New Buildings Institute (NBI)

NBI is redefining energy efficiency in the built environment.

Program Areas:
• Best practices in new and existing buildings
• Continuous code and policy innovation
• Zero energy leadership and market development
Acknowledgements

New Buildings Institute would like to thank Energy Trust of Oregon, Northwest Energy Efficiency Alliance, and CLEARresult for funding and coordinating this training.

New Buildings Institute would like to thank PNNL & DOE for making this presentation available.

Background

Figure 2.6: Oregon’s Projected GHG Emissions vs. Goals

- Inventoried Emissions 1990-2016
- Industrial
- Residential & Commercial
- Agriculture
- Electricity Use
- Transportation
- 2016 Actual Emissions: 67 Million MTCEq
- Oregon’s 2030 Goal: 51 million MTCEq
- Oregon’s 2050 Goal: 14 million MTCEq
- Paris Goals: 26-28% below 2005 by 2025
Executive Order 17-20

D. Increasing Energy Efficiency in Commercial Construction. The appropriate advisory board(s) and BCD are directed to conduct code amendment of the state building code to require, by October 1, 2022, that newly constructed commercial buildings, averaged across building types, will exceed International Energy Conservation Code and ASHRAE 90.1 by achieving at least equivalent performance levels with the measurable prescriptive energy efficiency portions of the most current version of ASHRAE 189.1 that are construction-related.

Zero-Ready Code

ASHRAE 90.1-2016 by October 2019
ASHRAE 90.1-2019 by October 2020

Incorporation of Architecture 2030 Framework for estimating energy consumption and renewables for a Zero Net Energy Building
Zero-Ready Code

**1. Design an energy efficient building**
- Efficiency Standard: ASHRAE 90.1-2016 minimum
- Efficient building envelope / daylighting
- Passive heating / cooling / ventilation
- Efficient systems / equipment / controls

**2. Address the remaining building's energy needs with:**
- On-site renewable energy
- And/or off-site renewable energy
  - Wind + solar + hydro
  - Other non-CO₂ emitting sources

---

**Zero-Ready Code**

### ABOUT YOUR BUILDING

<table>
<thead>
<tr>
<th>Code Pathway</th>
<th>Prescriptive</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>Select</td>
<td></td>
</tr>
<tr>
<td>Number of Stories</td>
<td>Enter Number</td>
<td></td>
</tr>
<tr>
<td>Primary Building Use</td>
<td>Select</td>
<td></td>
</tr>
</tbody>
</table>

### ON-SITE PV SYSTEMS

- Enter on-site PV system generation potential below, or estimate on-site PV system generation potential using PVWatts. If your building has multiple PV systems enter them below.
  - Use PV Watts
  - Enter Generation Potential

- Estimated Area for Collectors
- Module Type
- Inverter Efficiency (%)
Statewide Alternate Method

Structure of Standard 90.1-2016

- 1 Purpose
- 2 Scope
- 3 Definitions, Abbreviations, and Acronyms
- 4 Administration and Enforcement
- 5 Building Envelope
- 6 Heating, Ventilating, and Air Conditioning
- 7 Service Water Heating
- 8 Power
- 9 Lighting
- 10 Other Equipment
- 11 Energy Cost Budget Method
- 12 Normative References
- Normative Appendices A-H
Section 2 – Scope
2.1 – 2.4

Applies to:
- New buildings and their systems
- New portions of buildings and their systems
- New systems and equipment in existing buildings, and
- New equipment or building systems specifically identified in the standard that are part of industrial or manufacturing processes
- Criteria for determining compliance with requirements

Does not apply to:
- Single-family houses, low-rise multi-family < 3 stories above grade, manufactured houses (mobile or modular)
- Buildings that use neither electricity nor fossil fuel
- Certain other buildings or elements may be exempt
- Does not circumvent any safety, health, or environmental requirements

Compliance Paths for 2016
1. Prescriptive
2. Energy Cost Budget
3. Appendix G (New)
Compliance Path

Performance Cost Index (PCI) = \frac{\text{Proposed Building Performance}}{\text{Baseline Building Performance}}

\[ PCI_t = \frac{B_{\text{UEC}} + (B_{\text{PF}} \cdot B_{\text{REC}})}{B_{\text{BP}}} \]

