1nm
Stabilization Time:
Max of Signal: 47542 (2830)
Photometric Method: sphere-spectroradiometer
Photometric Condition: Sphere diameter: 1.50m, 4PI
CCD Integration Time: 246.67 ms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After

WORKSPACE

Microsoft R&D Headquarters, Beijing - NBBJ

WORKSPACE

Tableau Northedge - Gensler

Tableau Northedge - Gensler


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Google 75 E
Trimble - Mithun

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Layers & Controls

Tableau Northedge - Gensler

Lighting Industry Perspective

EFFICACY VS. LIGHTING QUALITY: IT DOESN'T HAVE TO BE A TRADE-OFF

Mark Lien LC, HBDP, CLMC, CLEP, LEED BD&C
Illuminating Engineering Society
mlien@ies.org

CHANGES IN THE MARKET & CODES UNDER DEVELOPMENT

- **ASHRAE**
- **CEC**
- **CIE**
- **IEEE**
- **IES**
- **NEMA**

ANSI/ASHRAE/IES STANDARD 90.1 / ERIC E. RICHMAN

Which standards have you recently completed or are working on that respond to or provide guidance for connected lighting?

- **“90.1-2016 and currently working on 90.1-2019”**

Also note 189.1, 90.2 & AEDG

CALIFORNIA ENERGY COMMISSION -TITLE 24 / SIMON LEE

- New building and appliance standards were adopted in 2016
- We are working on revisions to align Title 24 with Title 20
- Title 20 is also working with the industry on adaptive lighting.

CIE – YOSHI OHNO

- CIE 224 addressing the color fidelity index. The gamut index is being evaluated by TC1-91 and they will publish a report on a study of metrics beyond color fidelity including perception effects/preference. Must be accepted unanimously.

CIE – YOSHI OHNO

CIE Research Strategy / August 2016

The research topics listed here are those judged by the CIE as needing immediate attention by the research community in support of developments in lighting technology and application. Publications in the peer-reviewed literature on these topics will provide the basis for the next generation of CIE technical reports and standards.

Top Priority Topics

- Recommendations for Healthful Lighting and Non-Visual Effects of Light
- Colour Quality of Light Sources Related to Perception and Preference
- Integrated Glare Metric for Various Lighting Applications
- New Calibration Sources and Illuminants for Photometry, Colorimetry, and Radiometry
- Adaptive, Intelligent and Dynamic Lighting
- Application of New CIE 2006 Colorimetry
- Visual Appearance: Perception, Measurement and Metrics
- Support for Tailored Lighting Recommendations
- Metrology for Advanced Photometric and Radiometric Devices
- Reproduction and Measurement of 3D Objects

http://www.cie.co.at/index.php/Research+Strategy

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS / STEVEN TOWNSEND

- **“3001.9 Recommended Practice for the Lighting of Industrial and Commercial Facilities”**

ILLUMINATING ENGINEERING SOCIETY / BRIAN LIEBEL

New updates that will be ANSI/IES and in continuing maintenance

- RP-28 Visual Environment for Seniors
- RP-29 Hospital and Healthcare
- RP-7 Industrial Lighting

NEMA / KAREN WILLIS & CLARK SILCOX

Standards recently completed or are working on that respond to or provide guidance for connected lighting

