

## Designers Lighting Forum

Deciphering Code Updates for IECC and  
ASHRAE 90.1 Lighting and 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

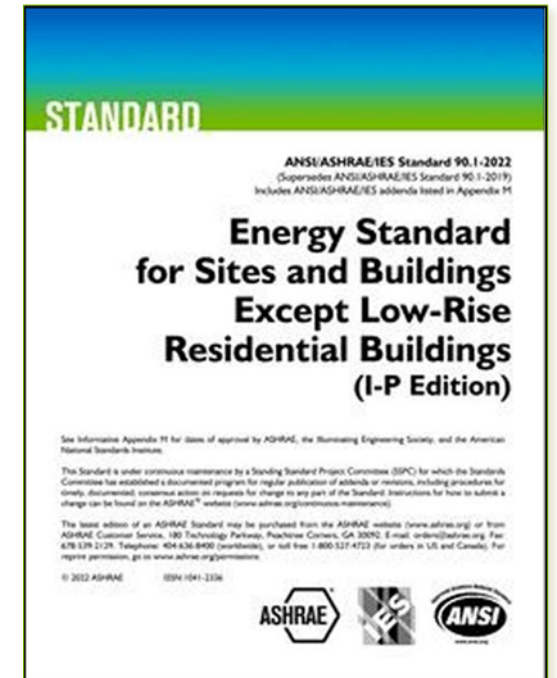
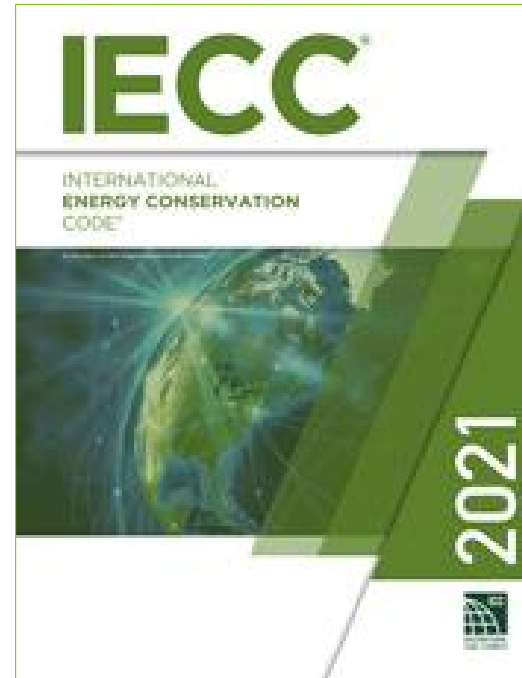
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At the end of this course, participants will be able to:

1. Understand the varied and complex issues associated with building energy codes.
2. Compare lighting and control requirements for IECC and ASHRAE 90.1 and how they have changed in the most recent versions.
3. Gain an understanding of the importance of lighting and control strategies.
4. Identify how to easily select, plan, and implement solutions to design a code compliant system.

# Energy Code and Standard Basics

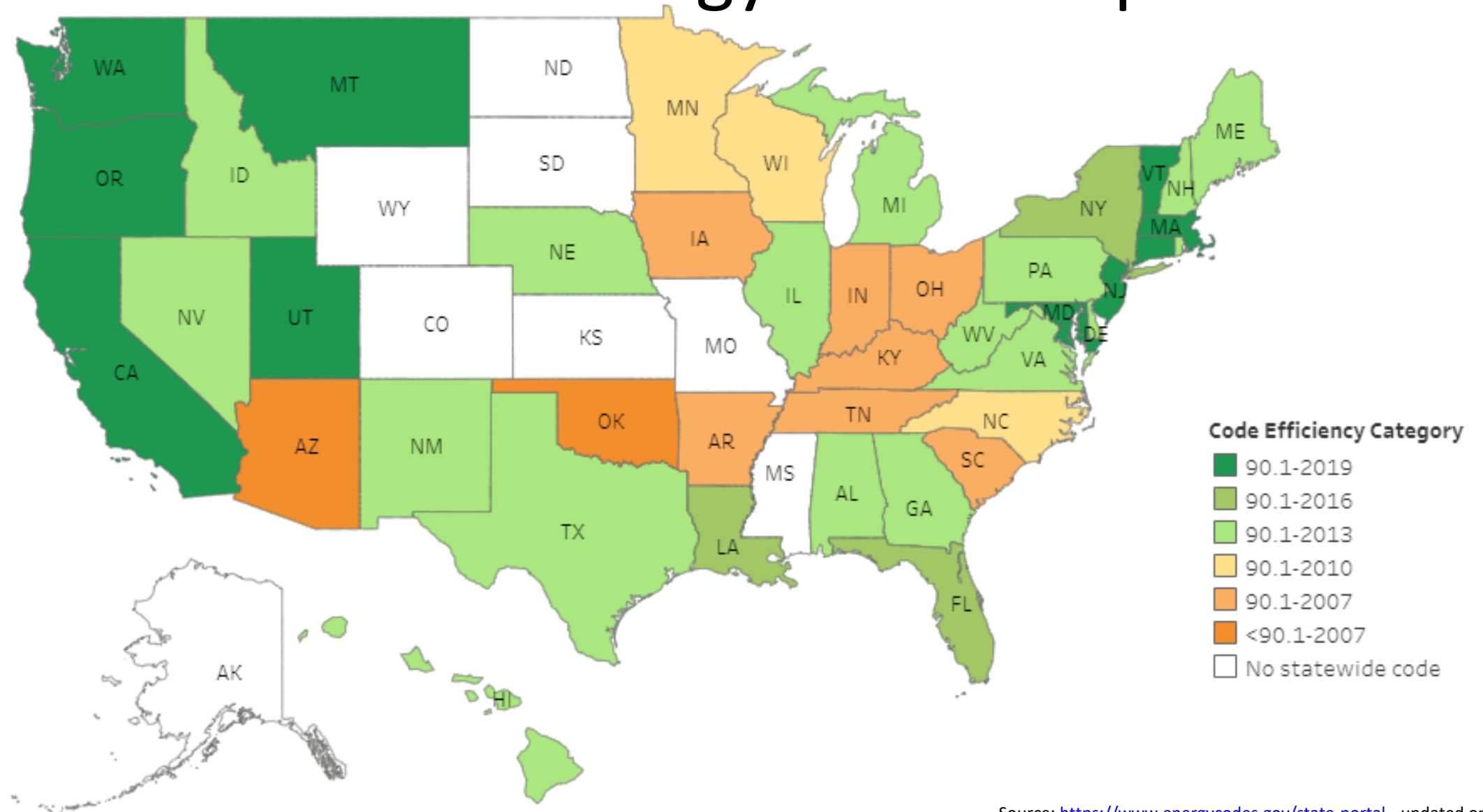
- Code vs Standard
  - A Code is a compilation of building requirements adopted as law by municipalities, e.g. IBC.
  - A Standard is a set of technical definitions, specifications, and guidelines which are referenced in codes and rating systems, e.g. ASHRAE 90.1.
  - Either can be adopted by as state or local municipality and enforced by code inspectors.
  - Check [www.energycodes.gov](http://www.energycodes.gov) and local government websites for adoption and local amendment information.