Compliance Options

<table>
<thead>
<tr>
<th>Building System</th>
<th>Compliance Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Envelope</td>
<td>Prescriptive Option</td>
</tr>
<tr>
<td>HVAC</td>
<td>Trade Off Option</td>
</tr>
<tr>
<td>SWH</td>
<td>Energy Code Compliance</td>
</tr>
<tr>
<td>Power</td>
<td>Simplified</td>
</tr>
<tr>
<td>Lighting</td>
<td>Performance Rating Method</td>
</tr>
</tbody>
</table>

Mandatory Provisions (required for most compliance options)
Section 8.4
Power – Mandatory Provisions

- 8.4.1 Voltage drop (5%)
- 8.4.2 Automatic receptacle control
- 8.4.3 Electrical Energy Monitoring
- 8.4.4 Low-Voltage Dry Type Distribution Transformers

Section 8 – 8.4.2
Automatic Receptacle Control

Automatically controlled
≥ 50% of all 125 volt 15- and 20-amp receptacles in:
- Private offices
- Conference rooms
- Rooms used primarily for printing and/or copying functions
- Break rooms
- Classrooms
- Individual workstations
Section 8 – 8.4.2
Automatic Receptacle Control (cont’d)

• Automatic control devices must function on:
  o Time-of-day controller provided to control ≤ 5,000 ft² and not more than one floor (occupant able to manually override up to 2 hours) OR
  o Occupant sensor(s) to turn off receptacles within 20 minutes of occupant leaving the space, OR
  o Automated signal from another control or alarm that turns receptacles off within 20 minutes after determining the area is unoccupied

• Controlled receptacles must be
  o visually marked to differentiate from uncontrolled receptacles
  o uniformly distributed throughout the space

• Plug-in type devices may not be used to comply with this requirement

Exceptions

• Receptacles designated for equipment requiring 24 hr/day 365 days/yr operation
• Spaces where automatic lighting shutoff would cause security or safety concerns
Section 8 – 8.4.3
Electrical Energy Monitoring

- Measurement devices in new building to monitor electrical energy use for each of these separately:
  - Total electrical energy
  - HVAC systems
  - Interior lighting
  - Exterior lighting
  - Receptacle circuits

- For buildings with multiple tenants, the above must be separately monitored for total building and for each tenant (excluding shared systems)

**Exception:**
- up to 10% of each separate load (other than total) can be from other electrical loads

---

**Compliance Lighting**

<table>
<thead>
<tr>
<th>Building System</th>
<th>Compliance Options</th>
</tr>
</thead>
<tbody>
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<td>HVAC</td>
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<td>SWH</td>
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<tr>
<td>Power</td>
<td>Simplified</td>
</tr>
<tr>
<td>Lighting</td>
<td>Performance Rating Method</td>
</tr>
</tbody>
</table>

Energy Code Compliance
Basic Lighting Requirements

Mandatory Requirements (Interior and Exterior)

+ Interior Lighting Power Limits

Total Connected Power ≤ Interior Lighting Power Allowance

Exemptions

Building Area

OR

Space-by-Space

Additional Allowances

Exemptions

Tradable

Non-Tradable

Exterior Lighting Power Limits

Total Connected Power ≤ Exterior Lighting Power Allowance

Section 9 Lighting

✓ General Application (Section 9.1)
  • Scope
  • Lighting Alterations
  • Installed Lighting Power
  • Interior and Exterior Luminaire Wattage

✓ Compliance (Section 9.2)

✓ Mandatory (Section 9.4)
  • Lighting control
  • Exterior lighting power
  • Functional testing
  • Dwelling units
  • Climate zone exception for daylighting control

✓ Building Area Method Compliance Path (Section 9.5)

✓ Alternative Compliance Path: Space-by-Space Method (Section 9.6)
### Section 9.4.1.1 Control Functions

- Local control
- Restricted to manual ON
- Restricted to partial automatic ON
- Bilevel lighting control
- Automatic daylight responsive controls for sidelighting
- Automatic daylight responsive controls for toplighting
- Automatic partial OFF (full OFF complies)
- Automatic full OFF
- Scheduled shutoff