- "NEMA Standards include NEMA SSL 7A-2015 Phase-Cut Dimming for Solid State Lighting: Basic Compatibility, NEMA 77-2017, Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria and upcoming NEMA SSL7B, Phase Cut LED Dimming Performance. White Papers in progress include LSD 55, an industry evaluation and collection of research on short wavelength light, LSD 74- 2016, Considerations of Field LED Driver Replacement , and the upcoming guidance on LED Replacements for Type A lamps.
- As Secretariat of 5 ANSI Committees, NEMA is directly involved in the following connected lighting standards for indoor and outdoor lighting:
- Proposed C136.48, For Roadway and Area Lighting Equipment—Wireless Networked Lighting Controllers
- Proposed C136.50, For Roadway and Area Lighting Equipment—Revenue Grade Energy Measurement within a Locking Type Control Device
- Proposed C136.52, For Roadway and Area Lighting Equipment—LED Drivers with Integral Energy Measurement Means
- Proposed C136.54, tentatively entitled, Occupancy Sensors For Roadway and Area luminaires
- Proposed C137.1, For Lighting Systems—0-10V Dimming Interface for LED Drivers, Fluorescent Ballasts, and Controls
- Proposed C137.2, Cybersecurity Requirements for Lighting Systems for Parking Facilities
- Proposed C137.3, For Lighting Systems— Minimum Requirements for installation of Energy Efficient Power over Ethernet (PoE) Lighting Systems"

USGBC / WES SULLENS

Are there areas of our industry that you feel are not being addressed or not keeping pace with market shifts? If so, do you have a recommendation on resolving this?

Energy codes are not necessarily keeping pace with the lighting technology changes. The fact that many lighting systems are now wifi capable is a radical shift that unlocks a lot of potential, but also energy consumption. Further, color changing LEDs may require more energy under some conditions, but they could represent health benefits that are far beyond the incremental energy penalty. This dimension of health/energy/quality is not necessarily reflected in codes today because they are still focused on LPDs and efficacy of lamps, and don't take into consideration the other benefits of quality lighting.

ANSI/ASHRAE/IES 90.1-2016

IMPORTANCE OF CONTROLS IN MEETING CODES

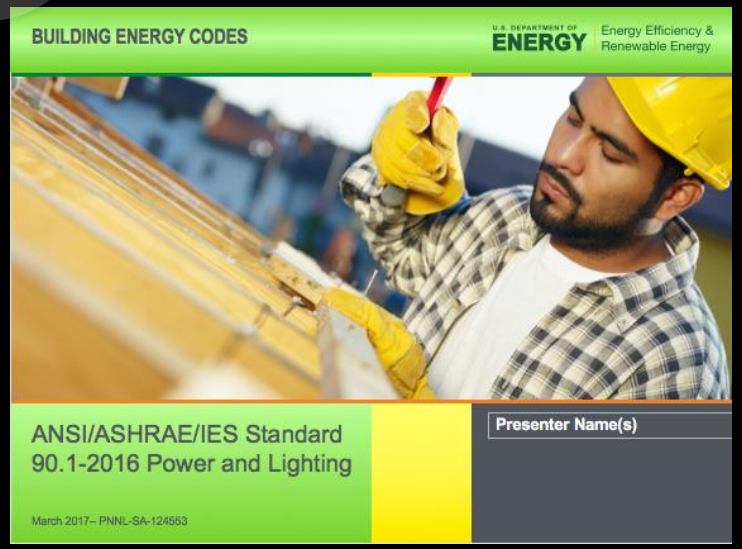
- Requirements to reduce lighting power by 30% during periods of non-occupancy or after business hours in exterior applications AND parking garages has been increased to 50%
- Lighting alterations (retrofits) section revised to add interior and exterior controls
- Application threshold changed to 20% of lighting load before requirements are applied. This acknowledges the added controls savings and practicality of applying controls in retrofits.
- If all mandatory control requirements are met for a space AND advanced controls are installed in that space, THEN additional limited lighting power is allowed

