COMPLIANCE OVERVIEW

1. Compliance and enforcement
2. Permitting and certification
3. Compliance approaches
4. Required forms
5. New additions and major changes
Primary responsibility for compliance and enforcement rests with the local enforcement agency, typically associated with a city or county government.

A building permit must be obtained from the local jurisdiction before construction of:

- A nonresidential building
- An outdoor lighting system
- Additions to existing buildings
- Significant alterations to existing lighting systems
- Signage
LOCAL ORDINANCES

State law allows local jurisdictions to adopt building energy efficiency standards that are more stringent than Title 24, Part 6, through an approval process with the California Energy Commission.

These local ordinances, sometimes called “reach codes,” are listed on the Energy Commission website: www.energy.ca.gov/title24/2013standards/ordinances
1. **Meet all mandatory requirements**
   - Required controls that must be installed
   - Functionality that a lighting system must be capable of
   - Specify if a device needs to be certified by the Energy Commission

2. **Meet all prescriptive or performance requirements**
   - Maximum lighting power allowance for a building or an area
   - Some methods allow for trade-offs between building systems, so a very efficient lighting system may allow for a greater HVAC load
THE PERFORMANCE APPROACH

Performance Approach:

- More flexible than prescriptive
- Based on an energy simulation model of the building
- Requires an approved computer software program
- Uses energy budgets to determine compliance
- Typically used for flexibility and ability to find the most cost-effective solution

Approved software:
CBECC-Com V2
IES Virtual Environment 2013 Title-24
Feature Pack 1 (VE2013 Title-24 FP1)

http://www.energy.ca.gov/title24/2013standards/2013_computer_prog_list.html
THE PRESCRIPTIVE APPROACH

Prescriptive Approach:

- Each component of proposed building must meet prescribed minimum efficiency
- Less design flexibility
- Failure to meet any requirement results in non-compliance
THE PRESCRIPTIVE APPROACH

Indoor Lighting

The prescriptive lighting power requirements are determined by one of three methods:

- Complete building method
- Area category method
- Tailored method

The allowed lighting varies according to building occupancy and task.
THE PRESCRIPTIVE METHODS

1. Complete building method
   Usable when at least 90% of the building is one primary type of use or sometimes for a single tenant space within a building. A **Single allowed lighting power** value governs the entire building.

2. Area category method
   Applicable for any permit situation, including tenant improvements. Lighting power values are assigned to **each major function areas** of a building (offices, lobbies, etc.). The allowed lighting power is the weighted average of these areas.

3. Tailored method
   Applicable when additional flexibility is needed to accommodate special task lighting needs in specific task areas. Lighting power allowances are determined **room-by-room and task-by-task**, with the area category method used for other areas in the building.
### Table 140.6-C in the Standards

**Area Category Method- Lighting Power Density Values (Watts/ ft²)**

<table>
<thead>
<tr>
<th>PRIMARY FUNCTION AREA</th>
<th>ALLOWED LIGHTING POWER (W/ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Area</td>
<td></td>
</tr>
<tr>
<td>Reading areas</td>
<td>1.2³</td>
</tr>
<tr>
<td>Stack areas</td>
<td>1.5³</td>
</tr>
<tr>
<td>Lobby Area</td>
<td></td>
</tr>
<tr>
<td>Hotel lobby</td>
<td>1.1³</td>
</tr>
<tr>
<td>Main entry lobby</td>
<td>1.5³</td>
</tr>
<tr>
<td>Locker/Dressing Room</td>
<td>0.8</td>
</tr>
<tr>
<td>Lounge Area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1³</td>
</tr>
<tr>
<td>Malls and Atria</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2³</td>
</tr>
<tr>
<td>Medical and Clinical Care Area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>Office Area</td>
<td></td>
</tr>
<tr>
<td>&gt; 250 square feet</td>
<td>0.75</td>
</tr>
<tr>
<td>≤ 250 square feet</td>
<td>1.0</td>
</tr>
</tbody>
</table>
# Complete Building Allowances