### Section 9 – 9.4.1.1 (a & b)

**Local Control:** At least one control that controls all the lighting in the space
- In spaces \( \leq 10,000 \text{ ft}^2 \), each control serves 2,500 \( \text{ft}^2 \) maximum and in spaces > 10,000 \( \text{ft}^2 \), serves 10,000 \( \text{ft}^2 \) maximum

**Restricted to Manual ON:** No lighting automatically turned on
- **Exception:** Where manual ON would endanger safety or security
Section 9 – 9.4.1.1 (c & d)

**Restricted to Partial On:** < 50% of general lighting power allowed to be automatically turned on, and none of remaining lighting automatically turned on

**Exception:** Lighting in open-plan offices allowed to turn on automatically to > 50% if control zone is ≤ 600 ft²

**Bi-Level Controls:**
- General lighting to provide at least one intermediate step in lighting power or continuous dimming in addition to full ON and full OFF
- To have at least one control step between 30% and 70% (inclusive) of full lighting power in addition to all off

Section 9 – 9.4.1.1 (e)

**Automatic Daylight Responsive Controls for Sidelighting**

- Apply when primary sidelighted areas is ≥ 150 W or primary and secondary sidelighted areas is ≥ 300 W
- Primary and secondary sidelighted areas controlled independently
When combined input power of all general lighting completely or partially under daylight areas under skylights and daylight areas under roof monitors is ≥ 150 W

Control overlapping toplighted and sidelighted daylight with toplighted area

Control system requirements:

- Calibration adjustment located ≤ 11ft above finished floor (sidelighted)
- Calibration doesn’t require physical presence of a person at sensor during calibration
- Continuous dimming, or
  - at least one control point between 50% and 70% AND
  - a second control point between 20% and 40% or lowest dimming level technology allows AND
  - third control point that turns off all controlled lighting
Automatically reduce general lighting power by at least 50% within 20 minutes of all occupants leaving the space

**Exception:**
- Space has LPD < 0.80 W/ft² AND
- High Intensity Discharge lamps AND
- General lighting power in space is automatically reduced by ≥ 30% within 20 minutes of all occupants leaving the space AND
- Total lighting load ≤ 0.02 W/ft² multiplied by gross lighted area of the building

**Section 9 – 9.4.1.1 (h) Automatic Full OFF**

- All lighting automatically shut off within 20 minutes of all occupants leaving the space
- Control device to control < 5,000 ft²

**Exceptions**
- Shop and lab classrooms
- Areas where auto shutoff causes safety or security concerns
- Lighting for 24/7 operation

Typically, users are allowed to choose to implement this control or Scheduled Shutoff
Section 9 – 9.4.1.1 (i)  
Scheduled Shutoff

Control lights on a scheduled basis (automatic time switch)
- Time-of-day controller or
- Signal from another control or alarm

Controller or system provide independent control sequences that
- Controls ≤ 25,000 ft²
- Not more than one floor
- Accounts for weekend and holidays

Manual override control
- < 2 hours during scheduled off
- Control ≤ 5,000 ft²

Exceptions
- Lighting for 24/7 operation
- Patient care spaces
- Areas where auto shutoff causes safety or security concerns
- Lighting load ≤ 0.02 W/ft² multiplied by gross lighted area of the building

Typically, users are allowed to choose to implement this control or Automatic Full Off

Section 9 – 9.4.1.2  
Parking Garage Lighting Control

- Automatic lighting shutoff per 9.4.1.1(i)
- Must reduce lighting power by minimum of 30% when no activity is detected for 20 minutes within a lighting zone ≤ 3,600 ft²
- Automatically reduce power at least 50% in response to daylight for luminaires within 20 ft of any perimeter wall that has
  - a net opening to wall ratio of ≥ 40% AND
  - no exterior obstructions within 20 ft

Exception
- Daylight transition zones and ramps without parking are exempt from 30% reduction and daylight control
Section 9 – 9.4.1.3
Control of Special Applications

