# *Luminaire Level Lighting Controls and Oregon Energy Code*

Panel:
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**Jesse Smith**, LC MFA LEED BD+C – Glumac Lighting Studio

Moderators:
**Kriya Kaping** - Energy Trust New Buildings
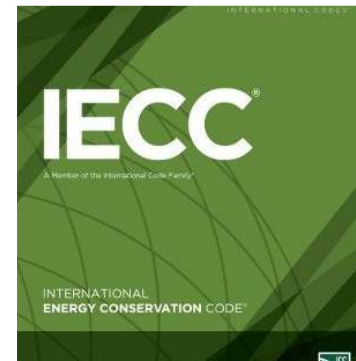**Angela Pilant**, LC – Evergreen Consulting Group

September 15, 2020

# *OR Code Compliance Pathways*

**ASHRAE**

90.1-2016* Current

90.1-2019 Future

Statewide Alternative Method (SAM)

Allows IECC 2018* until October 2020

**IECC**
A Member of the International Code Family®

INTERNATIONAL
ENERGY CONSERVATION CODE®

*Includes several administrative amendments*

# *Commercial Energy Code*

Oregon **Building Codes Division** is moving towards quick adoption of ASHRAE 90.1 as state code within a year of publication

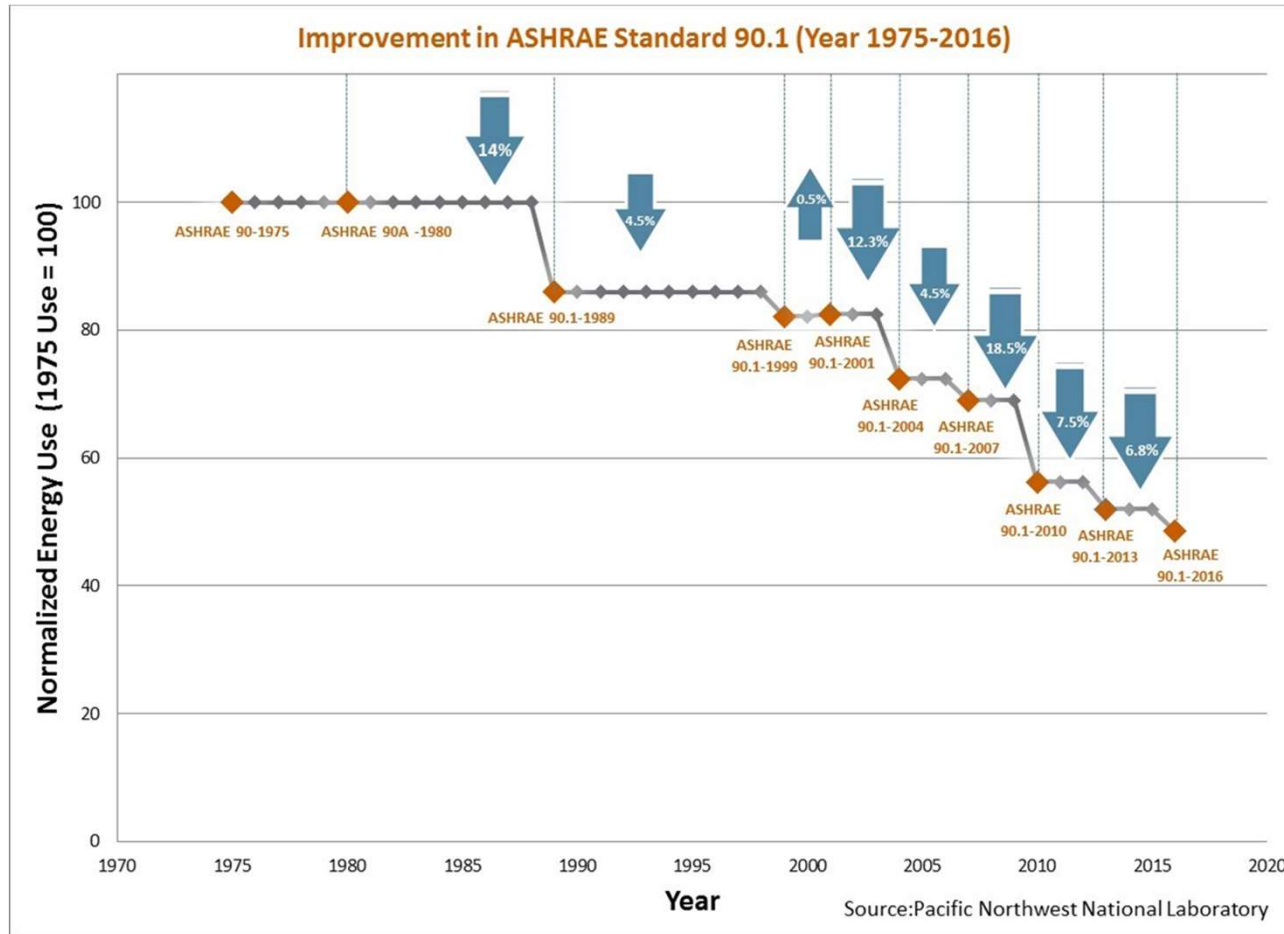– ASHRAE 90.1-2016 in October 2019
– ASHRAE 90.1-2019 next

