

Designers Light Forum

Deciphering IECC, ASHRAE 90.1, and Title 24, Part 6 Lighting and Lighting Control Requirements

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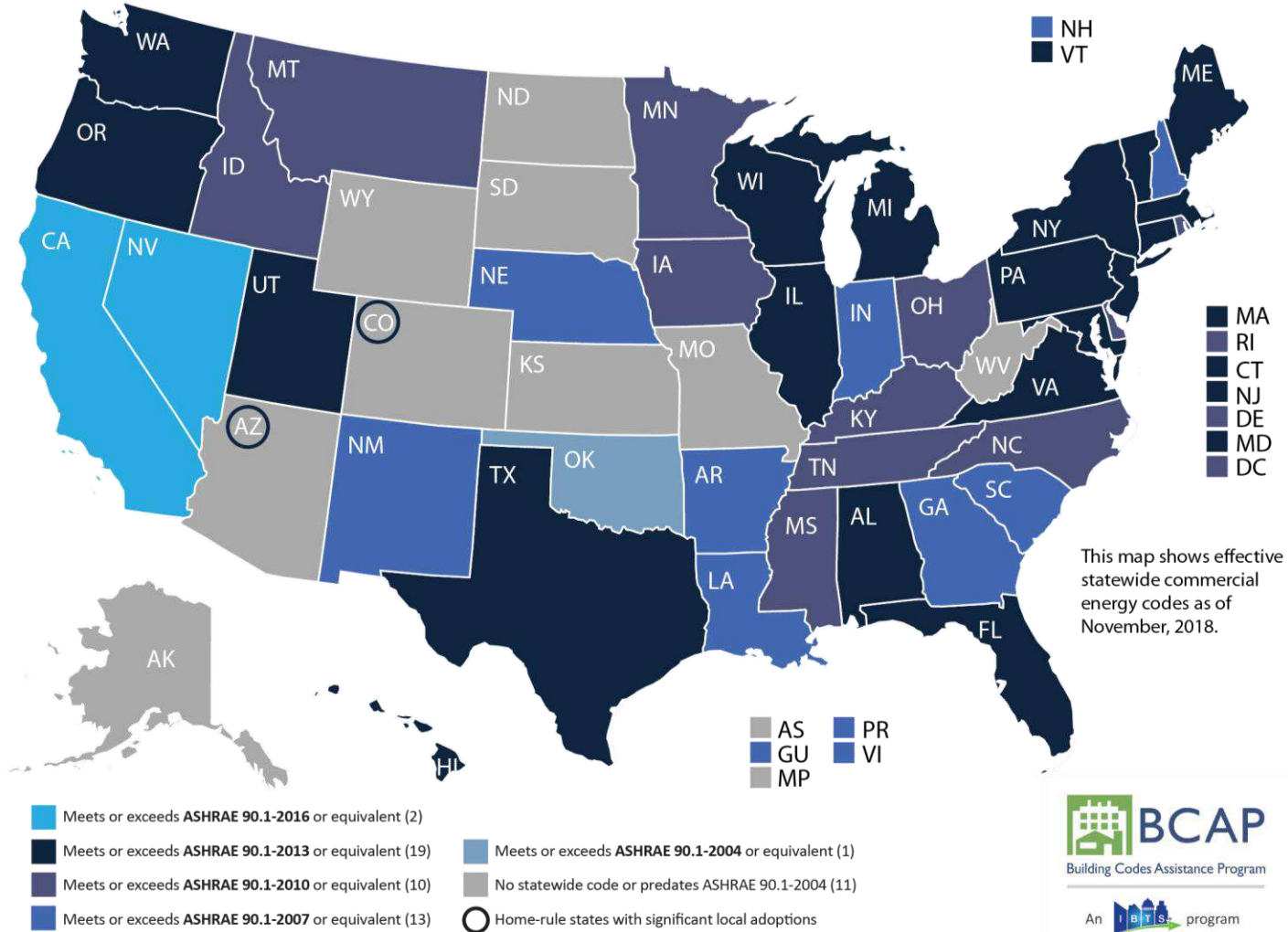
Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Learning Objectives