- Guestroom lighting and switched receptacles to be turned off within 20 minutes of occupants leaving the space
  - **Exception:** where captive key systems used
- Bathrooms controlled to automatically turn off lighting within 30 minutes of occupants leaving space
  - **Exception:** night lighting not > 5W
- Supplemental task lighting controlled by
  - Controller integral to the luminaires OR
  - Wall-mounted controller-readily accessible and located so occupant can see controlled lighting

Section 9 – 9.4.1.4
Mandatory Exterior Lighting Control

- Lighting must turn off when there is sufficient daylight
- Building façade and landscape lighting must be shut off between
  - midnight or business closing (whichever is later) **AND**
  - 6am or business opening (whichever comes first) **OR** times established by AHJ
- Power for signage to be automatically reduced by at least 50%
  - From midnight or within 1 hour of end of business operations (whichever is later) and until 6am or business opening (whichever is earlier) **OR**
  - During any period when no activity has been detected for a time no longer than 15 minutes
Section 9 – 9.4.1.4
Mandatory Exterior Lighting Control

- Luminaires serving outdoor parking areas with rated input wattage > 78 W and mounting height of ≤ 24 ft above ground
  - Lights must automatically reduce power of each luminaire by > 50% when no activity is detected in the area for 15 minutes or less
  - Limited to 1500 W of lighting controlled together

Exceptions
- Covered vehicle entrances
- Exits from buildings or parking structures *(where required for safety, security, or eye adaptation)*
- Lighting integral to signage and installed by manufacturer

Section 9.4.2
Exterior Lighting Power

**Exterior Building Lighting Power** must meet prescribed power limits:
- The total exterior lighting power allowance is the sum of the base site allowance plus individual lighting power densities (LPD) for the applicable “lighting power zone”
- Trade-offs are allowed only among “Tradable Surfaces” applications
- Some exemptions apply
Section 9.4.2
Tradable Exterior LPDs

Exterior applications are divided into 2 categories:

**Tradable:** allowed wattage may be traded among these applications

**Non-Tradable:** allowed wattage cannot be traded between surfaces or with other exterior lighting

| Section 9 – 9.4.4
Dwelling Units |

- Dwelling units (apartment, condo, living space, etc.) must be built so that at least 75 percent of the permanently installed lighting fixtures utilize lamps with an efficacy of at least 55 lm/W, or have a total luminaire (fixture) efficacy of at least 45 lm/W.
  - **Exception:** Lighting that is controlled with dimmers or automatic control devices.
- Applies to 4 story above grade multi-family (3 story and below not in scope of 90.1)
- Other common spaces in the building must follow standard 90.1 Requirements.
**Compliance Options**

**Building System**

- Envelope
- HVAC
- SWH
- Power
- Lighting

- Energy Code Compliance
  - Prescriptive Option
  - Trade Off Option
  - Energy Cost Budget
  - Simplified
  - Performance Rating Method

**Section 9 – Table 9.5.1**

**Building Types - Examples**

<table>
<thead>
<tr>
<th>Building Area Type</th>
<th>L/PD, W/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive facility</td>
<td>0.71</td>
</tr>
<tr>
<td>Convention center</td>
<td>0.76</td>
</tr>
<tr>
<td>Courthouse</td>
<td>0.90</td>
</tr>
<tr>
<td>Dining: Bar lounge/leisure</td>
<td>0.90</td>
</tr>
<tr>
<td>Dining: Cafeteria/fast food</td>
<td>0.79</td>
</tr>
<tr>
<td>Dining: Family</td>
<td>0.78</td>
</tr>
<tr>
<td>Dormitory</td>
<td>0.61</td>
</tr>
<tr>
<td>Exercise center</td>
<td>0.65</td>
</tr>
<tr>
<td>Fire station</td>
<td>0.53</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>0.68</td>
</tr>
<tr>
<td>Health-care clinic</td>
<td>0.82</td>
</tr>
<tr>
<td>Hospital</td>
<td>1.05</td>
</tr>
<tr>
<td>Office</td>
<td>0.79</td>
</tr>
<tr>
<td>Parking garage</td>
<td>0.15</td>
</tr>
<tr>
<td>Penitentiary</td>
<td>0.75</td>
</tr>
<tr>
<td>Performing arts theater</td>
<td>1.18</td>
</tr>
<tr>
<td>Police station</td>
<td>0.80</td>
</tr>
<tr>
<td>Post office</td>
<td>0.67</td>
</tr>
<tr>
<td>Religious facility</td>
<td>0.94</td>
</tr>
<tr>
<td>Retail</td>
<td>1.06</td>
</tr>
<tr>
<td>School/University</td>
<td>0.81</td>
</tr>
</tbody>
</table>
Section 9 – Table 9.6.1
Space-by-Space Allowances