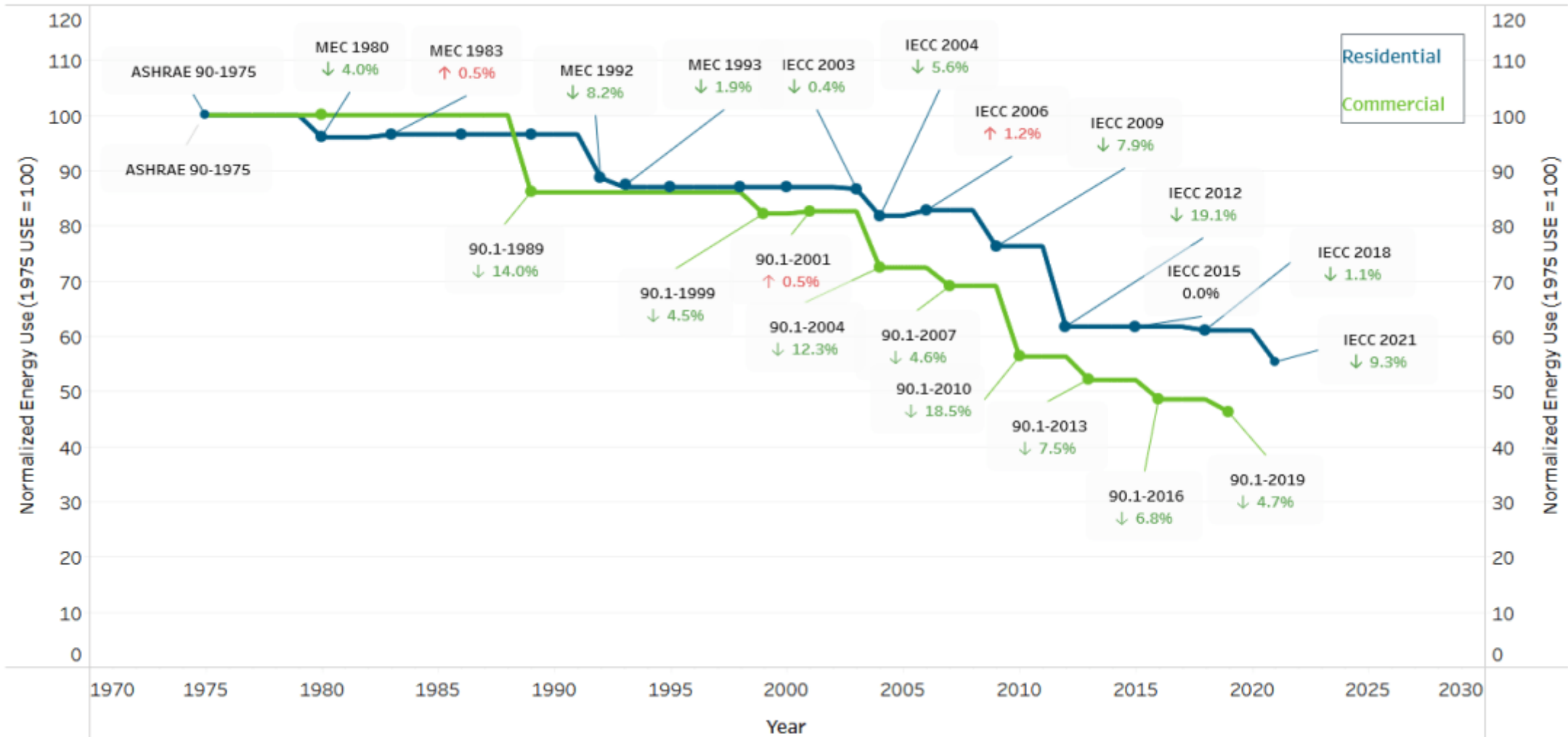
# Energy Codes and Standards

- IECC – International Energy Code
  - Recent adoptions range from 2009 – 2021 Versions
  - 2024 version will be released later this year
- ASHRAE 90.1 – Energy Standard
  - Recent adoptions range from 2007 – 2022 Versions
  - Required for Government/Federal projects

# Commercial Energy Code Adoption



# Estimated Energy Use Improvement



Source: <https://www.energycodes.gov/>

# LIGHTING UPDATES



# Lighting Changes to IECC 2021

- C405.3.2 Lighting power allowance
  - Decreases lighting power allowance for most space types
    - Small/Medium/Large Office
    - Standalone Retail/Strip Mall
    - Primary/Secondary School
    - Outpatient Healthcare/Hospital
    - Small/Large Hotel
    - Non-Refrigerated Warehouse
    - Mid-Rise/High-Rise Apartment

# Interior Lighting Power Limit Changes

## C405.3.2(1) *Partial List*

Building Area Method		
Building Area Type	LPD (w/ft <sup>2</sup> ) 2018	LPD (w/ft <sup>2</sup> ) 2021
Automotive facility	0.71	0.75
Dining: bar lounge/leisure	0.90	0.80
Dining: cafeteria/fast food	0.79	0.76
Fire station	0.53	0.56
Healthcare clinic	0.82	0.81
Hospital	1.05	0.96
Hotel/motel	0.75	0.56
Museum	1.06	0.55
Parking garage	0.15	0.18

## C405.3.2(2) *Partial List*

Space-By-Space Method		
Common Space Types	LPD (w/ft <sup>2</sup> ) 2018	LPD (w/ft <sup>2</sup> ) 2021
Office: Enclosed	0.93	0.74
Office: Open plan	0.81	0.61
Lounge/breakroom	0.62	0.59
Restroom	0.85	0.63
Storage room	0.46	0.38
Sales area	1.22	1.05
Retail mall concourse	0.90	0.82

# Allowance Calculation Example

- Library 100' x 200'
  - Reading area: 5,000 square feet
  - Stacks: 15,000 square feet
- Building Area Method
  - $20,000 \times 0.83 = \mathbf{16,600}$  W (2021)
    - $20,000 \times 0.78 = 15,600$  W (2018)
- Space-by-Space Method
  - Reading area:  $5,000 \times 0.96 = 4,800$  W (2021)
    - $5,000 \times 0.82 = 4,100$  W (2018)
  - Stacks:  $15,000 \times 1.18 = 17,700$  W (2021)
    - $15,000 \times 1.20 = 18,000$  W (2018)
  - Total **22,500** W (2021)
    - 22,100 W (2018)



# Lighting Changes to IECC 2021

- C405.4 Lighting for Plant Growth and Maintenance - *Addition*
  - *Not less than 95 percent of the permanently installed luminaires used for plant growth and maintenance shall have a photon efficiency of not less than 1.6  $\mu\text{mol}/\text{J}$  (micromoles per joule) as defined in accordance with ANSI/ASABE S640.*
  - Measures the number of photons emitted from the luminaires per joule of energy consumed.
  - Minimum efficiency is based on the Conservation Practice Standard Energy Efficient Lighting Systems Code 670 by the U.S. Department of Agriculture (Jan '20).
  - Developed with the American Society of Agricultural and Biological Engineers.



Source: IECC 2021

# Lighting Changes to IECC 2021

- C406 Additional energy efficiency requirements
  - Energy efficiency requirements with new point values
- C406.3 Reduced lighting power
  - Buildings shall comply with Section C406.3.1 or C406.3.2 and dwelling units and sleeping units within the building shall comply with C406.3.3.

