Lighting

2019 DOE Energy Codes Conference
Denver, CO
Prediction vs. performance

“Skate to where the puck is going to be, not where it has been.”
The decade passes:
2017 lighting data collected
2019 IECC and ASHRAE action
2021 IECC published
2022 states adopt 2021 code
2025 final 2021 code permits
2027 buy lighting packages
10 years later!
Continuing improvement @ 5%/year

Progress will be greater than zero

- Reflectances
- The 10% adder
How to reduce lighting energy use?

1. Automatically turn lights off when you don’t need any
2. Automatically turn lights down when you don’t need as much
3. Use efficient lamps & fixtures to begin with
Interior Lighting Controls

1. Turn lights *off* when you don’t need any
   A. Manual controls (light switches)
   B. Occupancy sensor controls
   C. Time clock controls

2. Turn lights *down* when you don’t need as much
   A. 50% light reduction switching
   B. Daylighting controls

In daylight zones:
- Occupancy + daylight sensors
  OR
- Time switch + daylight sensors
Occupancy sensors **required** in:

- Enclosed spaces *300 SF or less*, including:
  - Classrooms
  - Private offices
  - Restrooms
  - Warehouses (each aisle)
  - Conference & meeting rooms
  - Employee lunch & break rooms
  - Storage & janitor rooms

- Auto off, **plus**
- Auto on to 50% or
- Manual on to 100%
Time Switch Controls required everywhere

Except:

• **Areas with occupancy sensors**
• Lighting that stays on 24/7
• “...endanger safety or security”
• Dwelling units & sleeping units
• Shop & lab classrooms
• Patient care

• Override switch required each zone
Daylight controls required in daylight zones

Except:

• Security or emergency use
• Egress stairs and corridors
• Spaces with <150 W

Rules

• Primary, secondary, toplit zones
• Continuous dimming in office, classroom, lab, library
LLLC: cheaper and better?

- “Luminaire-Level Lighting Control”
  - Daylight-sensor
  - Occupancy sensor
  - Factory calibrated
  - Wireless controls
  - Individually adjustable with hand-held remote

- Less expensive without all that control wiring? (Maybe yes, maybe no.)

Separate Switching:
- Display, display case & accent
- Plant grow lights
- Food warming
- Task lighting
Exterior controls

- Always off during daylight hours
- Façade and landscape lighting
  - Shut off completely for 6 hours
- Other exterior lighting
  - 30% night turndown
  - **Occupancy sensor (15 min)**

Exterior power

**Calculation:**

1. Base site allowance +
2. Tradeable surfaces +
3. Non-tradeable surfaces
C406 Additional Efficiency Options:

#2: Lighting power

LPA 10% below table values

- So, it’s the only option anyone takes

#3: Digital lighting controls

- Digital control system capable of:
  - Setting schedules and light levels of fixtures or groups of fixtures
  - Load shedding
  - Configuring occupancy & daylight controls
    - Individual user control in open office
  - Continuous dimming capability
  - Max 8 lights on each daylight sensor
  - Sequence of operations defined on permit documents
New: C406 Additional Efficiency Req’s Table

Points by occupancy & CZ **218**
- Get 10 credits total
- Great work by Reid Hart of PNNL
- With NW Energy Codes Group

Plus additional credits:
- Dwelling units lighting **226**
- Metering where not req’d **237**
- FDD where not req’d **239**
- Commercial kitchen equip **240**

<table>
<thead>
<tr>
<th>Table C406.1(3) Additional Energy Efficiency Credits for Group E Occupancies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Zone:</td>
</tr>
<tr>
<td>1A</td>
</tr>
<tr>
<td>C406.2.1: 5% Heating</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>C406.2.2: 5% Cooling</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>C406.2.3: 10% Heating</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>C406.2.4: 10% Cooling</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>C406.3.1: 10% LPA</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>C406.4: Digital Lt Ctrl</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>C406.5: Renewable</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>C406.6: DOAS</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>C406.7.1: SWH HR*</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>C406.7.2: SWH NG eff*</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>C406.7.3: SWH HPWH*</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>C406.8: 85% UA</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>C406.9: Low Leak</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
Meanwhile, back in Albuquerque
Scope

- “Sites” now in IECC and ASHRAE (maybe)
- So, parking lot lighting...
Interior lighting: Great IECC clarifications

 Mostly from Jack Bailey and Glenn Heinmiller, representing IALD

• Untangles occ sensor & daylight sensor 170
• Untangles rules for open-plan office 171 & 172
• Clarifies stepped dimming rules 181
• Reduce lighting power per ASHRAE 206 & 208
• “Horticultural” lighting standard 209
• Occ sensors required for corridors 169
  • turn lights down 50% after 20 minutes
• ASHRAE: Nifty table (9.2.2.3) consolidates all the exceptions for lighting power and controls
Daylighting

- **Continuous dimming** req’d in all daylight zones 185
- Daylighting language cleanup & diagrams 187
- Zone extends 1/2 window height to sides 191
- Exception for deep overhangs 192
Exterior lighting

- Parking lot lights <24 ft height – reduce 50% after 15 minutes 198
  - Retails might not like this
- Spell out exterior lighting power calculation rules 211
Controlled Receptacles

- Private offices, open offices, classrooms, etc: 50% of all outlets controlled by time clock switch or occ sensor
- Either top half switched, or within 12" of non-controlled
- 5,000 sf max by one override
- (Could use same override switch as lighting)