<table>
<thead>
<tr>
<th>Type of Use</th>
<th>Allowed Lighting Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditorium Building</td>
<td>1.5</td>
</tr>
<tr>
<td>Classroom Building</td>
<td>1.1</td>
</tr>
<tr>
<td>Commercial and Industrial Storage Buildings</td>
<td>0.6</td>
</tr>
<tr>
<td>Convention Center Building</td>
<td>1.2</td>
</tr>
<tr>
<td>Financial Institution Building</td>
<td>1.1</td>
</tr>
<tr>
<td>General Commercial Building / Industrial Work Building</td>
<td>1.0</td>
</tr>
<tr>
<td>Grocery Store Building</td>
<td>1.5</td>
</tr>
<tr>
<td>Library Building</td>
<td>1.3</td>
</tr>
<tr>
<td>Medical Buildings / Clinic Building</td>
<td>1.1</td>
</tr>
<tr>
<td>Office Building</td>
<td>0.8</td>
</tr>
<tr>
<td>Parking Garage Building</td>
<td>0.2</td>
</tr>
<tr>
<td>Religious Facility Building</td>
<td>1.6</td>
</tr>
<tr>
<td>Restaurant Building</td>
<td>1.2</td>
</tr>
<tr>
<td>School Building</td>
<td>1.0</td>
</tr>
<tr>
<td>Theater Building</td>
<td>1.3</td>
</tr>
<tr>
<td>All other Buildings</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Slide Credit: Halley Fitzpatrick, PG&E
### AREA CATEGORY ALLOWANCES

<table>
<thead>
<tr>
<th>PRIMARY FUNCTION AREA</th>
<th>ALLOWED LIGHTING POWER (W/ft²)</th>
<th>PRIMARY FUNCTION AREA</th>
<th>ALLOWED LIGHTING POWER (W/ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditorium Area</td>
<td>1.5³</td>
<td>Library Area</td>
<td>1.2³</td>
</tr>
<tr>
<td>Auto Repair Area</td>
<td>0.9²</td>
<td>Reading areas</td>
<td>1.2³</td>
</tr>
<tr>
<td>Beauty Salon Area</td>
<td>1.7</td>
<td>Stack areas</td>
<td>1.5³</td>
</tr>
<tr>
<td>Civic Meeting Place Area</td>
<td>1.3³</td>
<td>Hotel lobby</td>
<td>1.1³</td>
</tr>
<tr>
<td>Classroom, Lecture, Training, Vocational Areas</td>
<td>1.2⁵</td>
<td>Main entry lobby</td>
<td>1.5³</td>
</tr>
<tr>
<td>Commercial and Industrial Storage Areas</td>
<td>0.6</td>
<td>Locker/Dressing Room</td>
<td>0.8</td>
</tr>
<tr>
<td>Commercial and Industrial Storage Areas (cond. and uncond.)</td>
<td>0.7</td>
<td>Lounge Area</td>
<td>1.1³</td>
</tr>
<tr>
<td>Commercial and Industrial Storage Areas (refrigerated)</td>
<td></td>
<td>Malls and Atria</td>
<td>1.2³</td>
</tr>
<tr>
<td>Convention, Conference, Multipurpose and Meeting</td>
<td>1.4³</td>
<td>Medical and Clinical Care Area</td>
<td>1.2</td>
</tr>
<tr>
<td>Center Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corridor, Restroom, Stair, and Support Areas</td>
<td>0.6</td>
<td>Office Area</td>
<td></td>
</tr>
<tr>
<td>Dining Area</td>
<td>1.1³</td>
<td>&gt; 250 square feet</td>
<td>0.75</td>
</tr>
<tr>
<td>Dining Area</td>
<td></td>
<td>≤ 250 square feet</td>
<td>1.0</td>
</tr>
<tr>
<td>Electrical, Mechanical, Telephone Rooms</td>
<td>0.7²</td>
<td>Parking Garage Area</td>
<td></td>
</tr>
<tr>
<td>Exercise Center, Gymnasium Areas</td>
<td>1.0</td>
<td>Parking Area</td>
<td>0.14</td>
</tr>
<tr>
<td>Exhibit, Museum Areas</td>
<td>2.0</td>
<td>Dedicated Ramps</td>
<td>0.3</td>
</tr>
<tr>
<td>Financial Transaction Area</td>
<td>1.2³</td>
<td>Daylight Adaptation Zones</td>
<td>0.6</td>
</tr>
<tr>
<td>General Commercial and Industrial Work Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low bay</td>
<td>0.9²</td>
<td>Retail Merchandise Sales, Wholesale Showroom Areas</td>
<td>1.2⁶ and ⁷</td>
</tr>
<tr>
<td>High bay</td>
<td>1.0²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precision</td>
<td>1.2⁴</td>
<td>Theater Area</td>
<td></td>
</tr>
<tr>
<td>Grocery Sales Area</td>
<td>1.2⁶ and ⁷</td>
<td>Motion picture</td>
<td>0.9³</td>
</tr>
<tr>
<td>Hotel Function Area</td>
<td>1.5³</td>
<td>Performance</td>
<td>1.4³</td>
</tr>
<tr>
<td>Kitchen, Food Preparation Areas</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory Area</td>
<td>1.4¹</td>
<td>Videoconferencing Studio</td>
<td>1.2⁸</td>
</tr>
<tr>
<td>Laundry Area</td>
<td>0.9</td>
<td>Waiting Area</td>
<td>1.1³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All other areas</td>
<td>0.6</td>
</tr>
</tbody>
</table>