# Lighting Changes to IECC 2021

- C406.3.1 Reduced lighting power *by more than ten percent*
  - The total connected interior lighting power calculated in accordance with Section C405.3.1 (equation method) shall be less than 90 percent of the total lighting power allowance in accordance with Section C405.3.2 (Building Area Method or Space-By Space Method).
- C406.3.2 Reduced lighting power *by more than 15 percent*
  - When the total connected interior lighting power calculated in accordance with Section C405.3.1 (equation method) is less than 85 percent of the total lighting power allowance in accordance with Section 405.3.2, additional energy efficiency credits shall be determined based on equation 4-13, rounded to the nearest whole number.

# Lighting Changes to IECC 2021

- C406.3.3 Lamp efficacy
  - Not less than **95 percent of the permanently installed lighting**, excluding kitchen appliance light fixtures, serving dwelling units and sleeping units shall be provided by **lamps with an efficacy of not less than 65 lumens per watt** or **luminaires with an efficacy of not less than 45 lumens per watt**.

# Lighting Changes to IECC 2021

- R202 Definition of high-efficacy light sources
  - Any lamp with an efficacy of not less than 65 lumens per watt, or luminaires with an efficacy of not less than 45 lumens per watt.



# Lighting Changes to IECC 2021

- R404.1.1 Exterior Lighting - *Addition*
  - Connected exterior lighting for **residential buildings** shall comply with Section C405.5.
    - Section C405.5 defines exterior lighting power requirements and now applies to residential buildings.
    - Exceptions:
      - Detached one- and two-family dwellings
      - Townhouses
      - Solar-powered lamps not connected to any electrical service
      - Luminaires controlled by a motion sensor
      - Lamps and luminaires that comply with Section R404.1

# Lighting Changes to ASHRAE/IES 90.1 - 2022

- 9.3.2 Simplified building method of calculating exterior power allowance
  - Office, retail, and school buildings less than 25,000 ft<sup>2</sup>

**Table 9.3.2 Simplified Building Method for Building Exteriors**

Exterior Area Type	Exterior Lighting Power Allowance <sup>a,b</sup>	Controls
All exterior areas		All lighting shall be <i>automatically</i> controlled to shut off the lighting when daylight is available.
Base allowance	200 W	<i>Luminaires</i> shall be turned off or the power reduced by a minimum of 75% during nonoperating hours.
Façade lighting	0.10 W/ft <sup>2</sup>	<i>Luminaires</i> shall be turned off or the power reduced by a minimum of 75% during nonoperating hours.
Roof terraces, special feature areas, walkways, plazas and ramps	0.07 W/ft <sup>2</sup>	<i>Luminaires</i> shall be turned off or the power reduced by a minimum of 75% during nonoperating hours.
Landscape	0.036 W/ft <sup>2</sup>	<i>Luminaires</i> shall be turned off or the power reduced by a minimum of 75% during nonoperating hours.
Entry doors	14 W/linear ft	<i>Luminaires</i> shall be turned off or the power reduced by a minimum of 75% during nonoperating hours.
Stairs	Exempt	No additional controls required.
Parking lots and drives	0.037 W/ft <sup>2</sup>	<i>Luminaires</i> mounted 25 ft or less above <i>grade</i> shall be controlled to reduce the power by at least 50% when no activity is detected for not longer than 15 minutes.
All other areas not listed	0.20 W/ft <sup>2</sup>	<i>Luminaires</i> shall be turned off or the power reduced by a minimum of 75% during nonoperating hours.

# Lighting Changes to ASHRAE/IES 90.1 - 2022

- 9.4.2 Exterior lighting power

- The total exterior lighting power allowance for all exterior applications is the sum of the base site allowance plus the individual allowances for areas that are designed to be illuminated and are permitted in Table 9.4.2-2 for the applicable lighting zone in Table 9.4.2-1.
  - Trade-offs are allowed only among exterior lighting apps listed in “Tradeable Surfaces”.

Table 9.4.2-1 Exterior Lighting Zones

Lighting Zone	Description
0	Undeveloped areas within national parks, state parks, forest land, rural areas, and other undeveloped areas as defined by the <i>authority having jurisdiction</i>
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of <i>residential</i> zoning, neighborhood business districts, light industrial with limited nighttime use and <i>residential</i> mixed use areas
3	All other areas
4	High-activity commercial districts in major metropolitan areas as designated by the local jurisdiction

# Lighting Changes to ASHRAE/IES 90.1 - 2022

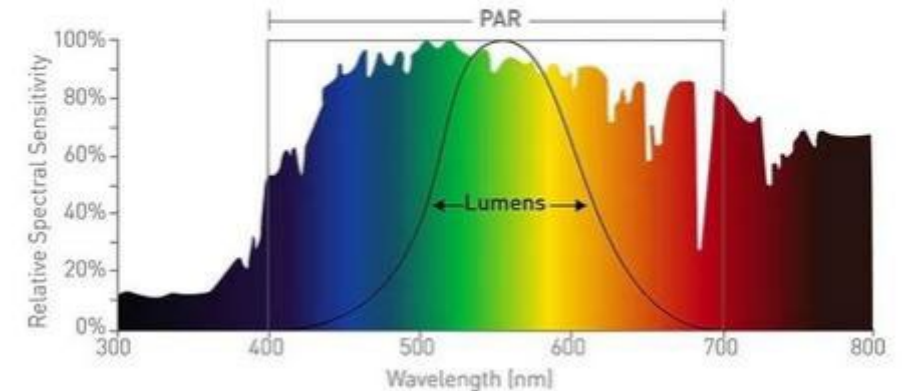
- Table 9.4.2-2 Individual lighting power allowance *reductions* for building exteriors

	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4	Section 9.4.1.4 Required Controls
<i>Building facades</i> (The allowance for each illuminated facade <i>orientation</i> shall be calculated by multiplying the allowable value by the entire <i>facade area</i> or facades length for that <i>orientation</i> .)	No allowance	0.056 /ft <sup>2</sup> of <i>facade area</i> or 1.4 W/linear ft of facade length	0.098 W/ft <sup>2</sup> of <i>facade area</i> or 2.4 W/linear ft of facade length	0.140 W/ft <sup>2</sup> of <i>facade area</i> or 3.4 W/ linear ft of facade length	0.196 W/ft <sup>2</sup> of <i>facade area</i> or 4.8 W/linear ft of facade length	(b) and (c)
Automated teller machines and night depositories	No allowance	90 W per location plus 35 W per additional ATM per location	90 W per location plus 35 W per additional ATM per location	90 W per location plus 35 W per additional ATM per location	90 W per location plus 35 W per additional ATM per location	(b)
Uncovered entrances and gatehouse inspection stations at guarded facilities	No allowance	0.144 W/ft <sup>2</sup>	0.252 W/ft <sup>2</sup>	0.360 W/ft <sup>2</sup>	0.504 W/ft <sup>2</sup>	(b) and either (d) or (e)
Uncovered loading areas for law enforcement, fire, ambulance, and other emergency service vehicles	No allowance	0.104 W/ft <sup>2</sup>	0.182 W/ft <sup>2</sup>	0.260 W/ft <sup>2</sup>	0.364 W/ft <sup>2</sup>	(b) and either (d) or (e)

# Lighting Changes to ASHRAE/IES 90.1 - 2022

- 9.4.4 Horticultural Lighting - *Addition*
  - 9.4.4.1 Luminaires in *greenhouse buildings* with at least 40 kW of connected load for horticultural lighting shall have a photosynthetic photon efficacy (PPE) of at least 1.7  $\mu\text{mol}/\text{J}$  (micromoles per joule).
  - 9.4.4.2 Luminaires in *indoor grow spaces* used for horticultural lighting shall have a PPE of at least 1.9  $\mu\text{mol}/\text{J}$  (micromoles per joule).
    - The metric used for horticultural lighting is Photosynthetic Photon Efficacy (PPE).
    - PPE is based on photosynthesis and includes infrared, visible, and ultraviolet light.
    - The unit of measurement for PPE is micromole ( $\mu\text{mol}$ ) per joule (J).