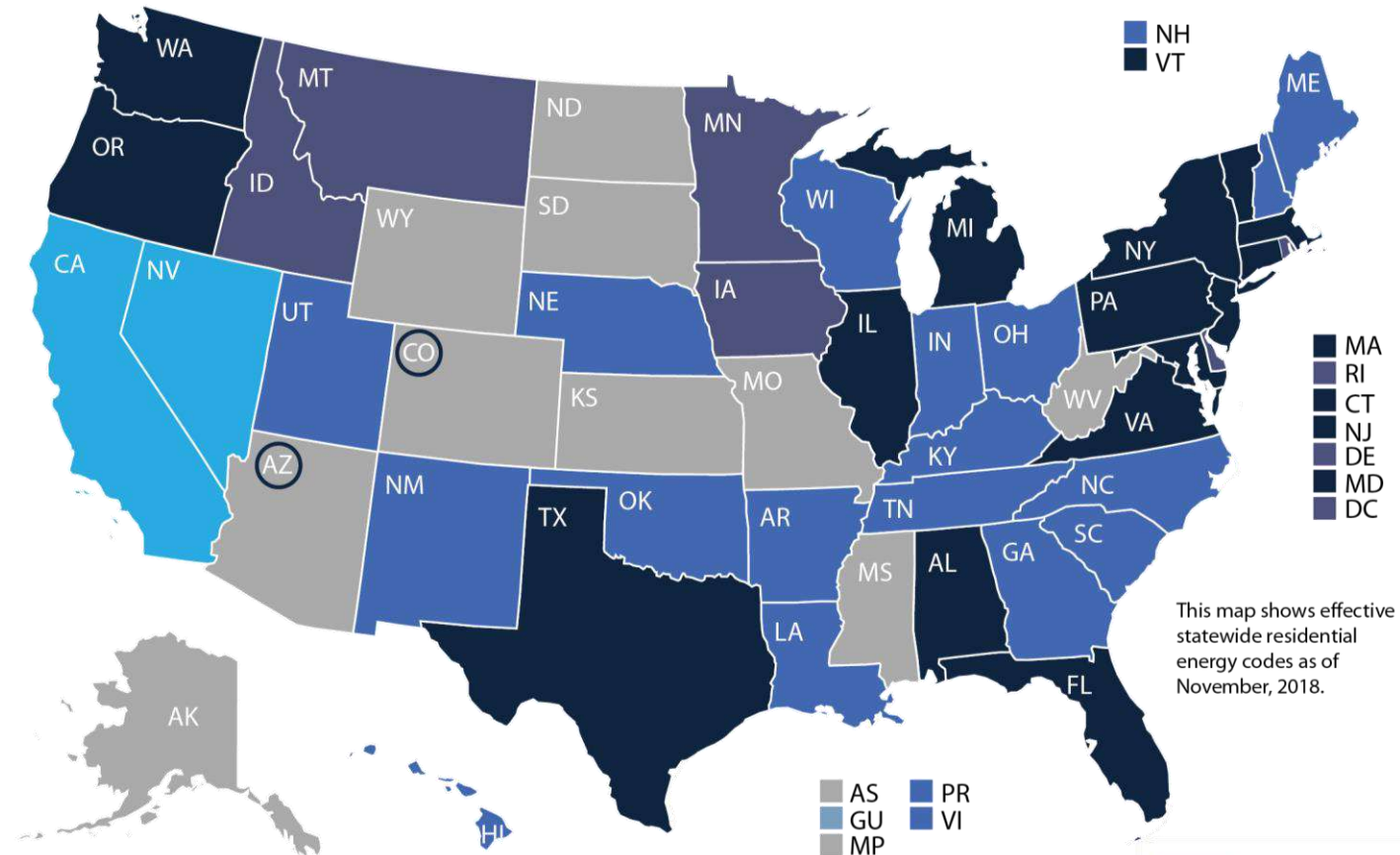
At the end of the this course, participants will be able to:

1. Understand the varied and complex issues associated with building energy codes.
2. Compare lighting and lighting control requirements for IECC, ASHRAE 90.1, and Title 24, Part 6 and how they have changed in the most recent versions.
3. Understand what the DesignLights Consortium (DLC) Networked Lighting Controls program is and the role it plays in the commercial market.
4. Identify how to easily select, plan, and implement solutions to design a code compliant system.

Commercial Energy Code Adoption



Residential Energy Code Adoption



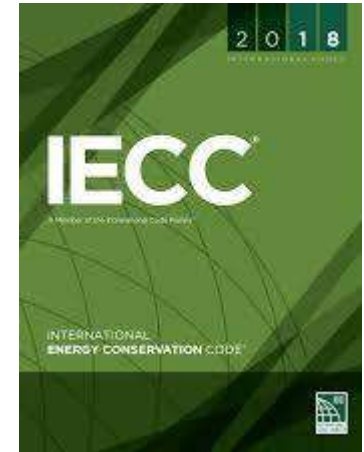
- Meets or exceeds the 2018 IECC or equivalent (2)
- Meets or exceeds the 2015 IECC or equivalent (17)
- Meets or exceeds the 2012 IECC or equivalent (8)
- No statewide code or precedes the 2006 IECC (12)
- Home-rule states with significant local adoptions



IECC

International Energy Conservation Code (IECC)

- Developed by the International Code Council
- To provide the highest quality codes, standards, products and services for all concerned with the safety and performance of the built environment
- Updated every three years
- Latest version is 2018
- Adoption ranges from 2009-2018
- 2015 is currently adopted through most of the Northeast, including NY
- Changes driven primarily because of improved efficacy of LED lighting and LED as the basis of design



What Changed in 2018 IECC from 2015?

- Commercial Lighting
 - Luminaire level lighting control option
 - Track lighting demand reduction
 - Interior lighting power limit changes
 - Interior lighting power limit exceptions
 - Exterior lighting power limit changes

Luminaire Level Lighting Controls (LLLC)

- C405.2 Lighting controls
- Lighting must use system control or luminaire level lighting controls
- Controls must monitor occupancy and ambient light
- Control system must include multiple setpoints and zoning
- Exceptions remain for security, emergency, and exit areas



DLC Networked Lighting Controls Qualified Products List (QPL)

“Required” Interior System Capabilities

The following capabilities must be available in all systems to be listed on the DLC Networked Lighting Controls QPL

- Networking of luminaires and devices
- Occupancy sensing
- Daylight harvesting / photocell control
- High-end trim
- Zoning
- Luminaire and device addressability
- Continuous dimming

“Reported” Interior System Capabilities

Systems are not required to include the following capabilities, but the DLC will report on the presence or absence of each reported capability for all systems listed on the QPL

- Type of user interface
- Luminaire integration
- Localized processing/distributed intelligence
- Scheduling
- Personal control
- Load shedding (DR)
- Plug load control
- BMS/EMS/HVAC integration
- Energy monitoring
- Device monitoring/remote diagnostics
- Operational and standby power

Track Lighting Demand Reduction

- C405.3.1
- Connected lighting power is the specified wattage of the luminaires, but not less than 8W per linear foot
- Reduction from 30W