On the surface…
- 35 unchanged
- 6 reduced
- 3 new

Looking closer*…
- 38 unchanged or increased!
- 3 reduced
- 3 new

*considering footnotes & other task allowances
NR CC - LT S - 01 - E

NR: Non-Residential
CC: Certificate of Compliance
CA: Certificate of Acceptance
CI: Certificate of Installation
Lighting
Number in Sequence
E: Used by Enforcement Authority
A: Used by Acceptance Tester
I: Interior
O: Outdoor
S: Signs
CERTIFICATES OF COMPLIANCE

Indoor
1. NRCC-LTI-01-E: Certificate of Compliance, Indoor Lighting
2. NRCC-LTI-02-E: Certificate of Compliance, Indoor Lighting Controls
3. NRCC-LTI-03-E: Certificate of Compliance, Indoor Lighting Power Allowance
4. NRCC-LTI-04-E: Certificate of Compliance, Tailored Method Worksheets
5. NRCC-LTI-05-E: Certificate of Compliance, Line Voltage Track Lighting

Outdoor
1. NRCC-LTO-01-E: Certificate of Compliance, Outdoor Lighting
2. NRCC-LTO-02-E: Certificate of Compliance, Outdoor Lighting Controls
3. NRCC-LTO-03-E: Certificate of Compliance, Outdoor Lighting Power Allowances
CERTIFICATES OF INSTALLATION

NRCI-LTI-01-E: This is the general Certificate of Installation used to declare that what was proposed in the Certificates of Compliance is actually what was installed.

NRCI-LTI-02-E: Used whenever a lighting control system or Energy Management Control System (EMCS) has been installed.

NRCI-LTI-03-E: Used whenever a line-voltage track lighting integral current limiter or a supplementary overcurrent protection panel has been installed.

NRCI-LTI-04-E: Must be submitted for two interlocked systems serving an auditorium, a convention center, a conference room, a multipurpose room, or a theater to be recognized for compliance.

NRCI-LTI-05-E: Must be submitted for a Power Adjustment Factor (PAF).

NRCI-LTI-06-E: Must be submitted for additional wattage installed in a video conferencing studio to be recognized for compliance.
CERTIFICATES OF INSTALLATION

**NRCI-LTO-01-E:** Certificate of Installation, Outdoor Lighting

**NRCI-LTO-02-E:** Certificate of Installation, Energy Management Control System or Lighting Control System
ACCEPTANCE TESTING

Acceptance testing helps ensure building equipment and systems perform properly. It is not a replacement for commissioning.