How Humans and Plants Perceive Light



Source: Hortidaily.com

# Lighting Changes to ASHRAE/IES 90.1 - 2022

- 9.5.1 Building area method compliance path – lighting power density reductions

Building Area Method		
Building Area Type	LPD (w/ft <sup>2</sup> ) 2019	LPD (w/ft <sup>2</sup> ) 2022
Automotive facility	0.75	0.73
Dining: bar lounge/leisure	0.80	0.74
Dining: cafeteria/fast food	0.76	0.70
Fire station	0.56	0.56
Healthcare clinic	0.81	0.77
Hospital	0.96	0.92
Hotel/motel	0.56	0.53
Museum	0.55	0.56
Parking garage	0.18	0.17



# Building Area Change Comparison

## ASHRAE/IES 90.1 – 2022 and IECC 2021

Building Area Method				
Building Area Type	LPD (w/ft <sup>2</sup> ) IECC - 2018	LPD (w/ft <sup>2</sup> ) 90.1 - 2019	LPD (w/ft <sup>2</sup> ) IECC - 2021	LPD (w/ft <sup>2</sup> ) 90.1 - 2022
Automotive facility	0.71	0.75	0.75	0.73
Dining: bar lounge/leisure	0.90	0.80	0.80	0.74
Dining: cafeteria/fast food	0.79	0.76	0.76	0.70
Fire station	0.53	0.56	0.56	0.56
Healthcare clinic	0.82	0.81	0.81	0.77
Hospital	1.05	0.96	0.96	0.92
Hotel/motel	0.75	0.56	0.56	0.53
Museum	1.06	0.55	0.55	0.56
Parking garage	0.15	0.18	0.18	0.17

# Lighting Changes to ASHRAE/IES 90.1 - 2022

- 9.5.2.1-1 Space-by-space method compliance path – lighting power density reductions

Common Space Types <sup>a</sup>	LPD, W/ft <sup>2</sup>	RCR	Local	Manual	Partial	Multilevel	Daylight	Daylight
			Control	ON	Auto ON	Lighting	Response	Response
			9.4.1.1(a)	9.4.1.1(b)	9.4.1.1(c)	9.4.1.1(d)	9.4.1.1(e) <sup>b</sup>	9.4.1.1(f) <sup>b</sup>
<b>Atrium</b>								
<20 ft in height	0.32	NA	REQ	ADD1	ADD1		REQ	REQ
≥20 ft and ≤40 ft in height	0.41	NA	REQ	ADD1	ADD1		REQ	REQ
>40 ft in height	0.51	11	REQ	ADD1	ADD1		REQ	REQ
<b>Audience Seating Area</b>								
Auditorium	0.57	6	REQ	ADD1	ADD1	REQ	REQ	
Gymnasium	0.23	6	REQ	ADD1	ADD1	REQ	REQ	REQ
Motion picture theater	0.27	4	REQ	ADD1	ADD1	REQ		
Performing arts theater	1.10	8	REQ	ADD1	ADD1	REQ		

\*Auditorium was 0.61 w/ft<sup>2</sup> in 2019



# Lighting Changes to ASHRAE/IES 90.1 - 2022

- 9.5.2.2 Additional Lighting Power - *Addition*
  - Additional power for video conferencing per Table 9.5.2.2 Section C

**Table 9.5.2.2 Additional Lighting Power**

Section	Description	Additional Lighting Power	Required Controls
9.5.2.2(a)	Decorative	0.70 W/ft <sup>2</sup>	Section 9.4.1.1(j)
9.5.2.2(b)	Retail sales	750 W + (Retail Area 1 × 0.40 W/ft <sup>2</sup> ) + (Retail Area 2 × 0.40 W/ft <sup>2</sup> ) + (Retail Area 3 × 0.70 W/ft <sup>2</sup> ) + (Retail Area 4 × 1.00 W/ft <sup>2</sup> )	Section 9.4.1.1(j)
9.5.2.2(c)	Video conferencing	0.50 W/ft <sup>2</sup>	See Tables 9.5.2.1-1 and 9.5.2.1-2 space types for required controls.

**Notes:**

Retail Area 1 = the *floor* area for all products not listed in Retail Areas 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

# LIGHTING CONTROL UPDATES

# Energy Code Basics for Lighting Controls

- Automatic Shutoff
  - Occupancy/Vacancy Sensing
  - Time of Day
- Light Reduction
  - Daylight Control
  - Manual Dimming
- Specific Applications
  - Exterior/Parking Garage
    - Daylight
    - Schedules
    - Occupancy
  - Plug Load Control
  - Energy Monitoring

# Lighting Control Requirements – IECC

- Code Sections
  - C405.2 – Lighting Controls
    - **C405.2.1. – Occupancy Sensors**
    - C405.2.2 – Time Switches
    - **C405.2.3 – Light Reduction**
    - **C405.2.4 – Daylight Control**
    - **C405.2.5 – Specific Applications**
    - C405.2.6 – Manual Controls
    - **C405.2.7 – Exterior Controls**
    - **C405.2.8 – Parking Garage**
    - **C405.11 – Receptacle Control**
    - **C405.12 – Energy Monitoring**
  - Control areas are outlined in specific code sections
  - Includes list of areas where occupancy sensors are required

# Lighting Control Requirements – ASHRAE 90.1

- Standard Sections
  - 8.4.2 – Receptacle Control
  - 8.4.3 – Energy Monitoring
  - 9.4.1.1 – Interior Lighting Control
    - A. Local Control
    - B. Restricted to Manual On
    - C. Restricted to Partial Automatic On
    - D. Multi-level Lighting Control
    - E. Automatic Daylighting for Sidelit Areas
    - F. Automatic Daylighting for Toplit Areas
    - G. Automatic Reduction Control
    - H. Automatic Full Off
    - I. Scheduled Shutoff
    - J. Scheduled Off – Non-Business Hours
  - 9.4.1.2 – Parking Garage Lighting Control
  - 9.4.1.3 – Special Applications
  - 9.4.3.2 – Dwelling Units
  - 9.4.3.3 – Exterior Lighting Control
  - **9.4.4.2 – Horticultural Lighting**

# Lighting Control Updates in ASHRAE 90.1 2022

- 9.4.4 Horticultural Lighting
  - Must be controlled by a device that automatically turns the lights off at specific times

# 2021 IECC Updates

## C405.2.1, C405.2.1.1 Occupancy Sensors

- Occupancy sensors shall be installed in the following locations:
  - Classroom/Lecture/Training Rooms
  - Conference/Meeting/Multi-purpose rooms
  - Copy/Print Rooms
  - Lounges/Breakrooms
  - Enclosed Offices
  - Open Plan Office Areas
  - Restrooms
  - Storage Rooms
  - Locker Rooms
  - **Corridors**
  - Warehouse Storage Areas
  - Other spaces 300SF or less enclosed by floor-to-ceiling height partitions
- Occupancy sensor function
  - Auto off after 20 min
  - Manual on or auto on to 50%
  - Must have a manual control to turn lights off
- Exception: Automatic full on with no manual controls permitted for:
  - Corridors
  - Interior parking areas
  - Stairways
  - Restrooms
  - Locker rooms
  - Lobbies
  - Library Stacks
  - Areas where manual operation would endanger occupant safety.