Interior Lighting Power Limit Changes

C405.3.2(1) *Partial List*

Building Area Method		
Building Area Type	LPD (w/ft ²) 2015	LPD (w/ft ²) 2018
Automotive facility	0.80	0.71
Dining: bar lounge/leisure	1.01	0.90
Dining: cafeteria/fast food	0.79	0.79
Exercise center	0.84	0.65
Fire station	0.67	0.53
Health care clinic	0.90	0.82
Hospital	1.05	1.05
Hotel/motel	0.87	0.75
Library	1.19	0.78
Museum	1.02	1.06
Office	0.82	0.79
Parking garage	0.21	0.15

C405.3.2(2) *Partial List*

Space-By-Space Method		
Common Space Types	LPD (w/ft ²) 2015	LPD (w/ft ²) 2018
Office: Enclosed	1.11	0.93
Office: Open plan	0.98	0.81
Lounge/breakroom	0.78	0.62
Restroom	0.98	0.85
Storage room	0.63	0.46
Library reading area	1.06	0.82
Library stacks	1.71	1.20
Sales area	1.59	1.22
Retail dressing room	0.71	0.50
Retail mall concourse	1.10	0.90

Allowance Calculation Example

- Library 100' x 200'
 - Reading area: 5,000 square feet
 - Stacks: 15,000 square feet
- Building Area Method
 - $20,000 \times 0.78 = 15,600 \text{ w/ft}^2$ (23,800 w/ft² 2015)
- Space-by-Space Method
 - Reading area: $5,000 \times 0.82 = 4,100 \text{ w/ft}^2$
 - Stacks: $15,000 \times 1.20 = 18,000 \text{ w/ft}^2$
 - Total 22,100 w/ft² (30,950 w/ft² 2015)



Interior Lighting Power

Interior Lighting Power Limit Exceptions

- The following are excluded from interior load calculations
 - TV broadcast lighting
 - Emergency lighting that is off during normal operation
 - Exit signs
 - Lighting for occupants with special needs including visual impairment
 - Casino gaming areas
 - Mirror lighting in dressing rooms
 - Task lighting for medical or dental purposes
 - Display lighting for galleries, museums, and monuments
 - Lighting for theatrical purposes
 - Lighting for photographic purposes
 - Lighting integral to equipment installed by manufacturer
 - Task lighting for plant growth
 - Food warming
 - Lighting equipment for sale
 - Advertising or directional signage

Additional Interior Lighting Power

- C405.3.2.2.1
- Lighting equipment installed in sales areas to highlight merchandise
- Equation 4-11:

$$1000W + (\text{Retail Area 1} \times 0.45 \text{ w/ft}^2) + (\text{Retail Area 2} \times 0.45 \text{ w/ft}^2) + (\text{Retail Area 3} \times 1.05 \text{ w/ft}^2) + (\text{Retail Area 4} \times 1.87 \text{ w/ft}^2)$$

- Retail Area 1: The floor area for all products not listed in Retail Area 2, 3, or 4
- Retail Area 2: The floor area used for the sale of vehicles, sporting goods, and small electronics
- Retail Area 3: The floor area used for the sale of furniture, clothing, cosmetics, and artwork
- Retail area 4: The floor area used for the sale of jewelry, crystal, and china

Exterior Lighting Power Limit Changes

- C405.4
- Exterior lighting power requirements
 - The sum of the base plus the individual areas that are to be illuminated as specified in Table C405.4.2(2) using the zones found in Table C405.4.2(1)



Zone	2018 IECC Table C405.4.2(1) Description
1	National & State Parks, forest land, rural areas
2	Predominantly residential zoning, neighborhood business district, light industrial with limited night-time use, residential mixed use areas
3	All other areas
4	High activity commercial in major metropolitan areas designated by the local land use planning authority

Exterior Lighting Power Limit Changes

C405.4.2(2)

Lighting power allowances for building exteriors

Exterior Allowance	Zone 1	Zone 2	Zone 3	Zone 4
Base Allowance	350 W	400 W	500 W	900 W
Parking areas/drives	0.03 w/ft ²	0.04 w/ft ²	0.06 w/ft ²	0.08 w/ft ²
Walkways <10' wide	0.5 w/ft ²	0.5 w/ft ²	0.6 w/ft ²	0.7 w/ft ²
Walkways >10' wide	0.1 w/ft ²	0.1 w/ft ²	0.11 w/ft ²	0.14 w/ft ²
Dining areas	0.65 w/ft ²	0.65 w/ft ²	0.75 w/ft ²	0.95 w/ft ²
Stairways	0.6 w/ft ²	0.7 w/ft ²	0.7 w/ft ²	0.7 w/ft ²
Entry canopies	0.2 w/ft ²	0.25 w/ft ²	0.4 w/ft ²	0.4 w/ft ²
Open sales lots	0.2 w/ft ²	0.2 w/ft ²	0.35 w/ft ²	0.5 w/ft ²

C405.4.2(3)

Individual lighting power allowances for building exteriors for specific applications

	Lighting Zones			
	Zone 1	Zone 2	Zone 3	Zone 4
ATM teller machines	135W per location plus 45W per additional ATM per location			
Uncovered entrances and gatehouse inspection stations	0.5 w/ft ² of area			
Drive up windows and doors	200W per drive through			
Parking near 24-hour retail entrances	400W per main entry			