1. Review documents to make sure that controls are properly documented
2. Review the installation and perform testing to ensure controls operate as required by Title 24
3. Fill out the Certificates of Acceptance and submit them to the enforcement agency in order to receive an occupancy permit
ACCEPTANCE TESTING PROCESS

1. **Plan Review (installing contractor, engineer of record)**
   Review plans and specifications to ensure they meet all Title 24 requirements. Typically done prior to signing a Certificate of Compliance.

2. **Construction Inspection (installing contractor, engineer of record)**
   Check that the equipment installed is capable of complying with the requirements of the Standards. Construction inspection also assures that the equipment is installed correctly and is calibrated.

3. **Functional Testing (Field Technician)**
   Acceptance tests are performed to ensure that all equipment performs as required by Title 24.

4. **Occupancy**
   Once all required Certificates of Acceptance are submitted, the enforcement agency releases a Certificate of Occupancy.
ACCEPTANCE TESTS AND FORMS

Acceptance tests apply to all new equipment and controls installed on new or existing lighting systems. These tests cover:

NRCA-LTI-02-A: Lighting Control Acceptance
• Occupancy sensors
• Manual daylight controls
• Automatic time switch controls

NRCA-LTI-03-A: Automatic Daylight Control Acceptance
• Automatic daylight controls

NRCA-OLT-02-A: Outdoor Lighting Acceptance Tests
• Motion sensors (location, sensor coverage, signal strength)
• Astronomical time clocks
• Other shutoff controls
In order to be certified as an acceptance test technician, a person must:

1. Be employed by an organization that is a Certified employer: [https://www.calctp.org/acceptance-technicians/contractors](https://www.calctp.org/acceptance-technicians/contractors)

2. Have at least three years of experience with lighting controls

3. Fill out the appropriate forms and pay the fees outlined on the CALCTP website: [https://www.calctp.org/acceptance-technicians](https://www.calctp.org/acceptance-technicians)

4. Take the training course offered at one of the CALCTP training centers: [https://www.calctp.org/training-center-list](https://www.calctp.org/training-center-list)
CERTIFICATES OF ACCEPTANCE

NRCA-LTI-02-A: Lighting Controls

NRCA-OLT-02-A: Outdoor Lighting Acceptance Tests
MANDATORY DEVICE REQUIREMENTS

The majority of lighting control devices are now regulated by California Appliance Efficiency Standards, Title 20

• Devices must be certified to the California Energy Commission
• Expanded requirements for:
  Automatic time switch controls
  Dimmers
  Occupant sensing devices
  Photocontrols
• Check www.appliances.energy.ca.gov
MAJOR UPDATE: TITLE 24 TRIGGERS

Interior:
- Projects affecting more than 10% of the luminaires in a space, or with 40 or more luminaire modifications-in-place per year, must comply with the new 2013 standards.

Exterior:
- Upgrades that replace more than 10% of the luminaires but less than 50% must meet all mandatory controls requirements, but do not need to meet the new lighting power density requirements.
- Alterations that replace more than 50% of the luminaires in a space, or any alteration that increases the connected lighting load, must comply with all mandatory requirements and lighting power density allowances.
### TABLE 141.0-E Requirements for Luminaire Alterations

<table>
<thead>
<tr>
<th>Quantity of existing affected luminaires per Enclosed Space</th>
<th>Resulting Lighting Power for Each Enclosed Space</th>
<th>Applicable Mandatory Control Provisions for Each Enclosed Space</th>
<th>Multi-level Lighting Control Requirements for Each Altered Luminaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum total &lt; 10% of existing luminaires</td>
<td>Existing lighting power is permitted</td>
<td>Existing provisions are permitted</td>
<td>Existing controls are permitted</td>
</tr>
<tr>
<td>Sum total ≥ 10% of existing luminaires</td>
<td>≤ 85% of allowed lighting power per Section 140.6 Area Category Method</td>
<td>§130.1(a), (c)</td>
<td>Two level lighting control ² or §130.1(b)</td>
</tr>
<tr>
<td></td>
<td>&gt; 85% of allowed lighting power per Section 140.6 Area Category Method</td>
<td>§130.1(a), (c), (d) ³</td>
<td>§130.1(b)</td>
</tr>
</tbody>
</table>