# 2021 IECC Updates

## C405.2.1.3 Corridors

- Occupancy sensors in corridors shall uniformly reduce the lighting power to not more than 50% of full power within 20 minutes of being unoccupied



# 2018 IECC Updates

## C405.2.1.3 Open Office Plan Areas

- If open office area is equal to or greater than 300SF:
  - General lighting – divide into zones of 600SF or less
  - Occupancy sensing controls required in open office plan areas and must control separate zones, dim lighting power and automatically turn lights off after 20 minutes when a space is vacant
    - Exception for general lighting turned off by time switch

# 2021 IECC Updates

## C405.2.3.1 Light Reduction Controls

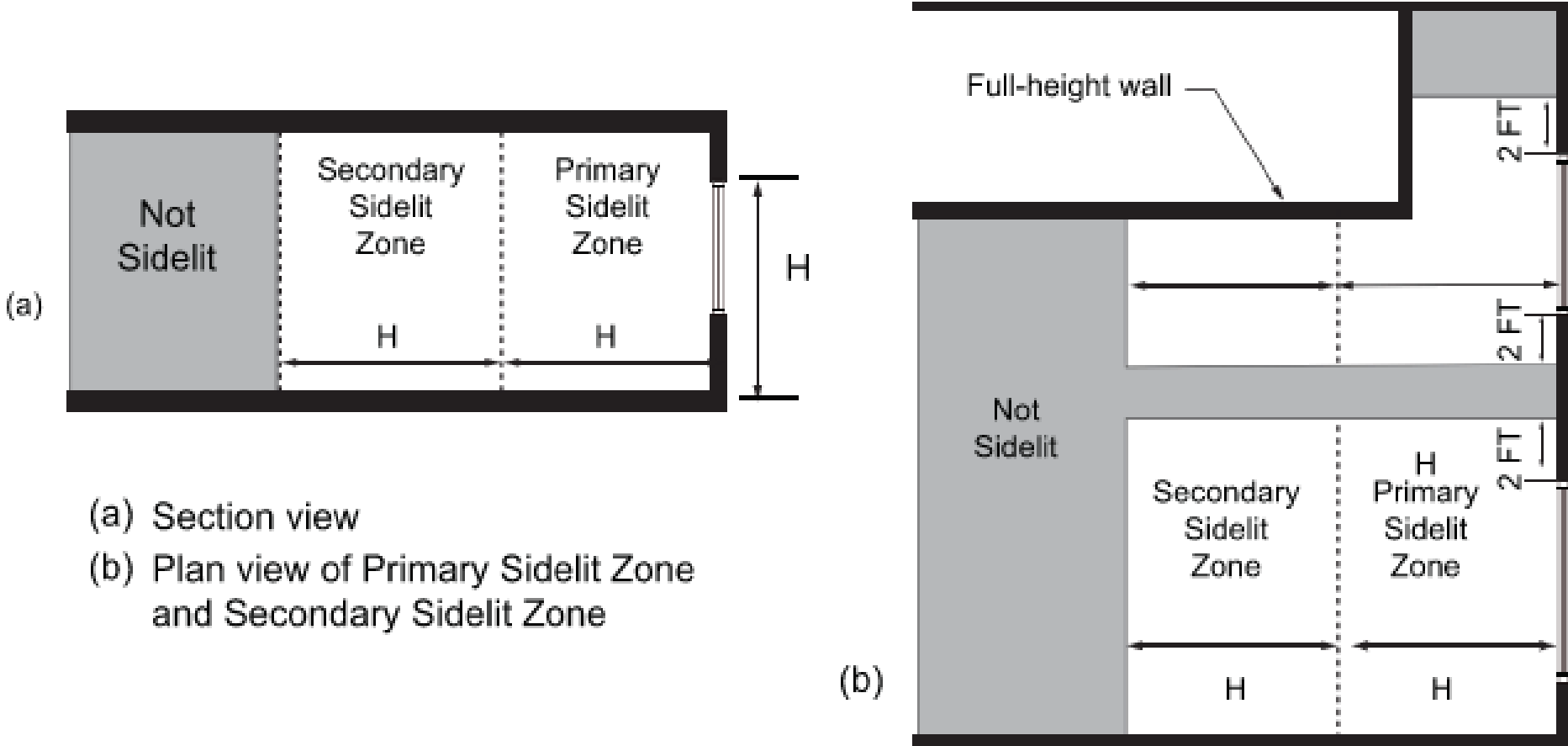
- Lighting that requires manual control as defined in Section C405.2.3.1 must also have partial-OFF capabilities that reduce lighting by at least 50%
- Standard includes additional requirements for open office areas – see Section C405.2.1.3

# 2021 IECC Updates

## C405.2.4 Daylight Responsive Controls

- Required for areas with 150W or more of general lighting within toplit and primary sidelit daylight zones and must be independently controlled
- Required for secondary sidelit zones with more than 300W of general lighting within the zones
- When occ sensor controls have reduced lighting power per 405.2.1.2, daylight controls shall continue to adjust levels in response to daylight, but shall be configured to not increase the lighting power above the specified unoccupied setpoint

# 2021 IECC Updates C405.2.4.2 Sidelit Daylight Zone



(a) Section view  
(b) Plan view of Primary Sidelit Zone and Secondary Sidelit Zone

**FIGURE C405.2.4.2(1)  
PRIMARY AND SECONDARY SIDELIT DAYLIGHT ZONES**

# 2021 IECC Updates

## C405.2.5 Specific Applications

- Task lighting for medical and dental
  - Provide a manual control separate from the general lighting
  - All lighting and switched receptacles to be turned off within 20 minutes of occupants leaving the space

# 2021 IECC Updates

## C405.11 Receptacle Control

- Receptacle Control
  - At least 50% of all receptacles must be controlled automatically in:
    - Private Offices
    - Conference Rooms
    - Print/Copy Rooms
    - Breakrooms
    - Classrooms
    - Individual workstations – including those installed in modular furniture
    - 25% of branch circuit feeders installed for modular furniture not shown on the construction documents

# 2021 IECC Updates

## C405.11.1 Receptacle Control

- Either split controlled receptacles shall be provided with the top receptacle controlled, or a controlled receptacle shall be located within 12" of each uncontrolled receptacle
- Controlled by:
  - Time of day
  - Occupancy sensor after 20 minutes
  - Signal from another control or alarm system after 20 minutes
- All receptacles to be identified and be uniformly distributed within the space

# 2021 IECC Updates

## C405.2.7.1-3 Exterior Lighting Control

- Exterior Lighting Control
  - Turn lights off when sufficient daylight is available
  - Lighting serving outdoor parking areas with a rated wattage greater than 78w and mounted at 24ft or less shall be controlled to automatically reduce the power of each luminaire by 50% when no activity has been detected for 15 minutes. No more than 1500w of lighting shall be controlled together.