Exterior Lighting Power Limit Exceptions

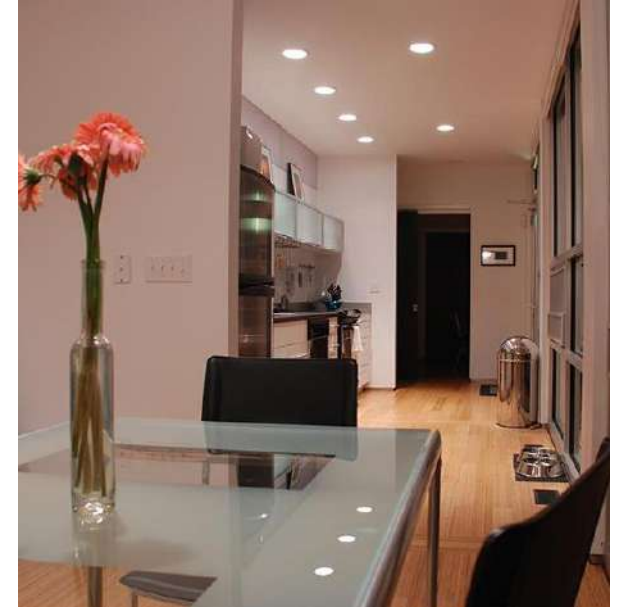
- The following are excluded from exterior load calculations
 - Lighting approved because of safety considerations
 - Emergency lighting that is off during normal operation
 - Exit signs
 - Specialized signal, directional, and marker associated with transportation
 - Advertising and directional signage
 - Integral to equipment and installed by manufacturer
 - Theatrical purpose lighting
 - Athletic playing areas
 - Temporary lighting
 - Industrial production, material handling, transportation sites, and associated storage areas
 - Theme elements in theme/amusement parks
 - Used to highlight features of art, monuments, and national flag
 - Lighting for water features and swimming pools
 - Lighting controlled within dwelling units complying with R404.1



Photo credit: nyclovesnyc.blogspot.com

Residential Lighting Increase in Efficacy

- R404.1
- Not less than 90% of the permanently installed lighting fixtures shall contain only high-efficacy lamps
- Increase from 75% in 2015
- High-efficacy:
 - Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with a minimum efficacy of not less than:
 - 60 lumens per watt for lamps over 40 watts
 - 50 lumens per watt for lamps over 15 watts to 40 watts
 - 40 lumens per watt for lamps 15 watts or less



What Changed in 2015 IECC and 2018 IECC?

2015 IECC

Lighting Control Changes

- Occupancy sensors required in more areas
- Specific controls for warehouse applications
- Addition of light reduction controls
- Daylight responsive controls
- Exterior controls
- Functional testing (commissioning)

2018 IECC

Lighting Control Changes

- Auto-OFF for occupancy sensors changed from 30 to 20 minutes
- Manual-ON / Auto-ON to no more than 50% of full-ON
- Separate lighting controls for open offices
- Additional occupancy sensor control areas

Automatic Time Switch Controls

- **Automatic Time Switch Controls** required for all areas not controlled by occupancy sensors
 - Relay panels work well for this
- **General occupancy sensor controls:**
 - **Auto-OFF within 20 minutes** of occupants leaving space
 - **Manual-ON** or **Auto-ON to no more than 50% of full-ON**
 - **Must** incorporate a **manual control that allows occupants to turn lights OFF** in readily accessible areas
- **Warehouse occupancy sensor controls:**
 - **Automatically reduce** lighting power by not less than **50% in aiseways**
 - **Must** control lighting in **each aisleway independently** and not control lighting beyond the aisleway
- Occupancy sensors must be installed in:
 - Classrooms/**lecture/training rooms**
 - Conference rooms/**meeting rooms**
 - Copy/print rooms
 - Employee lunch and break rooms
 - **Enclosed offices**
 - Janitor closets
 - **Locker rooms**
 - Lounges
 - **Open plan office areas**
 - Private offices
 - Restrooms
 - Storage rooms
 - Warehouses
 - All other spaces 300 SF and less enclosed by floor to ceiling height partitions

Light Reduction Controls

- **Light reduction controls:**
 - **Manual** control to reduce connected lighting load **at least 50%**
- **Can control:**
 - All lamps – dimming
 - Dual switching
 - Inboard/outboard switching
 - Controlling each fixture or lamp independently
- **Not required** in daylight zones **with daylight responsive controls**



Daylight Responsive Controls

- Required in spaces where **more than 150W of lighting** is installed in the **toplit or sidelit zones**
- Toplit zones **controlled independent** of lights in sidelit zones
- Controls must be **configured to be calibrated from within** the controlled space
- **Calibration** must be **readily accessible**
- In **offices, classrooms, labs, and library reading rooms** controls shall dim lights continuously from full power to **15% of full light output**
- Must be **capable of full shutoff** of all controlled lights
- Daylight zones in **different orientations** (i.e. N, S, E, W) must be **controlled separately**
- May be **controlled together if 150W or less**



Exterior Lighting Controls

- **Automatically turn off** lighting as function of **available daylight**
- **Building façade** lighting to be **controlled via dusk/dawn** and a **set opening and closing time**
- Any **other lighting** shall have controls **configured to reduce** connected lighting power by **not less than 30%** **from:**
 - Midnight to 6:00am
 - 1 hour of business closing to 1 hour of business opening
 - Any time space is unoccupied for more than 15 minutes