Table 9.6.1 Lighting Power Density Allowances Using the Space-by-Space Method and Minimum Control Requirements Using Either Method (Continued)

<table>
<thead>
<tr>
<th>Common Space Types</th>
<th>LDV, W/m²</th>
<th>ACR Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>0.93</td>
<td>REG, ADD1</td>
</tr>
<tr>
<td>Office</td>
<td>0.93</td>
<td>ADD1</td>
</tr>
<tr>
<td>Office</td>
<td>0.91</td>
<td>ADD1, ADD1</td>
</tr>
<tr>
<td>Pharmacy area</td>
<td>1.34</td>
<td>REG, ADD1, ADD1</td>
</tr>
<tr>
<td>Restaurant</td>
<td>0.96</td>
<td>REG</td>
</tr>
<tr>
<td>All other rooms</td>
<td>0.85</td>
<td>REG</td>
</tr>
<tr>
<td>Sales Area</td>
<td>1.02</td>
<td>REG, ADD1, ADD1</td>
</tr>
<tr>
<td>Staging Area, General</td>
<td>0.42</td>
<td>REG, ADD1, ADD1</td>
</tr>
<tr>
<td>Costume</td>
<td>0.58</td>
<td>REG, ADD1</td>
</tr>
<tr>
<td>Storage Room</td>
<td>0.97</td>
<td>REG, ADD1</td>
</tr>
<tr>
<td>Storage Room &gt; 50 sq ft</td>
<td>0.46</td>
<td>REG, ADD1, ADD1</td>
</tr>
<tr>
<td>Storage Room &gt; 100 sq ft</td>
<td>0.46</td>
<td>REG, ADD1, ADD1</td>
</tr>
</tbody>
</table>

Section 9 – 9.6.1
Space-by-Space Method

- Applies to any building configuration by calculating allowances for individual spaces
- Advantages
  - More flexible than building area method
  - More accurately accounts for actual room lighting power needs
  - Provides additional allowances for:
    - Difficult room configurations
    - Decorative and retail needs
    - Use of advanced controls not already required in the standard
- Limitations
  - More calculations needed (individual spaces)
Section 9 – 9.6.1
Space-by-Space Method

Calculation Process

1) Determine the gross lighted area of each space type
   • include balconies and mezzanines
   • Use centerline of walls between spaces

2) Calculate the space power allowance by multiplying the space type area by the applicable allowance from Table 9.6.1

3) Sum all the allowances

Section 9 – Table 9.6.1
Space-by-Space Allowances

Table 9.6.1 Lighting Power Density Allowances Using the Space-by-Space Method and Minimum Control Requirements Using Either Method (Continued)
### Section 9 – Table 9.6.1  
Space-by-Space Allowances

<table>
<thead>
<tr>
<th>Common Space Type</th>
<th>( \text{LFD} ), ( \text{W/m}^2 )</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>0.05</td>
<td>REG</td>
</tr>
<tr>
<td>Enclosed and (&lt;250) ( \text{m}^2 )</td>
<td>0.05</td>
<td>REG</td>
</tr>
<tr>
<td>Open plan</td>
<td>0.01</td>
<td>REG</td>
</tr>
<tr>
<td>Parking Area, Interior</td>
<td>0.14</td>
<td>See Section 9.4.1.2</td>
</tr>
<tr>
<td>Pharmacy Area</td>
<td>0.34</td>
<td>REG</td>
</tr>
<tr>
<td>Office</td>
<td>0.96</td>
<td>REG</td>
</tr>
<tr>
<td>Enclosed and (&lt;250) ( \text{m}^2 )</td>
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<td>REG</td>
</tr>
<tr>
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<td>0.91</td>
<td>REG</td>
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<tr>
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<td>0.14</td>
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<tr>
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<td>0.34</td>
<td>REG</td>
</tr>
<tr>
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<td>0.46</td>
<td>REG</td>
</tr>
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<td>0.46</td>
<td>REG</td>
</tr>
<tr>
<td>Open plan</td>
<td>0.46</td>
<td>REG</td>
</tr>
<tr>
<td>Storage Room</td>
<td>0.07</td>
<td>REG</td>
</tr>
<tr>
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<td>0.46</td>
<td>REG</td>
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<tr>
<td>(&lt;50) ( \text{m}^2 )</td>
<td>0.46</td>
<td>REG</td>
</tr>
</tbody>
</table>