# 2021 IECC Updates

## C455.2.8 Parking Garage Controls

- Parking Garage Lighting Controls
  - Parking garage lighting to be controlled by an occupancy sensor or time switch
  - Lighting power of each luminaire shall be automatically reduced by a minimum of 30% when there is no activity for 20 minutes. Control zones shall be no larger than 3,600SF
  - Lighting for covered vehicle entrances from buildings and parking structures shall be separately controlled by a device that automatically reduces the lighting by at least 50% from sunset to sunrise
  - The power to luminaires within 20 feet of any perimeter wall structure that has a net wall to opening ratio of at least 40% and no exterior obstructions within 20 feet, shall be automatically reduced in response to daylight by at least 50%

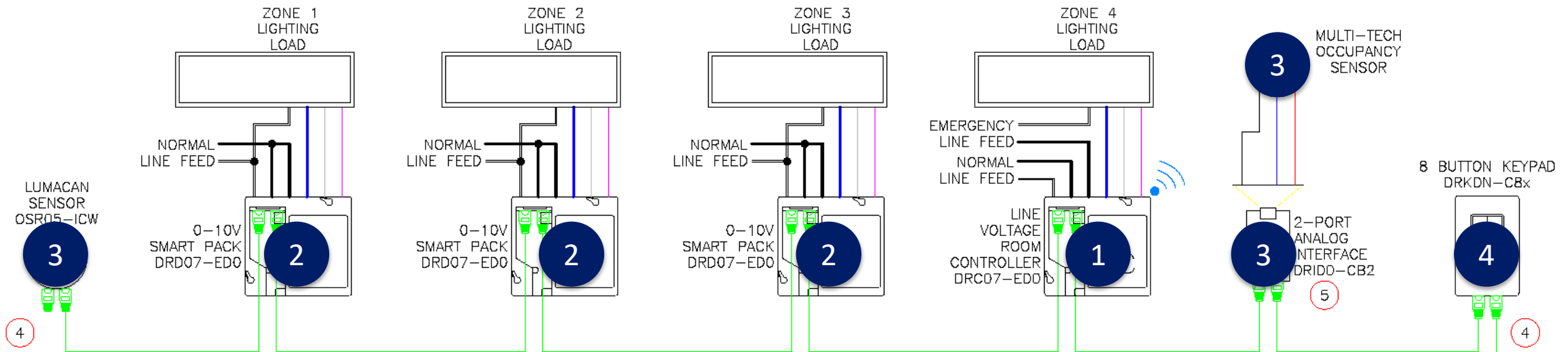
# Basic Functions

- All loads are controlled by one or more of:
  - Manual Control
  - Occupancy or Vacancy Sensing
  - Daylight Sensing
  - Time of Day
  - Switching
  - Dimming

# Code Compliance Architecture Example

## SYSTEM COMPONENTS

- 1 Room Controller
- 2 Load Controller
- 3 Sensors/AI
- 4 User Controls



# Private Office Lighting & Control Solutions



## Linear with Integrated Controls

Slim profile with a double tear drop shaped frosted diffuser with soft curves to enhance the visual space with a high level of efficiency, visual comfort, and integrated wireless occupancy/ daylight sensor



## Downlight

Shallow profile downlight fits within a 2-1/2" plenum space when plenum space is limited or other obstructions (i.e. HVAC) are present



## Downlight

Complete family of small aperture (2", 4", 6", 8") downlights with accent and wall wash options



## Recessed Linear

High efficiency options with spotless lensing and multiple mounting styles including T-grid and trimless



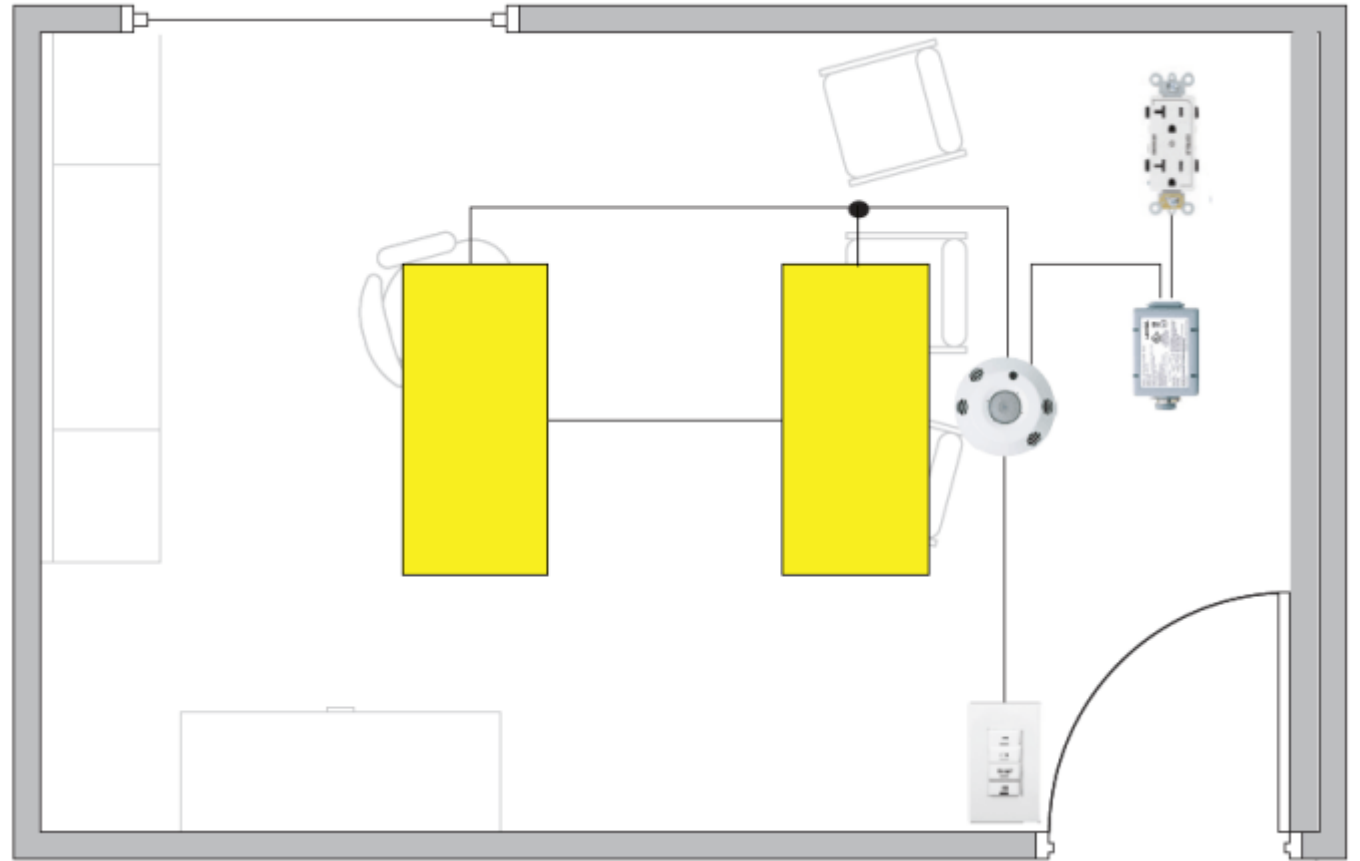
## Sensors and/or Room Controllers

Sensors provide simple occupancy/vacancy sensing; Room Controllers include dimming and daylighting functionality, ideal for spaces with windows