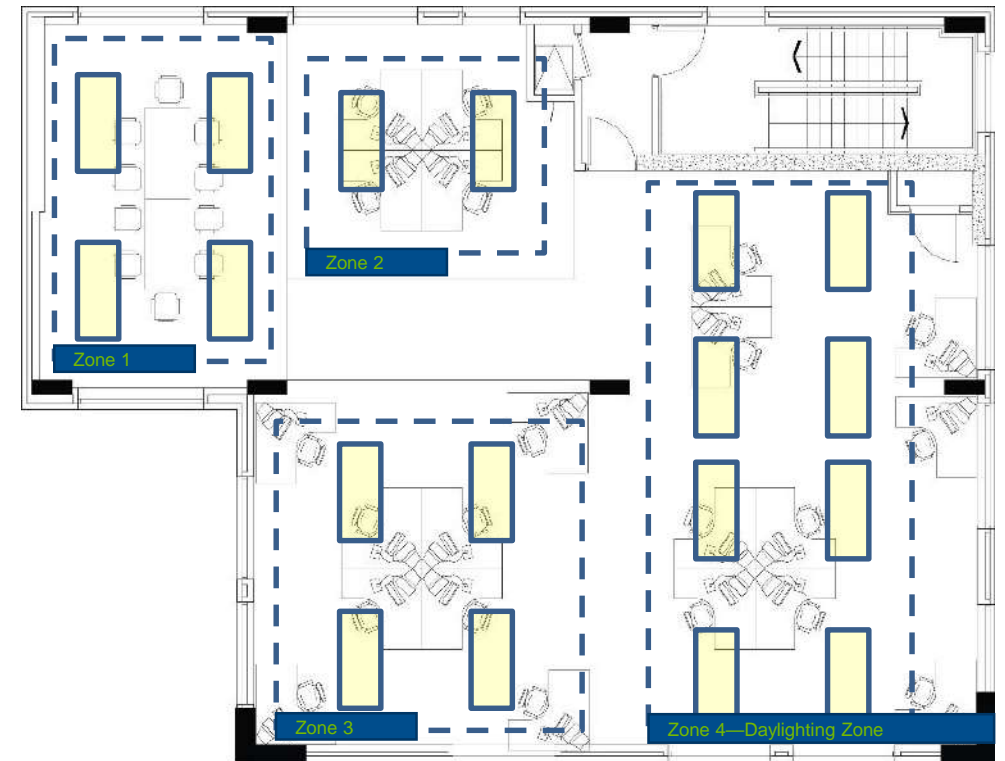


Additional Efficiency Options

- Must comply with at least one of the following:
 - More efficient HVAC performance
 - Reduced lighting power density
 - Enhanced lighting controls
 - On-site supply of renewable energy
 - Dedicated outdoor air system
 - High efficiency water heating

Enhanced Digital Lighting Controls

- System **must include** the following:
 - Luminaires capable of **continuous dimming**
 - Luminaires capable of **being addressed individually** or via a **group of not more than 4** luminaires
 - **Not more than 8 luminaires** shall be controlled together in a **daylight zone**
 - Fixtures to be **controlled through a digital control system** that includes the following function:
 - Control reconfiguration based on **digital addressability**
 - **Load shedding**
 - **Individual user control** of overhead general illumination in **open offices**
 - **Occupancy sensors** shall be capable of being reconfigured through the **digital control system**
 - Must provide **sequence of operation** including specification of outlining each of the functions of digital control system



Specific Application Controls

- **Hotel and motel sleeping units**
 - **Master control devices** capable of capable of automatically switching off all installed luminaires and switched receptacles **within 20 minutes** of occupants leaving the room
- **EXCEPTIONS**: lighting and switch receptacles controlled by capacitive key systems **and spaces where patient care is provided**
- **Permanently installed luminaires** within **dwelling units** to have controls complying with **C405.2.1.1** or **C405.2.2.2**
- Nonvisual applications, plant growth and food warming shall be **controlled via automatic time-switch control**



Separately controlled

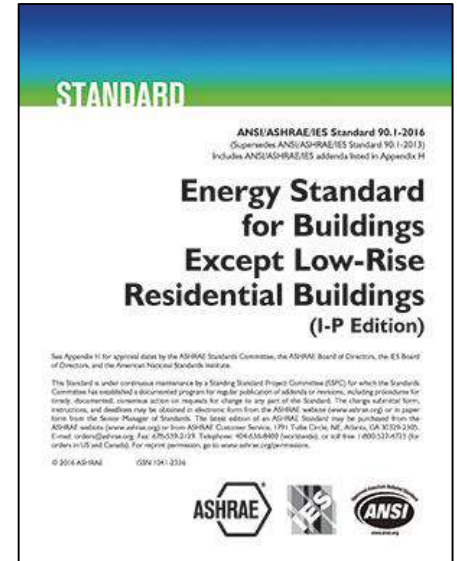


Master switch at entry

ASHRAE 90.1

ANSI/ASHRAE/IES Standard 90.1

- Developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers and the Illuminating Engineering Society
- This standard provides the minimum requirements for energy-efficient design of most buildings, except low-rise residential buildings.
- Updated every three years
- Latest version is 2016
- Adoption ranges from 2004-2016
- 2013 is currently adopted through most of the Northeast, including NY
- Changes driven primarily because of improved efficacy of LED lighting and LED as the basis of design



What Changed in 2016 IECC from 2013?

- Commercial Lighting
 - Exterior lighting power limit changes
 - Dwelling unit efficacy increase
 - Interior lighting power limit changes

Exterior Lighting Power Limit Changes

- Section 9.4.2-2
- Individual lighting power allowances for building exteriors
- Reduced from 2013 by about 30%
- Aligns with IECC 2018



	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Uncovered loading areas for emergency service vehicles	No allowance	0.35 w/ft ²			
Uncovered entrances and gatehouse inspection stations	No allowance	0.5 w/ft ²			
Drive up windows and doors	No allowance	200W per drive through			
Parking near 24-hour retail entrances	No allowance	400W per main entry			

Dwelling Unit Efficacy Increase

- Section 9.4.4
- Not less than 75% of the permanently installed lighting fixtures shall use lamps with an efficacy of at least 55 lm/W or have luminaire efficacy of at least 45 lm/W
- New section
- 90% in IECC 2018
- Exception: Lighting that is controlled with dimmers or automatic control devices



Photo credit: B. Lively Images

Additional Interior Lighting Power

- Section 9.6.2
- Lighting equipment installed in sales areas to highlight merchandise
- Allowances reduced about 25%
- Aligns with IECC 2018 except Retail Area 4 at 1.87 w/ft²

$$1000W + (\text{Retail Area 1} \times 0.45 \text{ w/ft}^2) + (\text{Retail Area 2} \times 0.45 \text{ w/ft}^2) + (\text{Retail Area 3} \times 1.05 \text{ w/ft}^2) + (\text{Retail Area 4} \times 1.88 \text{ w/ft}^2)$$