**+**

**Incorporation of Architecture 2030 Framework for estimating energy consumption and renewables for a Zero Net Energy Building**
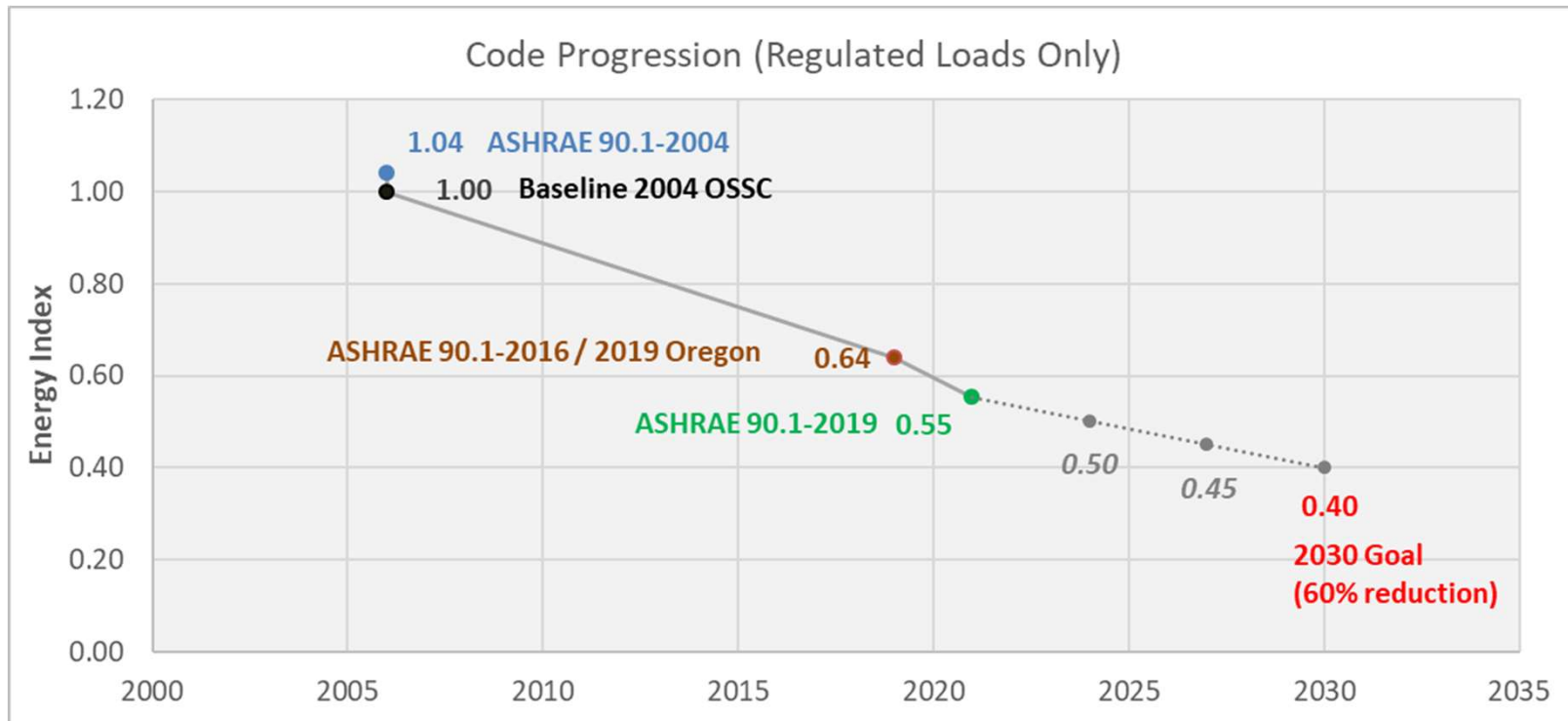
## Benefits of 90.1 Include

- Quicker, less resource-intensive, streamlined adoption (i.e. more buildings under advanced code)
- More predictable
- Comprehensive cost analysis
- Well-supported

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# Code Progression



Improvement in ASHRAE Standard 90.1 (Year 1975-2016)

Source: Pacific Northwest National Laboratory

# Code Progression



Code Progression (Regulated Loads Only)

**Codes are becoming more and more efficient, and Controls are a major factor**

# OR Code and LLLC

**C405.2 Lighting controls (Mandatory).** Lighting systems shall be provided with controls that comply with one of the following.