# Sample Application – Private Office

- Meets the following IECC requirements:
  - Auto Shutoff
  - Manual Control
  - Multi-Level Control
  - Daylighting
  - Receptacle Control



# Open Office Lighting & Control Solutions



## Recessed

A recessed, low-profile design luminaire featuring a single piece luminous lens; for use with indoor applications where high-efficiency, high-performance and ease of installation are required



## Downlights

Recessed 4" & 6" LED new construction downlights for spot, narrow flood, flood, and wide flood illumination



## Downlights

Featuring a highly configurable single point source LED, ideal for numerous ceiling heights and lighting applications



## Recessed Linear

High efficiency options with spotless lensing and multiple mounting stiles including T-grid and trimless

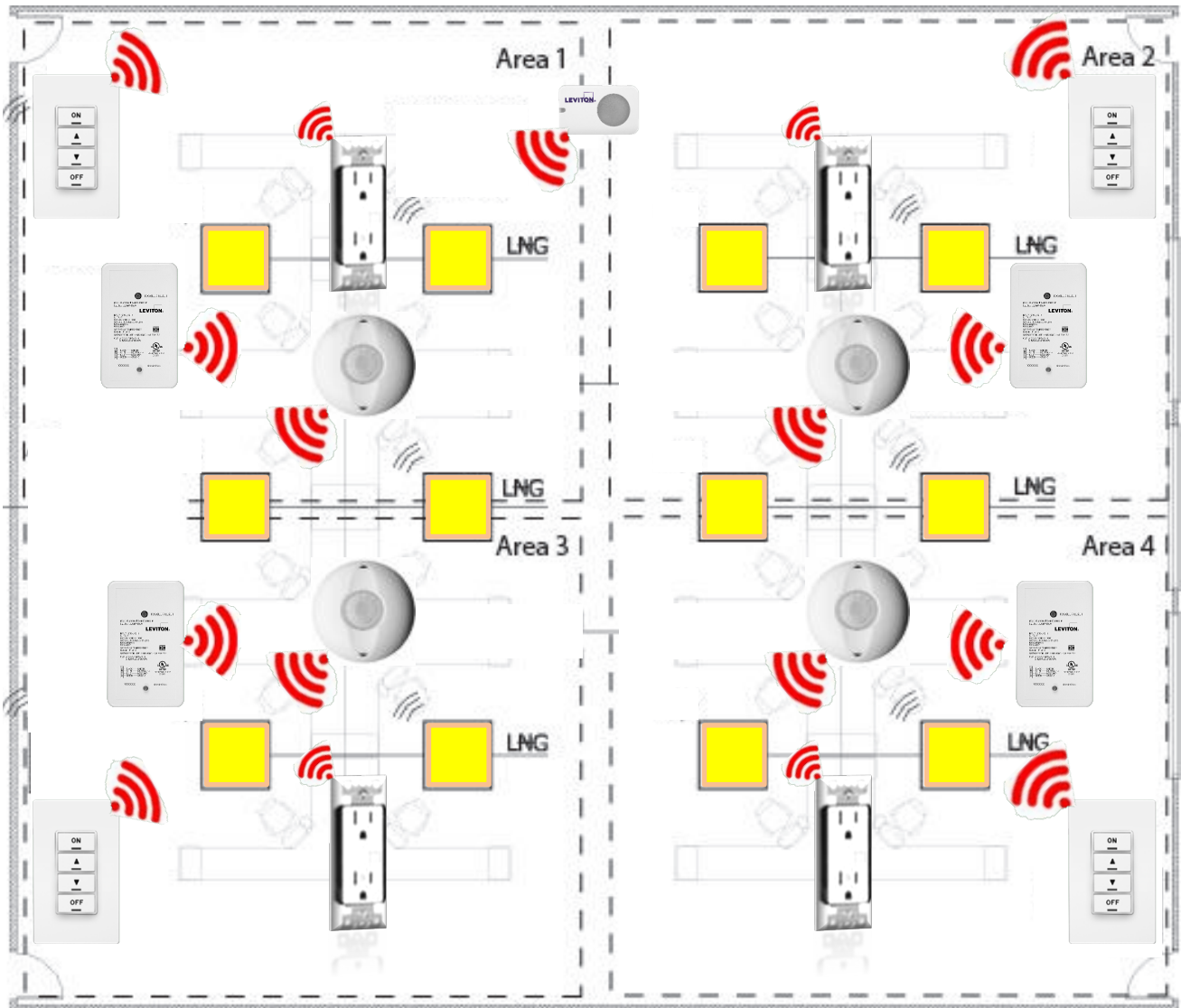


## Room Control System

Meet code compliance requirements for auto shutoff, manual control, daylight zone control, multi-level lighting control, and receptacle control

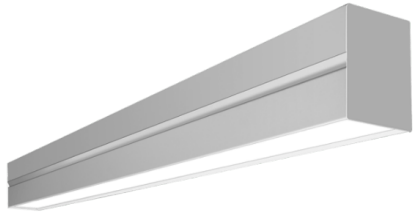


# Code Compliance – Open Office Application



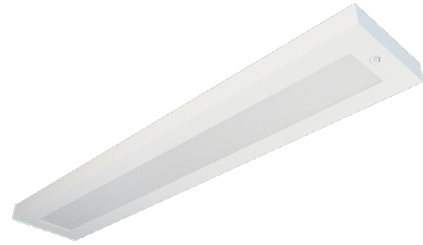
- Meets the following IECC requirements:
  - Auto Shutoff
  - Manual Control
  - Multi-Level Control
  - Daylighting
  - Receptacle Control

# Classroom Lighting & Control Solutions



## Linear

This LED modular linear luminaire with direct and indirect illumination features a narrow design and is ideal for architectural applications that require clean and uniform lines



## Linear

This LED modular linear luminaire with direct and indirect illumination features a narrow design and is ideal for architectural applications that require clean and uniform lines



## Linear

Suitable for surface, suspended or wall-mounting individually or in continuous rows while offering an optional uplight component with an internal baffle that separates uplight and downlight components



## Downlights

Performance LED downlights delivering up to 1600 lumens with a wide, smooth beam pattern