- Retail Area 1: The floor area for all products not listed in Retail Area 2, 3, or 4
- Retail Area 2: The floor area used for the sale of vehicles, sporting goods, and small electronics
- Retail Area 3: The floor area used for the sale of furniture, clothing, cosmetics, and artwork
- Retail area 4: The floor area used for the sale of jewelry, crystal, and china



Interior Lighting Power Limit Changes

Table 9.5.1

Lighting Power Density
 Reduced 12% on average
 Aligns with IECC 2018
Partial List

Building Area Method		
Building Area Type	LPD (w/ft ²) 2013	LPD (w/ft ²) 2016
Automotive facility	0.80	0.71
Dining: bar lounge/leisure	1.01	0.90
Dining: cafeteria/fast food	0.90	0.79
Exercise center	0.84	0.65
Fire station	0.67	0.53
Health care clinic	0.90	0.82
Hospital	1.05	1.05
Hotel/motel	0.87	0.75
Library	1.19	0.78
Museum	1.02	1.06
Office	0.82	0.79
Parking garage	0.21	0.15

Interior Lighting Power Limit Changes

Table 9.6.1

Lighting Power Density

Reduced 26% on average

Aligns mostly with IECC 2018

Partial List

Space-By-Space Method		
Common Space Types	LPD (w/ft ²) 2015	LPD (w/ft ²) 2018
Office: Enclosed	1.11	0.93
Office: Open plan	0.98	0.81
Restroom	0.98	0.85
Storage room < 50 sf²	1.24	0.97
Storage room ≥ 50 sf ²	0.63	0.46
Library reading area	1.06	0.82
Library stacks	1.71	1.20
Sales area	1.44	1.22
Retail dressing room	0.71	0.50
Retail mall concourse	1.10	0.90

What Changed in ASHRAE 90.1 2013 and 2016?

2013 ASHRAE 90.1

Lighting Control Changes

- Switching of receptacles – more areas
- Energy monitoring
- Primary and secondary daylight zones
- Reduced timeout settings
- Scheduled shut-off
- Control Table 9.6.1 shows required controls for each space type
- Functional testing
- Electrical energy monitoring

2016 ASHRAE 90.1

Lighting Control Changes

- Warehouses
- Exterior lighting control
- Electrical energy monitoring

Occupancy Sensing Control

- Occupancy sensors must be installed in:
 - Classrooms
 - Conference rooms
 - Break rooms
 - Private offices
 - Restrooms
 - Storage rooms
 - Office spaces up to 250 SF



Receptacle Control

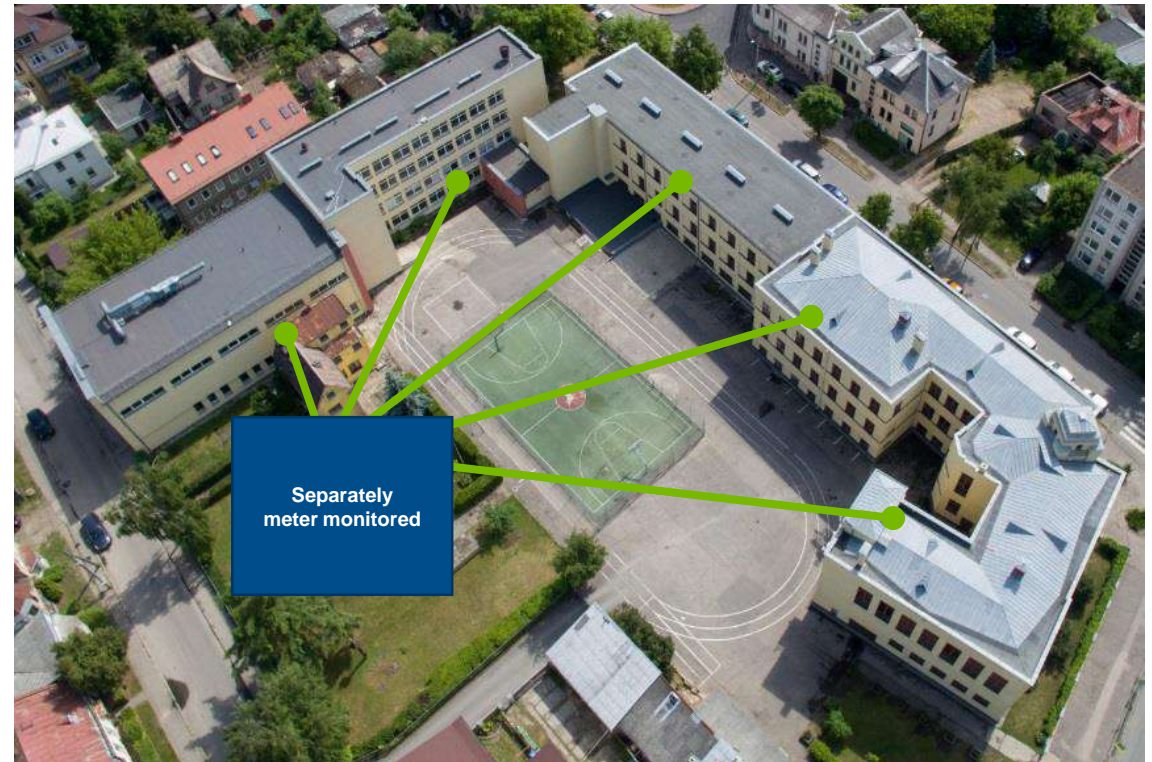
- **At least 50% of receptacles** in:
 - Private offices
 - Conference rooms
 - Printing/copy rooms
 - Classrooms
 - Individual workstations
 - 25% of branch circuit feeders installed for modular furniture
- **Turned off via:**
 - **Time of day**
 - **Occupancy sensor**—off after **20 minutes** when space is unoccupied
 - **Signal from another control system**—off after **20 minutes** when space is unoccupied