1. Lighting controls as specified in Sections C405.2.1 through C405.2.6.

2. Luminaire level lighting controls (LLLC) and lighting controls as specified in Sections C405.2.1, C405.2.4 and C405.2.5. The LLLC luminaire shall be independently capable of:

   2.1. Monitoring occupant activity to brighten or dim lighting when occupied or unoccupied, respectively.

   2.2. Monitoring ambient light, both electric light and daylight, and brighten or dim artificial light to maintain desired light level.

   2.3. For each control strategy, configuration and reconfiguration of performance parameters including; bright and dim setpoints, timeouts, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configurations.

# *OR Code and LLLC*

**ASHRAE**

ASHRAE 90.1 – no direct mention of LLLC for code compliance, but it can be incorporated as a compliance strategy to meet many of the control requirements, including:

- Partial automatic on
- Bilevel lighting control
- Automatic daylight responsive control
- Automatic partial/full off
- Scheduled shutoff

| *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. | | | 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 9.4.1.1[e][6]) | *Automatic* Daylight Responsive *Controls* for Toplighting (See Section 9.4.1.1[f][6]) | *Automatic* Partial OFF (See Section 9.4.1.1[g] [Full Off complies]) | *Automatic* Full OFF (See Section 9.4.1.1[h]) | Scheduled Shutoff (See Section 9.4.1.1[i]) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Common *Space* Types[1] | *LPD*, W/ft$^2$ | *RCR* Threshold | a | b | c | d | e | f | g | h | i |
| Office | | | | | | | | | | | |
| Enclosed and ≤250 ft$^2$ | 0.93 | 8 | REQ | ADD1 | ADD1 | REQ | REQ | REQ | | REQ | |
| Enclosed and >250 ft$^2$ | 0.93 | 8 | REQ | ADD1 | ADD1 | REQ | REQ | REQ | | ADD2 | ADD2 |

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# *Why Lighting Controls?*

- Energy Code Compliance
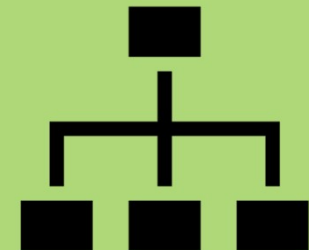- Additional Energy Savings
- Faster Installation
- Flexibility

# *What is LLLC?*

- Integrated Sensors
- Individually Addressable
- Networkable
- Compatible Components

# *LLLC Capabilities*

- Addressability
- Networkability
- Occupancy Sensing
- Daylight Harvesting/Photocell Control
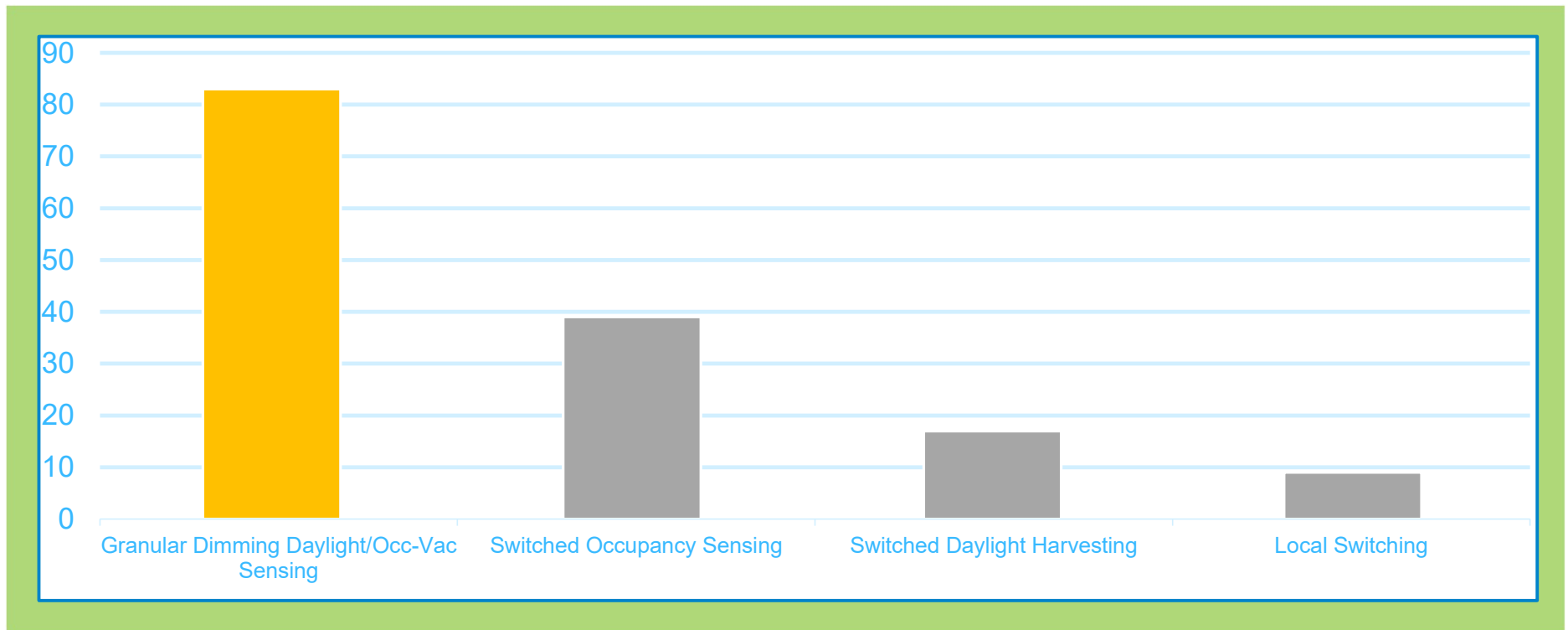- Continuous Dimming
- High-End Trim
- Zoning