*Note: This table is divided into two sections, the first section covers areas that are typically found in a single building type, the second section covers spaces that are typically found in multiple building types. The content of the table covers spaces that are typically found in a single building type.*
Section 9 – Table 9.6.1
Space-by-Space Allowances

- Used only when applying the space by space method
- Calculate the Room Cavity Ratio (RCR) for the empty room:
  \[ RCR = 2.5 \times \frac{\text{Room Cavity Height} \times \text{room perimeter length}}{\text{room area}} \]
  (Room Cavity Height = Luminaire mounting height – Workplane height)
- If RCR is greater than the RCR threshold for that space type from Table 9.6.1, a 20% increase is allowed
- For corridor/transition spaces, a 20% adjustment is allowed when less than 8 feet wide, regardless of the RCR
Decorative and Retail display highlighting

- Increase in the lighting power allowance when using the space-by-space method.
- Applications must be automatically controlled, separately from the general lighting.
- Additional allowances can only be used for the additional lighting equipment – and not general lighting.
  - Decorative luminaires in addition to the general lighting = 0.75 W/ft²
  - Retail display lighting = varies by retail type

Section 9 – 9.6.2
Additional Retail Lighting Power

Additional Interior Lighting Power Allowance = 1000 watts + 
(Retail Area 1 x 0.45 W/ft²) + 
(Retail Area 2 x 0.45 W/ft²) + 
(Retail Area 3 x 1.05 W/ft²) + 
(Retail Area 4 x 1.88 W/ft²),

Where:
- **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.

Other merchandise categories not listed may be included in Retail Areas 2 through 4, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is approved by the authority having jurisdiction.
Section 9 – 9.6.3
Additional Interior Lighting Power

Advanced Controls: An increase in the allowance is allowed for the use of additional advanced controls

- Additional power can be used anywhere in the building
- Additional Interior Lighting Power Allowance is calculated as:

  \[ \text{Lighting Power Under Control} \times \text{Control Factor} \]

Table 9.6.3 Control Factors Used in Calculating Additional Interior Lighting Power Allowance

<table>
<thead>
<tr>
<th>Additional Control Method (in Addition to Mandatory Requirements)</th>
<th>Open Office</th>
<th>Private Office</th>
<th>Conference Room, Meeting Room, Classroom (Lecture/Training)</th>
<th>Retail Sales Area</th>
<th>Lobby, Atrium, Dining Area, Corridors, Gym/Pool, MdL Concourse, Parking Garage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual continuous dimming control or programmable multilevel dimming control</td>
<td>0.05</td>
<td>0.05</td>
<td>0.10</td>
<td>0.10</td>
<td>0</td>
</tr>
<tr>
<td>Programmable multilevel dimming control using programmable time scheduling</td>
<td>0.05</td>
<td>0.05</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Occupancy sensors controlling the uplight component of workstation specific luminaires with continuous dimming to off capabilities</td>
<td>0.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Occupancy sensors controlling the uplight component of workstation specific luminaires with continuous dimming to off operation, in combination with personal continuous dimming control at uplight illumination by workstation occupant</td>
<td>0.30&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Automatic continuous daylight dimming in secondary sidelit areas</td>
<td>0.10&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.10&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.10&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.10&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.10&lt;sup&gt;c&lt;/sup&gt;</td>
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Questions?

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