**Alterations that change the area of the enclosed space or the space type or increase the lighting power in the enclosed space**

| Any number | Comply with Section 140.6 | §130.0(d) ³ | §130.1(a), (c), (d) ³, (e) | §130.1(b) |

---

1. Affected luminaires include any luminaire that is changed, replaced, removed, relocated; or, connected to, altered or revised wiring, except as permitted by EXCEPTIONS 1 and 2 to Section 141.0(b) ²lili:
2. Two level lighting control shall have at least one control step between 30 and 70% of design lighting power in a manner providing reasonably uniform illuminations
3. Daylight controls in accordance with Section 130.0(d) are required only for luminaires that are altered.
TABLE 141.0-F-Requirements for Luminaire Modifications-in-Place

For compliance with this Table, building space is defined as any of the following:
1. A complete single story building
2. A complete floor of a multi floor building
3. The entire space in a building of a single tenant under a single lease
4. All of the common, not leasable space in single building

<table>
<thead>
<tr>
<th>Quantity of affected luminaires per Building Space per annum</th>
<th>Resulting Lighting Power per Each Enclosed Space Where ≥ 10% of Existing Luminaires are Luminaire Modifications-in-Place</th>
<th>Applicable mandatory control provisions for each enclosed space</th>
<th>Applicable multi-level lighting control requirements for each modified luminaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum total &lt; 40 Luminaire Modifications-in-Place</td>
<td>Existing lighting power is permitted</td>
<td>Existing provisions are permitted</td>
<td>Existing controls are permitted</td>
</tr>
<tr>
<td>Sum total ≥ 40 Luminaire Modifications-in-Place</td>
<td>≤ 85% of allowed lighting power per Section 140.6 Area Category Method</td>
<td>§130.1(a), (c)</td>
<td>Two level lighting control [3] Or §130.1(b)</td>
</tr>
<tr>
<td></td>
<td>&gt; 85% of allowed lighting power per Section 140.6 Area Category Method</td>
<td>§130.0(d) [4], §130.1(a), (c), (d) [4]</td>
<td>§130.1(b)</td>
</tr>
</tbody>
</table>

1. Control requirements only apply to enclosed spaces for which there are Luminaire Modifications-in-Place.
2. Multi-level controls are required only for luminaires for which there are Luminaire Modifications-in-Place.
3. Two level lighting control shall have at least one control step between 30% and 70% of design lighting power in a manner providing reasonably uniform illuminations
4. Daylight controls in accordance with Section 130.0(d) are required only for luminaires that are modified-in-place.
WHAT IS A REPAIR?

“Reconstruction or renewal for the purpose of maintenance of any component, system, or equipment of an existing building.”

- Replacement in kind of lamps, lamp holders, or lenses
- Alterations caused directly by the disturbance of asbestos
- Repairs may not increase energy consumption of repaired equipment
- If you replace any component, system, or equipment that is regulated by Title 24, that modification is considered an alteration and not a repair.

Repairs do not trigger Title 24.
WHAT IS AN ALTERATION?

- Luminaire replacement
- Luminaire removal or relocation
- Wiring alterations
- Connecting luminaires to switches, relays, branch circuits, and other controls

Alterations trigger Title 24 requirements.
WHAT IS A LUMINAIRE MODIFICATION IN PLACE?