ANSI/ASHRAE/IES 90.1-2016

IMPORTANCE OF CONTROLS IN MEETING CODES

Small part of Table 9.6.1 shown below

Informative Note: This table is divided into two sections; this first section covers space types that can be commonly found in multiple building types. The second part of this table covers space types that are typically found in a single building type.			The control functions below shall be implemented in accordance with the descriptions found in the referenced paragraphs within Section 9.4.1.1. For each space type: (1) All REQs shall be implemented. (2) At least one ADD1 (when present) shall be implemented. (3) At least one ADD2 (when present) shall be implemented.								
			Local Control (See Section 9.4.1.1[a])	Restricted to Manual ON (See Section 9.4.1.1[b])	Restricted to Partial Automatic ON (See Section 9.4.1.1[c]	Bilevel Lighting Control (See Section 9.4.1.1[d])	Automatic Daylight Responsive Controls for Sidelighting (See Section	Automatic Daylight Responsive Controls for Toplighting (See Section	Automatic Partial OFF (See Section 9.4.1.1[g] [Full Off complie	Automatic Full OFF (See Section 9.4.1.1[h])	Scheduled Shutoff (See Section 9.4.1.1[i])
Common Space Types[1]	LPD	RCR	a	b	c	d	e	f	g	h	i
Atrium											
<20 ft in height	0.03/ft total	NA	REQ	ADD1	ADD1		REQ	REQ		ADD2	ADD2
≥20 ft and ≤40 ft in height	0.03/ft total	NA	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
>40 ft in height	0.40 + 0.02/ft total height	NA	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Audience Seating Area											
Auditorium	0.63	6	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Convention center	0.82	4	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Gymnasium	0.65	6	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Motion picture theater	1.14	4	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Penitentiary	0.28	4	REQ	ADD1	ADD1		REQ	REQ		ADD2	ADD2
Performing arts theater	2.03	8	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Religious building	1.53	4	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Sports arena	0.43	4	REQ	ADD1	ADD1		REQ	REQ		ADD2	ADD2
All other audience seating areas	0.43	4	REQ	ADD1	ADD1		REQ	REQ		ADD2	ADD2
Banking Activity Area	0.86	6	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Breakroom (See Lounge/Breakroom)											
Classroom/Lecture Hall/Training Room											



38 of the 72 slide deck on 90.1-2016 lighting addresses controls

INDUSTRY RESOURCES & COMMITTEES

Recommended Practices/ANSI Standards*	
RP-1-12	American National Standard Practice for Office Lighting*
RP-3-13	American National Standard Practice on Lighting for Educational Facilities*
RP-4-13	Recommended Practice for Library Lighting
RP-5-13	Recommended Practice for Daylighting Buildings
RP-6-15	Sports and Recreational Lighting
RP-8-14	Roadway Lighting*
RP-16-10	Nomenclature and Definitions for Illuminating Engineering*
RP-20-14	Lighting for Parking Facilities (Revised 2016)
RP-22-11	Tunnel Lighting*
RP-27.1-15	Photobiological Safety for Lamp & Lamp Systems-General Requirements*
RP-27.2-00	Photobiological Safety for Lamp and Lamp Systems-Measurement Techniques* (Reaffirmed 2011, 2017)
RP-27.3-07	Photobiological Safety for Lamp & Lamp Systems-Risk Group Classifications & Labeling*
RP-28-16	Lighting and the Visual Environmental for Seniors and the Low Vision Population*
RP-29-16	Lighting for Hospital and Health Care Facilities*
RP-30-17	Recommended Practice for Museum Lighting*
RP-31-14	Recommended Practice for the Economic Analysis of Lighting
RP-33-14	Lighting for Exterior Environments
RP-36-15	IES/NALMCO Recommended Practice for Lighting Maintenance
RP-37-15	Outdoor Lighting for Airport Environments
*Indicates ANSI Approved Standard: *	