50% of receptacles: controlled and 50% of receptacles: non-controlled

Energy Monitoring

- **Measurement devices** must be **installed** in new buildings to monitor energy use for **each of the following separately**:
 - Total Energy
 - HVAC Systems
 - Interior Lighting
 - Exterior Lighting
 - Receptacle Circuits
- Recorded every 15 minutes and reported at least hourly, daily, monthly.
- Data must be maintained for 36 months and made available for each tenants



Space Control Requirements

- Used in space types listed in table 9.6.1
 - **Local Control** – manual-ON/OFF
 - Restricted **Manual-ON**
 - Restricted **Partial-ON – auto on to 50%**
 - **Bi-Level Control** – step between 30% and 70%
 - **Automatic Daylight** Controls
 - **Automatic Partial-OFF** – reduce **to 50%** unoccupied
 - **Automatic Full-OFF**
 - **Scheduled Shutoff**
- **Partial Auto-ON Restriction— Revision**
 - **Exception was added** to requirement for **manual-ON OR partial auto-ON** to accommodate advanced lighting controls for added energy savings
 - **Open-plan office space** lighting **allowed** to turn on **automatically to more than 50%** (i.e. full auto-ON)
 - **Exception limits** control zones to **600 SF** to preserve savings

Daylighting Controls

- **Reduce** the lighting power in **response to available daylight**
 - **Continuous** Dimming
 - At least **one control step** between **50% and 70%**, **20% and 40%**, and **off**
- Now have **primary and secondary daylight** zones
 - Required for:
 - **Sidelit areas with 150W** or greater installed in **primary zone**
 - **Sidelit areas with 300W** or greater installed in **primary and secondary zone**
 - **Primary and secondary** zones to be **controlled separately**
 - **Toplit** areas with **150W**



Daylight zone: adjacent to vertical windows



Daylight zone: under skylights

Exterior Lighting Controls

- Turn lights off when sufficient daylight is available
- Façade and landscape lighting to be automatically turned off during specified times of day
- Advertising signage power to be reduced by 30% during specified times or when area is unoccupied
- Exterior Lighting Controls—Revision
 - Requirements to reduce exterior lighting power by 30%
 - During periods not occupied
 - OR
 - After business hours in exterior applications
 - » AND
 - Parking garages have been increased to 50%

Parking Garage and Specific Parking Lighting

- Parking Garage Controls

- Must reduce lighting power by 30% when unoccupied for 20 minutes
- Covered vehicle entrance and exit
 - automatically reduce lighting by 50% from sunset to sunrise
- Perimeter fixtures must be controlled in response to daylight

- Specific Parking Lighting Control

- Parking areas with poles 24 feet or less
- Lights greater than 78 Watts
- Requirement . . .
 - Lights must automatically reduce power of each luminaire by at least 50% when no activity is detected in the area for 15 minutes or less
 - Limited to 1500 Watts of lighting controlled together

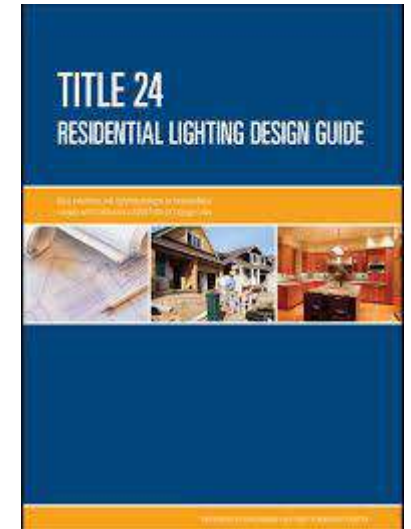
Functional Testing

- Lighting control devices and controls systems shall be **tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition** in accordance with the construction documents and manufacturer's installation instructions.
- When occupant sensors, time switches, programmable schedule controls, or photosensors are installed, at a **minimum, the following shall be performed**:
 - **Confirm** that the **placement, sensitivity**, and **time-out** adjustments for occupancy sensors yield acceptable performance, lights turn off only after space is vacated and do not turn on unless space is occupied
 - **Confirm** that the **time switches** and **programmable schedule controls** are programmed to turn lights off
 - **Confirm** that **photosensor controls** reduce electric light levels based on **amount of usable daylight** in space
- The **construction documents** shall state the party **who will conduct and certify the functional testing**
- The **party responsible** shall **not be directly involved** in either the **design or construction** of the project

CALIFORNIA TITLE 24, PART 6

California Title 24, Part 6

- Developed by the California Energy Commission
- This standard is a response to a legislative mandate to reduce California's energy consumption initiated in 1978
- Includes residential and non-residential requirements
- Updated every three years
- Latest version is 2016
- Changes driven primarily because of improved efficacy of LED lighting and LED as the basis of design



California Title 24 Non-Residential Changes

- Reduction to indoor lighting power density values
- Reduction to outdoor lighting power density values