- Lamp and ballast change-outs
- Reflector or optical system modifications
- Whole fixture retrofit kits

These trigger slightly different requirements, but do require compliance with Title 24.
These new requirements are **mandatory** and apply to all non-residential buildings that use **more than 50 kVA**, including new construction and additions. This new chapter includes:

- Service metering
- Disaggregation of circuits
- Voltage drop
- Receptacle control
- DR
- EMCS
SERVICE METERING

The building owner or occupant must have access to read a meter with:

1. Display of current kW usage
2. A manually resettable system to measure kWh usage over time
3. Larger services require additional capabilities

“Smart meters” usually meet the requirements as long as the data is accessible to the building owner or occupant.

<table>
<thead>
<tr>
<th>TABLE 130.5-A MINIMUM REQUIREMENTS FOR METERING OF ELECTRICAL LOAD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meter Type</strong></td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Instantaneous (at the time) kW demand</td>
</tr>
<tr>
<td>Historical peak demand (kW)</td>
</tr>
<tr>
<td>Resettable kWh</td>
</tr>
<tr>
<td>kWh per rate period</td>
</tr>
</tbody>
</table>
DISAGGREGATION OF ELECTRICAL LOADS

Disaggregation increases as loads get larger.
Disaggregation is not required until the service reaches 50 kVA, so most projects less than 5,000 ft$^2$ will not be required to comply. The more kVA is used, the more disaggregation is required (see Table 130.5-B).

Buildings must be wired to separate electrical loads by types.
For example, separate feeders and panels need to be available for lighting, plug and equipment loads, HVAC loads, etc.

This requirement does not require any metering.
By placing all load of a particular type on one feeder, a portable device can be temporarily attached to that feeder to allow for measurements.

This is mandatory, but will likely affect new buildings and for major additions or renovations.
If the existing service switchboard, feeders, and panel boards remain unchanged, this requirement is not triggered.
### EXCERPT FROM TABLE 130.5-B

<table>
<thead>
<tr>
<th>Load Type</th>
<th>Services rated 50 kVA or less</th>
<th>Services rated more than 50kVA and less than 250 kVA</th>
<th>Services rated more than 250kVA and less than 1000kVA</th>
<th>Services rated more than 1000kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lighting including exit and egress lighting and exterior lighting</strong></td>
<td>Not required</td>
<td>All lighting in aggregate</td>
<td>All lighting disaggregated by floor, type or area</td>
<td>All lighting disaggregated by floor, type or area</td>
</tr>
<tr>
<td><strong>Plug load including appliances rated less than 25 kVA</strong></td>
<td>Not required</td>
<td>All plug load in aggregate</td>
<td>All plug load separated by floor, type or area</td>
<td>All plug load separated by floor, type or area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sets of plug loads exceeding 25 kVA connected load in an area less than 5000 sf</td>
<td>Sets of plug loads exceeding 25 kVA connected load in an area less than 5000 sf</td>
<td>Sets of plug loads exceeding 25 kVA connected load in an area less than 5000 sf</td>
</tr>
</tbody>
</table>
VOLTAGE DROP

The recommended voltage drop limits from the California Electrical Code (Title 24, Part 3) are now mandatory, but have not been changed otherwise:

- The voltage drop in feeders is limited to 2% of design load
- The voltage drop in branch circuits is limited to 3% of design load
- Emergency power circuits are exempt
CIRCUIT CONTROLS FOR 120-VOLT RECEPTACLES

Plug loads are a large and increasing electrical load in most office buildings.

All of the following spaces must have **both** controlled and uncontrolled 120-volt receptacles:

- Private offices
- Open office areas
- Reception lobby
- Conference room
- Kitchens in office spaces
- Copy rooms

The controlled outlets must be clearly marked. Each uncontrolled receptacle should have a controlled receptacle within 6 feet of it.
CIRCUIT CONTROLS FOR 120-VOLT RECEPTACLES

The intent of this rule is to have built-in, hardwired power controls. Wireless motion sensors may be used, but the actual power switch must be hardwired. All of the controlled outlets must be:

1. Clearly marked as controlled
2. Automatically switched off any time the general lighting would be automatically turned off