# Why Use LLLC?

- Augment Efficient Source Technology
- Combine Control Schemes
- Take Advantage of LED Dimmability
- Faster Installation
- Automatic Code Compliance
- Non-Energy Benefits

# Deeper Energy Savings

- Compounded Control Schemes

# *Simple LLLC Systems*

- Comprehensive or Simple Projects
- Minimal Components
- Standard Control Capabilities/Vocabulary
- Standard 4-Step Configuration on Site

# Comprehensive LLLC Systems

- Larger projects
- Additional Devices Required
- Optional Control Capabilities
- Additional/3rd Party Configuration/Training

# *Fewer Components*

## Without LLLC

- Dimming Driver

- Occupancy and Daylight Sensors

- LED Luminaire

## With LLLC

- LED luminaire with integrated, wireless occupancy / daylight sensing and dimming driver

# *Historical Lighting Control*

- Dimming Driver

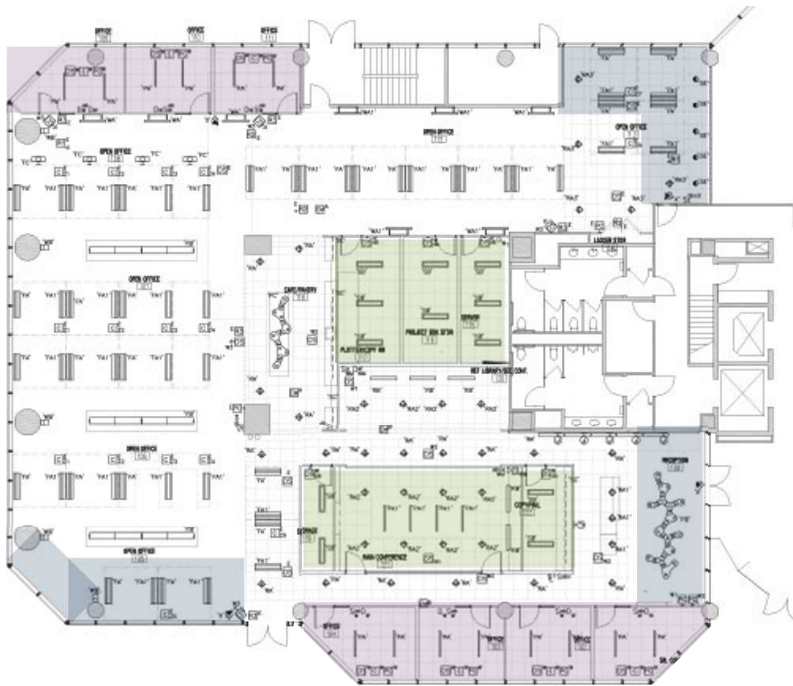- Occupancy and Daylight Sensors

- LED Luminaire
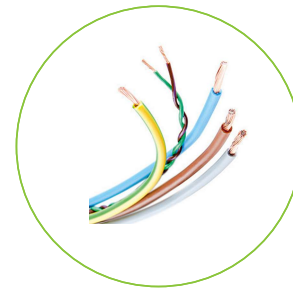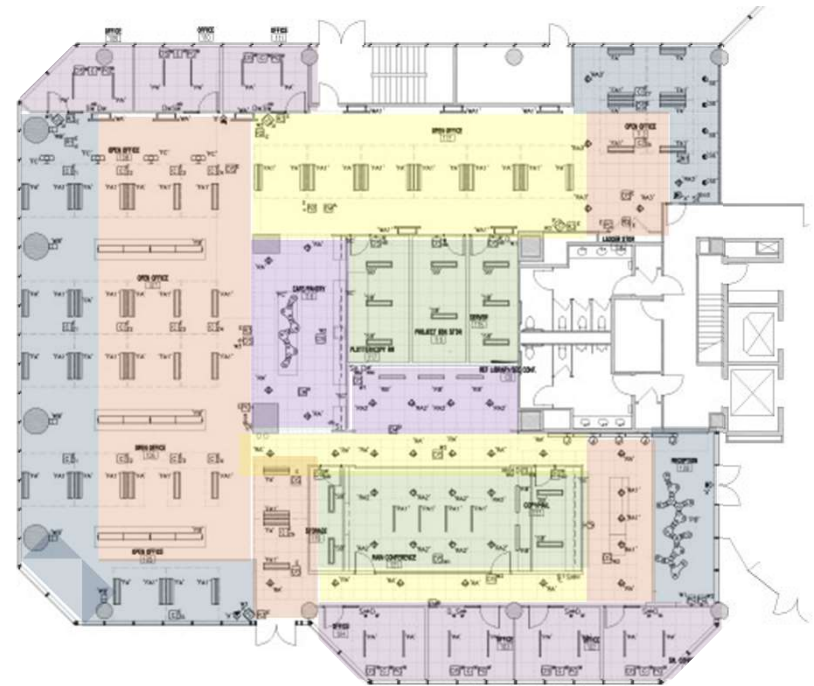
- Lots of Wiring