Design Guides	
DG-1-16	Design Guide for Color and Illumination
DG-3-00	Application of Luminaire Symbols on Lighting Design Drawings* (Reaffirmed 2015)
DG-4-14	Design Guide for Roadway Lighting Maintenance
DG-10-12	Choosing Light Sources for General Lighting
DG-18-08	Light + Design: A Guide to Designing Quality Lighting for People and Buildings
DG-19-08	Design Guide for Roundabout Lighting
DG-20-09	Stage Lighting: A Guide to the Planning of Theatres and Auditoriums
DG-21-15	Design Guide for Residential Street Lighting
DG-22-12	Sustainable Lighting: An Introduction to the Environmental Impacts of Lighting
DG-23-14	Design Guide for Toll Plazas
DG-25-12	Design Guide for Hotel Lighting
DG-26-16	Design Guide for Lighting the Roadway in Work Zones
DG-28-15	Guide for Selection, Installation, Operations and Maintenance of Roadway Lighting Control Systems*
DG-29-11	The Commissioning Process Applied to Lighting and Control Systems
Guidelines	
G-1-16	Guideline for Security Lighting for People, Property, and Critical Infrastructure
G-2-10	Guideline for the Application of General Illumination ("White") Light - Emitting Diode (LED) Technologies
Lighting Energy Management	
LEM-3-13	IES Guidelines for Upgrading Lighting Systems in Commercial and Institutional Spaces
LEM-7-13	Lighting Controls for Energy Management
Technical Memoranda	
TM-1-12	The Five Lighting Metrics
TM-10-00	Addressing Obtrusive Light (Urban Sky Glow and Light Trespass) in Conjunction with Roadway Lighting (Reaffirmed 2011)
TM-12-12	Spectral Effects of Lighting on Visual Performance at Mesopic Light Levels
TM-15-11	Luminaire Classification System for Outdoor Luminaires (+ Addendum)
TM-18-08	Light and Human Health: An Overview of the Impact of Optical Radiation on Visual, Circadian, Neuroendocrine, and Neurobehavioral Responses
TM-21-11	Projecting Long Term Lumen Maintenance of LED Light Sources (+ Addendum)
TM-23-11	Lighting Control Protocols
TM-24-13	An Optional Method for Adjusting the Recommended Illuminance for Visually Demanding Tasks within IES Illuminance Categories P through Y Based on Light Source Spectrum
TM-25-13	Ray File Format for the Description of the Emission Property of Light Sources
TM-26-15	Methods for Projecting Catastrophic Failure Rate of LED Packages
TM-27-14	IES Standard Format for the Electronic Transfer of Spectral Data
TM-28-14	Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires
TM-30-15	IES Method for Evaluating Light Source Color Rendition

Lighting Measurement Testing and Calculation Guides	
LM-9-09	Electrical and Photometric Measurement of Fluorescent Lamps
LM-20-13	Photometry of Reflector Type Lamps
LM-28-12	IES Guide for the Selection, Care and Use of Electrical Instruments in the Photometric Laboratory
LM-37-16	Guide for Determination of Average Luminance (Calculated) for Indoor Luminaires
LM-40-10	Life Testing of Fluorescent Lamps (Reaffirmed 2017)
LM-41-14	Photometric Testing of Indoor Fluorescent Luminaires
LM-45-15	Electrical and Photometric Measurements of General Service Incandescent Filament Lamps
LM-46-04	Photometric Testing of Indoor Luminaires Using HID or Incandescent Filament Lamps (Reaffirmed 2012)
LM-47-12	Life Testing of High Intensity Discharge (HID) Lamps
LM-49-12	Life Testing of Incandescent Filament Lamps
LM-50-13	Photometric Measurement of Roadway and Street Lighting Installations
LM-51-13	Electrical and Photometric Measurement of High Intensity Discharge Lamps
LM-52-03	Photometric Measurements of Roadway Sign Installations (Reaffirmed 2014)
LM-54-12	IES Guide to Lamp Seasoning
LM-58-13	IES Approved Method for Spectroradiometric Measurement Methods for Light Sources (+ Addendum)
LM-61-06	Identifying Operating Factors for Installed High Intensity Discharge Luminaires (Reaffirmed 2014)
LM-62-06	Laboratory or Field Thermal Measurements of Fluorescent Lamps and Ballasts in Luminaires (Reaffirmed 2015)
LM-63-02	Standard File Format for Electronic Transfer of Photometric Data* (Reaffirmed 2008)
LM-65-14	Life Testing of Single-Based Fluorescent Lamps
LM-66-14	Electrical and Photometric Measurements of Single-Based Fluorescent Lamp
LM-71-14	Photometric Measurement of Tunnel Lighting Installations
LM-72-97	Directional Positioning of Photometric Data (Reaffirmed 2003, 2010)
LM-73-04	Photometric Testing of Entertainment Luminaires Using Incandescent Filament Lamps or High Intensity Discharge Lamps (Reaffirmed 2009)
LM-74-05	Standard File Format for the Electronic Transfer of Luminaire Component Data
LM-75-01	Goniophotometer Types and Photometric Coordinates (Reaffirmed 2012)
LM-77-09	Intensity Distribution Measurement of Luminaires and Lamps Using Digital Screen Imaging Photometry
LM-78-07	Approved Method for Total Luminous Flux Measurement of Lamps using an Integrating Sphere Photometer
LM-79-08	Electrical and Photometric Measurements of Solid State Lighting Products
LM-80-15	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules*
LM-81-10	Photometric Testing of Skylights and Tubular Daylighting Devices Under Hemispheric Sky Conditions
LM-82-12	Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature
LM-83-12	IES Spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure (ASE)
LM-84-14	Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires
LM-85-14	Electrical and Photometric Measurements of High-Power LEDs
LM-86-15	Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components
Handbook	
HB-10-11	The Lighting Handbook, 10th Edition