Reduction to Indoor Lighting Power Density Values

Table 140.6-C

Lighting Power Density
Area Category Method
Aligns with 90.1-2013

Partial List

Primary Function Area	Allowed Lighting Power Density (W / ft ²)		
	2016	Δ	
Auditorium Area	1.4 ³	↓ 0.1	
Convention, Conference, Multipurpose and Meeting Center Areas	1.2 ³	↓ 0.2	
Dining Area	1.0 ³	↓ 0.1	
Electrical, Mechanical, Telephone Rooms	0.55 ²	↓ 0.15	
Exhibit, Museum Areas	1.8	↓ 0.2	
Financial Transaction Area	1.0 ³	↓ 0.2	
Hotel Function Area	1.4 ³	↓ 0.1	
Kitchen, Food Preparation Areas	1.2	↓ 0.4	
Laundry Area	0.70	↓ 0.2	
Library Area, Reading Areas	1.1 ³	↓ 0.1	
Lobby Area	Hotel Lobby	0.95 ³	↓ 0.15
	Main Entry Lobby	0.95 ³	↓ 0.55
Locker/Dressing Room	0.70	↓ 0.1	
Lounge Area	0.90 ³	↓ 0.2	

Reduction to Outdoor Lighting Power Density Values

Table 140.7-A

Outdoor power allowance update
 Reductions range from 11-56%

Lighting Zone 0 added: undeveloped areas in parks and preserves. (1) max 15W luminaire acceptable at entrances for safety

ATM, tunnel, and bridge lighting is no longer exempt

Type of Power Allowance	Lighting Zone 0	Lighting Zone 1		Lighting Zone 2 ¹		Lighting Zone 3 ¹		Lighting Zone 4	
Area Wattage Allowance (AWA)	No allowance	0.02 W/ft ²	↓42%	0.03 W/ft ²	↓33%	0.04 W/ft ²	↓35%	0.05 W/ft ²	↓56%
Linear Wattage Allowance (LWA)		0.15 W/lf	↓40%	0.25 W/lf	↓44%	0.35 W/lf	↓41%	0.45 W/lf	↓47%
Initial Wattage Allowance (IWA)		340W	No Change	450W	↓11%	520W	↓32%	640W	↓37%

California Title 24 Residential Changes

- Indoor luminaire requirements, all high efficacy
- JA8 high efficacy luminaire definition expansion

Indoor Luminaire Requirements, All High Efficacy

Table 6-1
Summary of
compliant
luminaire types

Recessed
downlights shall
not contain
screw-based
lamps

High Efficacy Luminaires*	JA8 High Efficacy Lighting – Lamps and Light Sources that must be JA8-certified	*Recessed Downlight Luminaires in Ceilings
<ul style="list-style-type: none"> • Pin-based linear fluorescent • Pin-based compact fluorescent • Pulse-start metal halide • High pressure sodium • GU-24 other than LEDs • Inseparable SSL luminaires installed outdoors • Inseparable SSL luminaires with colored light sources for decorative lighting purpose 	<ul style="list-style-type: none"> • Light sources in ceiling recessed downlight luminaires.* • LED luminaires with integral sources • Screw-based LED lamps (A-lamps, PAR lamps, etc.) • Pin-based LED lamps (MR-16, AR-111, etc.) • GU-24 based LED light source • Any source or luminaire not listed elsewhere on this table 	<ul style="list-style-type: none"> • Shall not have screw based sockets • Shall contain JA8-certified light sources • Shall meet all performance requirements in §150.0(k)1C

Indoor Luminaire Requirements, JA8

Table 6-6: JA8

Performance requirements

Must be certified to the CEC

Will not increase in 2019

Partial List

Specification	Requirement
Initial Efficacy	≥ 45 lumens/Watt
Power Factor at Full Rated Power	≥ 0.90
Correlated Color Temperature (CCT)	For inseparable SSL luminaires, LED light engines and GU24 LED lamps, ≤4000 Kelvin. For all other sources, ≤3000 Kelvin.
Color Rendering Index (CRI)	≥90
R9	≥50
Rated Life	≥ 15,000 hours
Minimum Dimming Level	≤ 10%
Flicker	< 30% for frequencies of 200 Hz or below, at 100% and 20% light output.

Indoor residential luminaire lighting requirements

Chart courtesy CLTC UC Davis

Mandatory Measure	Screw-Base Luminaire	Pin-Base ¹ Luminaire	Recessed Downlight	Inseparable SSL ⁵ Luminaire (LED)	Night Lights ²	All Other
High Efficacy (required)	Yes—All	Yes—All	Yes—All	Yes—All	No	Yes—All
High Efficacy Qualification via JA8 lamps and luminaires³	All, excluding hard-wired ballasted HID	Only GU-24 LED lamps	All types, and certified compliant for elevated temperatures	All, except colored-decorative	No	All types
Automatic Qualification as High Efficacy: Listed in Table 150.0-A, Column 1 (JA8 compliance not required)	Hard-wired, ballasted HID only	All types, excluding GU-24 LED	None	Colored-decorative	No	None
Dimmer, Vacancy Control or EMCS⁴	Yes—All	Not mandatory, except for GU-24 LED	Yes—All	All, except colored-decorative	No	All
Other Requirements	Cannot be a recessed downlight	Must use an electronic ballast	Airtight, IC-rated and maintenance per § 150(k)1.C	None	Must consume 5W or less	None

¹ Excludes recessed downlights

² Permanently installed or integral to luminaire or exhaust fan

³ Enclosed luminaires must use JA8 lamps certified for use at elevated temperatures

⁴ Excludes luminaires in closets less than 70ft² and hallways

⁵ Solid-state lighting such as LED where the LED source is permanently attached to the luminaire

What Changed in 2016 and 2019 Title 24, Part 6?

2016 Title 24, Part 6

Lighting Control Changes

- Shut-Off Controls
- Manual Space Control
- Automatic Daylight Control
- Multi-Level Area Controls
- Demand Response
- Receptacle Control
- Multi-Level Outdoor Lighting Controls

2019 Title 24, Part 6

Lighting Control Changes

- Hospitality Shut Off Controls
- Automatic Scheduling
- Motion Sensing Controls

QUESTIONS?

This concludes The American Institute of Architects Continuing
Education Systems Course

Thank you for attending

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