# *LLLC Installation Advantages*

- Labor Savings
- Relieved Wiring Frustration
- Faster Project Completion
- Simple Configuration
- Future Expandability
- Reconfigurable

# Dynamic LLLC Control



- Code-required control zones



- Granular control zone potential

# Non-Energy Benefits

- Asset Tracking
- Space Utilization
- Indoor Positioning/Wayfinding
- Room Scheduling
- Remote Diagnostics
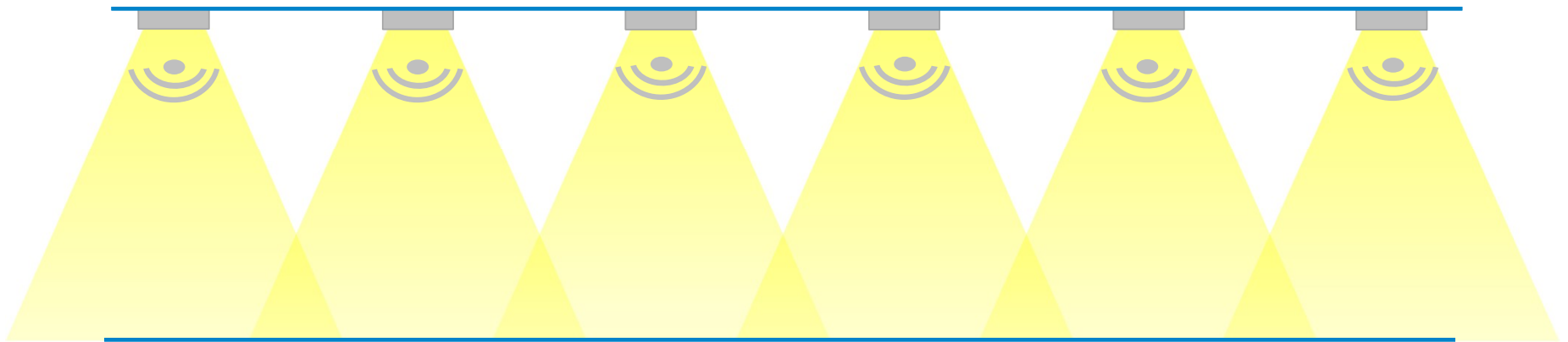- External Systems Integration
- Security
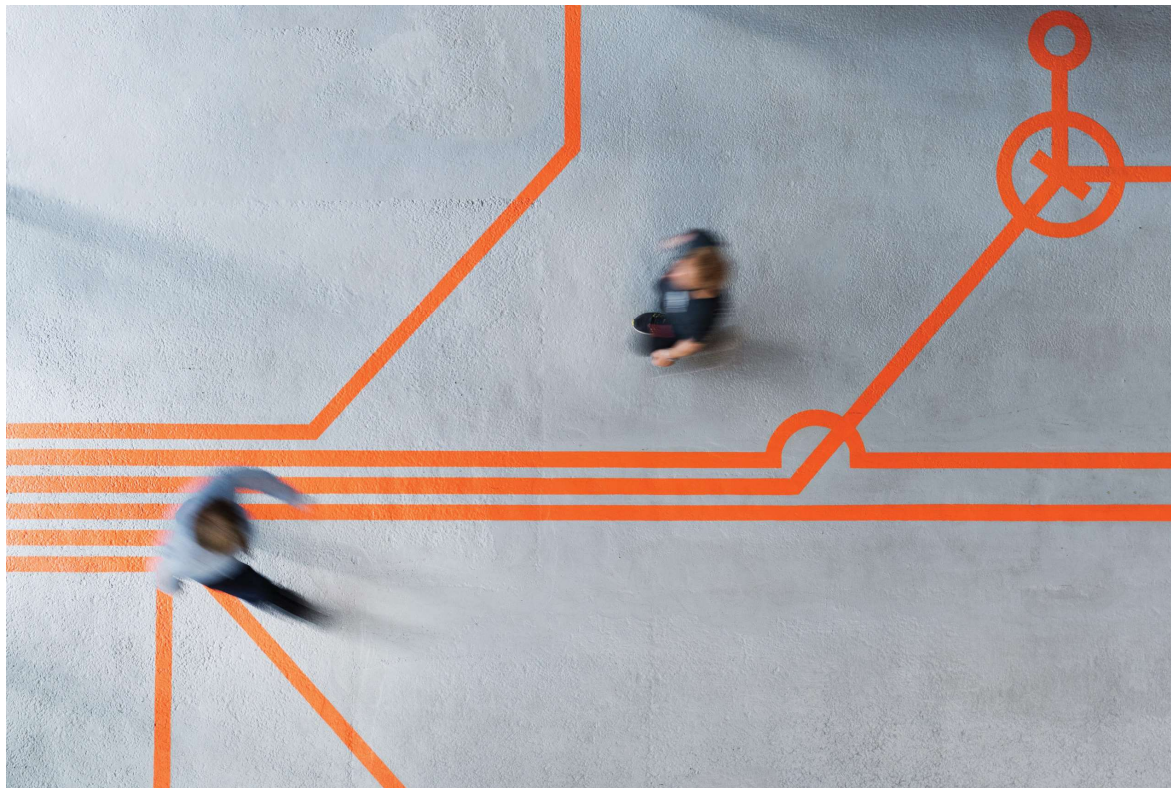- Futureproofing