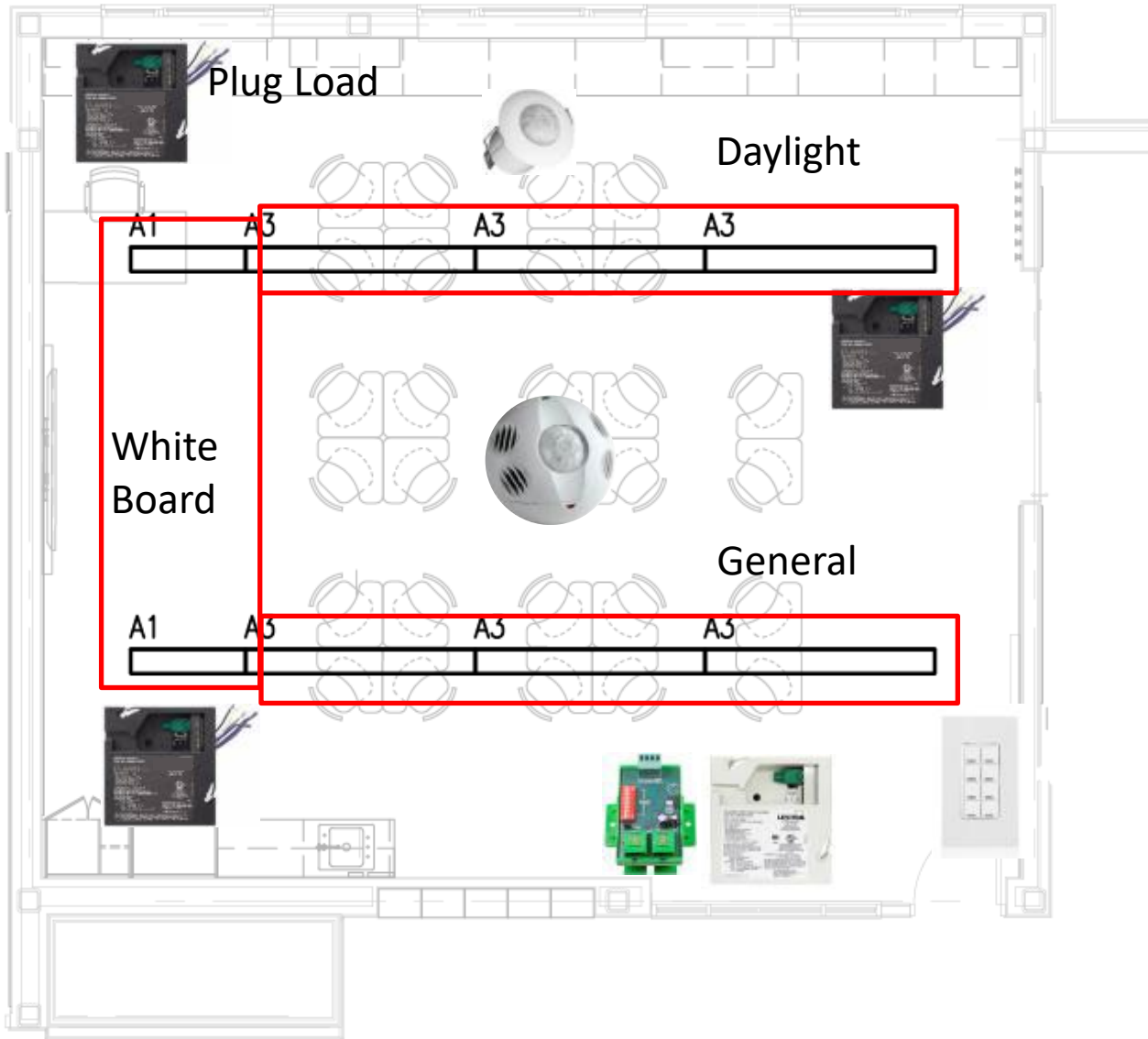
## Room Control System

Meet code compliance requirements for auto shutoff, manual control, daylight zone control, multi-level lighting control, and receptacle control





# Sample Education Application – Classroom



- Meets the following IECC requirements:
  - Auto Shutoff
  - Manual Control
  - Multi-Level Control
  - Daylighting
  - Receptacle Control

# 2021 IECC

## C405.12 Energy Monitoring

- Energy monitoring required for new buildings 25,000SF and larger
  - Measurement devices must be installed in new buildings to monitor energy use for each of the following separately:
    - HVAC Systems
    - Interior Lighting
    - Exterior Lighting
    - Plug Loads
    - Process loads – any load not included in HVAC that exceeds 5% of the peak connected load for the building
    - Building operations and other miscellaneous loads

# 2021 IECC

## C405.12.3 Energy Monitoring

- **Metering Equipment**
  - Automatically communicate consumption to data acquisition system
  - Building systems that can monitor energy consumption can be used instead of meters
  - CTs have a tested accuracy of +/- 2%
  - Provide at least hourly data to the data acquisition system and graphical report
- **Data Acquisition**
  - Store data for a minimum of 36 months
- **Graphical Energy Report**
  - Permanent and readily accessible reporting mechanism accessible by building operation and management personnel
  - Provide graphical data for each end use category for every hour, day, month, and year for the past 36 months

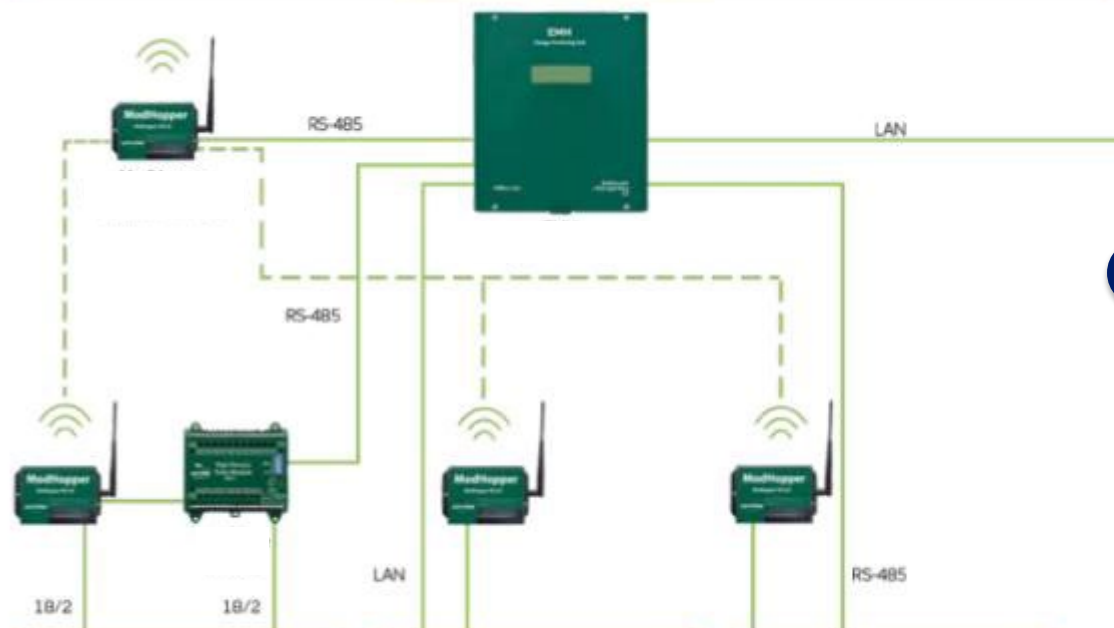
# Basic Functions

- Measure desired loads
- Collect and store data
- Present data

# Code Compliance Submetering Architecture Example

2

## Automated Data Collection



1

### Pulse Only Meters

Electric

Water Gas Steam

### Ethernet Meters

Protocols:  
- ModBus TCP/IP  
- BACNet IP

### Advanced Communication Meters

Protocols:  
- ModBus RTU (Series 8000)  
- ModBus RTU and BACNet MS/TP (Series 4000/4100 and 7100)

3

### On-Site Software

Building Management System

### Web-Based Software

Energy Information Software

## SYSTEM COMPONENTS

- 1 Submetering Hardware
- 2 Data Collection
- 3 Software/Graphical Report

This concludes The American Institute of Architects Continuing  
Education Systems Course

# Have Code Questions? Need Design Help?

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Find more code resources