https://www.ies.org/standards/ies-lighting-library/

http://www.nema.org/Standards/Pages/All-Standards-by-Product.aspx

http://www.cie.co.at/index.php/Publications/Standards

Resources

LC Study Group

IES Lighting Certification (LC) Study Group 2017

For those already registered to take the National Council on Qualifications for the Lighting Professions (NCQLP) lighting certification exam, the IES is offering an LC Study Group, an online, web-based support program. Enrollment in the LC Study Group is not mandatory in order to take the NCQLP exam. Applicants: please provide proof of acceptance by the NCQLP and of payment to take the exam.
20 study sessions. Instructor: Craig A. Bernecker, Ph.D., FIES, LC

IES Member: $925; Group Rate (5 or more): $850 each
Non-IES Member: $1025; Group Rate (5 or more): $950 each

Study Group Starts: August 28
Study Group Ends: November 2
NCQLP Exam Date: November 4

To inquire, contact Tom Butters, Director of IES Education at tbutters@ies.org

Educational Webinar Series

Webinar Schedule

IES Leadership Bootcamp

July 13th 12:00 EDT

G-1, Security Lighting Guidelines for People, Property and Critical Infrastructure

August 17th 12:00 EDT
Participants in this webinar are eligible for one (1) IES Continuing Education Unit (CEU).

RP-29, Lighting for Hospitals and Healthcare Facilities

September 21st 12:00 EDT
Participants in this webinar are eligible for one (1) IES Continuing Education Unit (CEU).

WHAT CAN DLC/EE PROGRAMS/INDUSTRY POINT TO AS OBJECTIVE INFORMATION FOR DEFINITIONS?

ANSI Mission Statement:

- **To enhance both the global competitiveness of U.S. business and the U.S. quality of life by promoting and facilitating voluntary consensus standards and conformity assessment systems, and safeguarding their integrity.**
  - **ANSI/RP-16 https://www.ies.org/standards/ansi-ies-rp-16-10/**
  - **ANSI/C137 Nomenclature (out for balloting now-available soon)**
  - **Other CIE, ASHRAE, IEEE, UL, IES & NEMA ANSI documents**

EFFICACY VS. LIGHTING QUALITY: IT DOESN'T HAVE TO BE A TRADE-OFF

Mark Lien LC, HBDP, CLMC, CLEP, LEED BD&C
Illuminating Engineering Society
mlien@ies.org

Panel Discussion

Audience Q&A

Thank You!

All Presentations will be posted on the DLC Website after the meeting.