# NEBs: Asset Tracking

- Energy Code Compliance
- Additional Energy Savings
- Faster Installation
- Flexibility

# NEBs: Space Utilization

# NEBs: Indoor Positioning/Wayfinding

# NEBs: Room Scheduling

# NEBs: Remote Diagnostics

# NEBs: External Systems Integration

# *NEBs: Security*
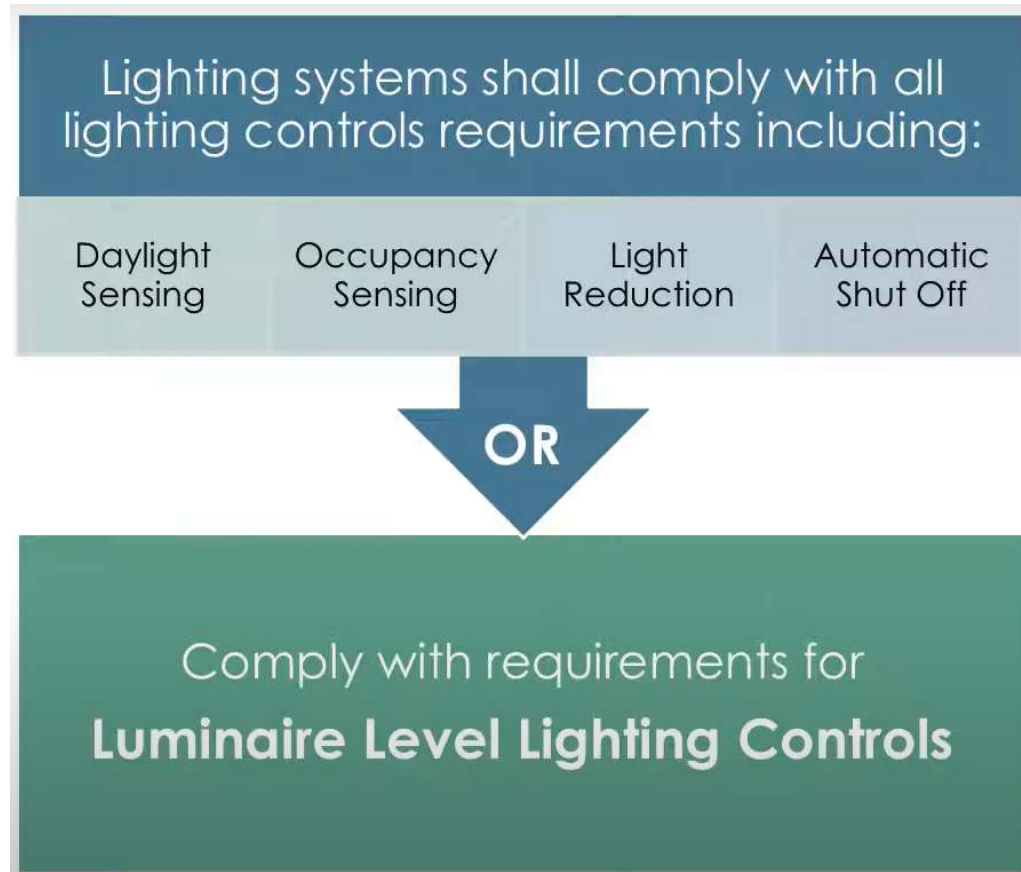
# *NEBs: Futureproofing*

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# *Selecting LLLC Systems*

- DLC Technical Requirements
- DLC NLC Qualified Product List

# *Design Considerations*

- Ease of Design
  - Easy to document
  - Easy to price



Lighting systems shall comply with all lighting controls requirements including:

| Daylight Sensing | Occupancy Sensing | Light Reduction | Automatic Shut Off |

**OR**

Comply with requirements for **Luminaire Level Lighting Controls**
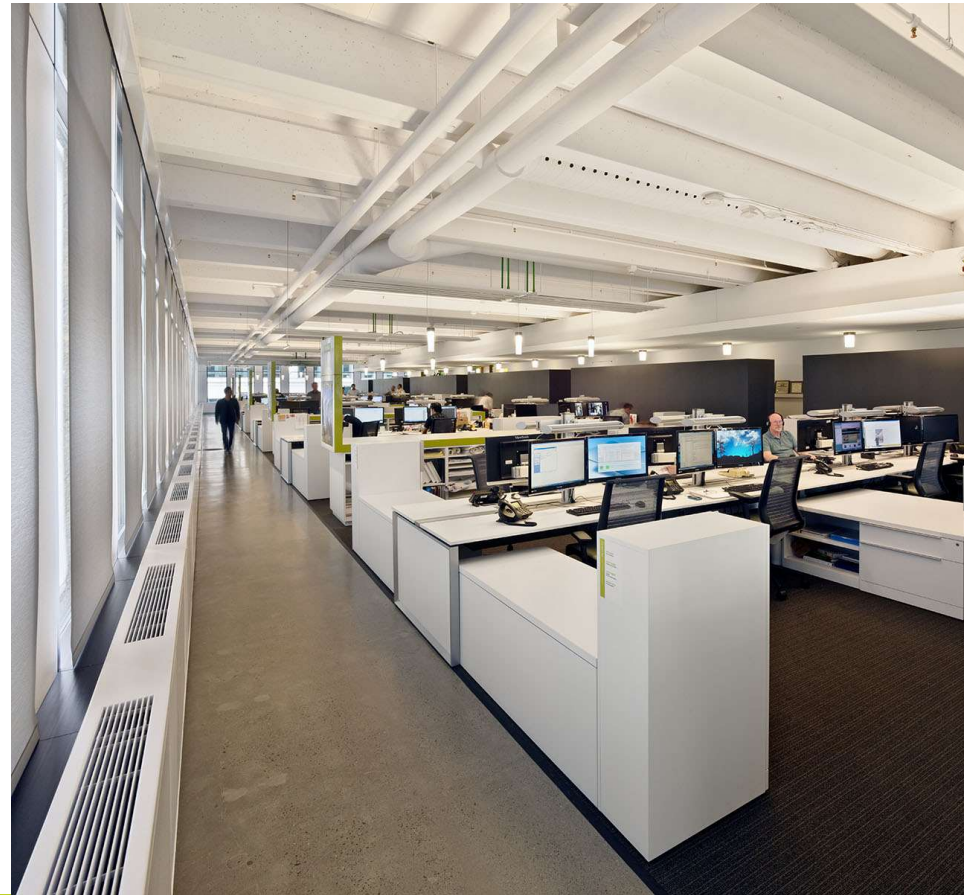
# Design Considerations

- Ease of Installation
  - Part of the fixture
  - Great for retrofits
- Flexibility
  - During design
  - During construction
  - Post Occupancy
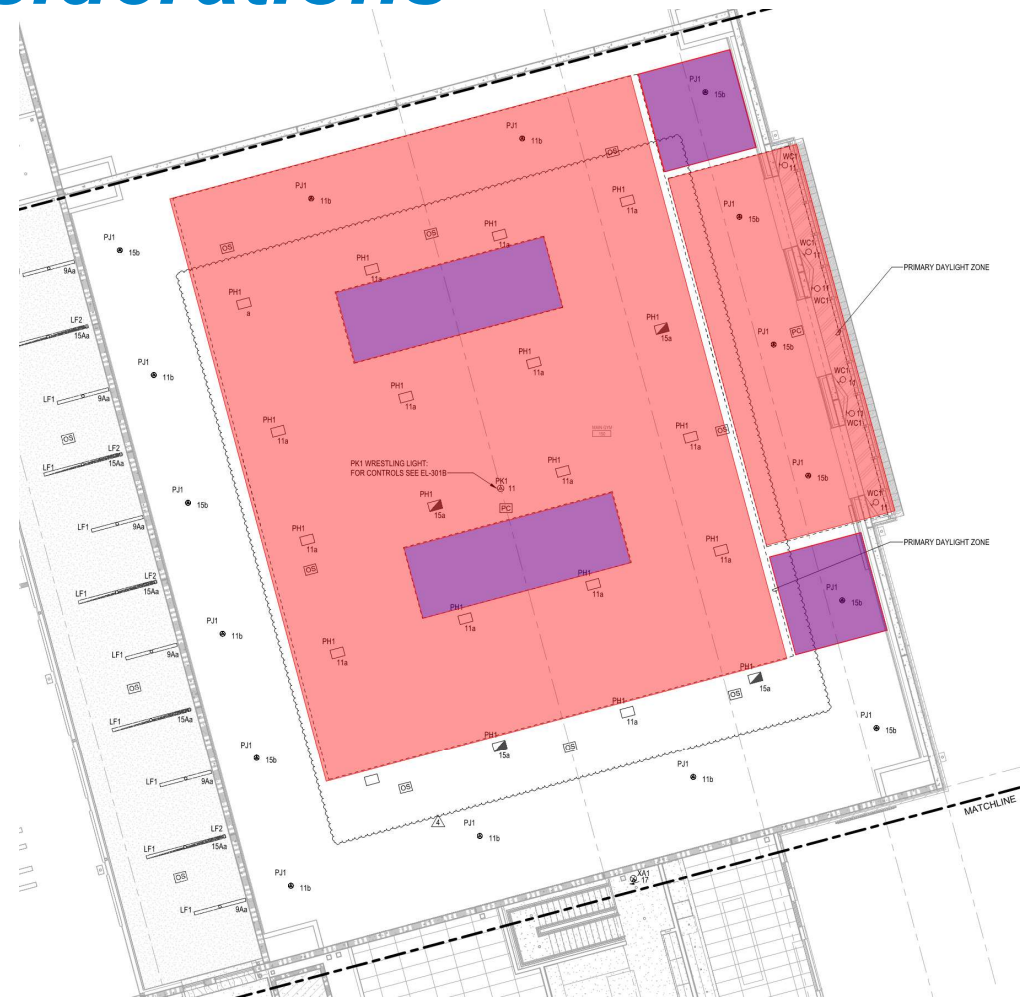
# Design Considerations

- Occupant Comfort
    - Individual control of fixtures via individual dimmer or software
    - Dimming
    - More accurate occupancy sensing

# Design Considerations

- Beyond Traditional Lighting Controls
  - How is the space being used?
  - Density maps
  - Occupancy Limits
  - Targeted Cleaning
  - Heat maps
  - Asset tracking
  - Contact tracing
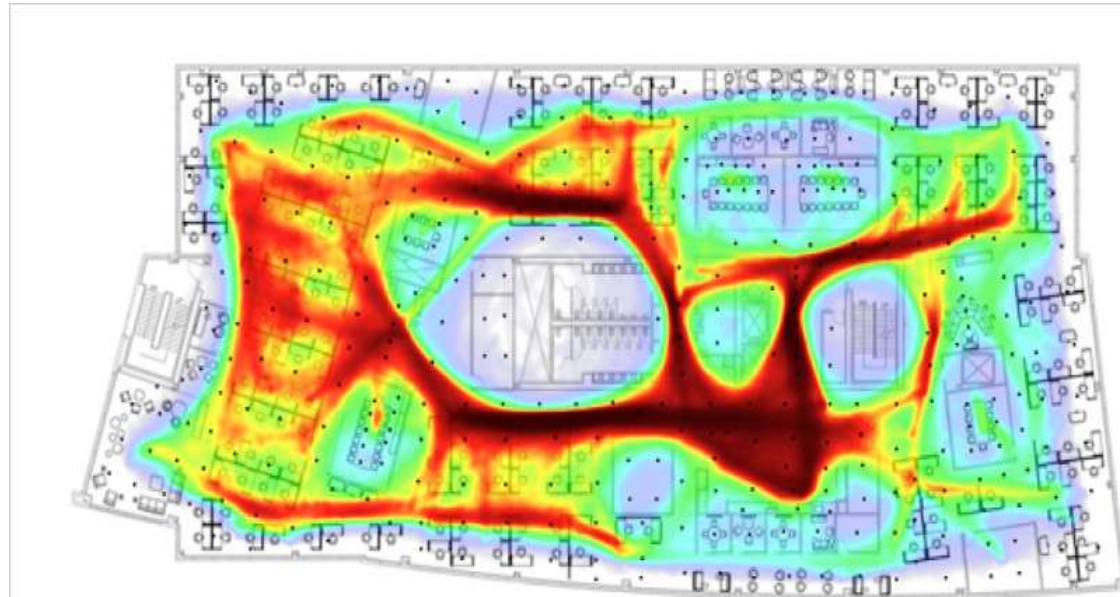
# *Design Considerations*

- What are the potential downsides?
  - Aesthetics
  - Controlling different fixtures
  - Controlling different sources

# *Design Considerations*

- What are the potential downsides?
  - Getting fixture manufactures onboard
  - Client capabilities

# *Questions? Comments?*

*Thank You!*