2016 Title 24 Part 6
Essentials and More
Nonresidential Standards
for Architects

Ying Wang
Okapi Architecture Inc.
What’s New and Where We’re Headed

- Welcome
- 2016 Fact Sheet Review
- Where we are headed and what it means to YOU
- 2019 Code to be effective January 1, 2020

- Energy Standards Key Concepts
- Nonresidential Commissioning Standards
- Compliance Process Roadmap
- Nonresidential Solar Ready Standards
- Nonresidential Envelope Standards
- Nonresidential Daylighting Standards
- Applying the Standards to Your Job: Developing Design Recommendations
- Course Conclusion
Fact Sheet: “What’s New with 2016 Code”

- Quick reference document with update highlights.

For latest 2016 Fact Sheets, check http://www.energycodeace.com/content/resources-fact-sheets/
What Good Does Title 24 Do?

2016 Building Energy Efficiency Code applies to any California building permit granted after January 1, 2017

Projected Savings from 2016 Standards

- Energy Savings (Nonres):
  - 31.2 gigawatt-hours electricity annual savings
  - 1.55 million therms natural gas annual savings
- Emission Reduction (Nonres)
  - 13.7 thousand tons CO$_{2E}$
  - 20.6 tons NO$_x$
  - 0.68 tons SO$_x$
- Water Savings (Overall)
  - 330 million gallons annual savings

Benefits of Increased Energy Efficiency

- Lower energy costs
- Reliable delivery
- Increased comfort
- Improved environment

Source: CEC Publication Number 400-2015-012 (February 2015)
Energy code is evolving

As mechanical and lighting energy budgets get reduced, envelope design and choices are affected.

ZNE (zero net electricity) continues to remain an important goal for the California Energy Commission, and the 2019 Building Energy Efficiency Standards is a significant step toward ZNE goals.
Design Review by Architects

- Depending on size of project, you may be asked or required to sign off on Design Review documents (Certificates of Compliance).

- If so, you must ensure design specifications comply with Energy Standards and are consistent with the Certificate(s) of Compliance for the building or system.

Design Review §10-103(a)1

- Design Reviewer can be a licensed Architect or licensed Contractor in addition to a professional Engineer:
  - Buildings < 10,000 ft² may be the Engineer, Contractor, or Architect of record.
  - Buildings ≥ 10,000 ft² and < 50,000 ft², and simple mechanical systems, shall be a qualified in-house Engineer or Architect with no other project involvement, or a third party Engineer, Architect, or Contractor.
  - Buildings ≥ 50,000 ft² and all buildings with complex mechanical systems serving > 10,000 ft², the signer shall be a third party Engineer, Architect, or Contractor.
Commissioning §120.8

- Required for ALL new buildings with \( \geq 10,000 \text{ ft}^2 \) nonresidential conditioned space.
  - Includes nonresidential spaces in hotel/motel and high-rise residential buildings.

- Owner’s Project Requirements (OPR) must include building envelope performance expectations under 2016 Energy Standards.

- Basis of Design (BOD) document must also now include any building envelope components considered in OPR.

Additional information on Commissioning is in Module 5: Nonresidential Commissioning Standards.
Prescriptive insulation requirements have become more stringent under the 2016 Energy Standards.

Mandatory and Prescriptive insulation requirements have become more stringent for metal and wood-framed walls in certain climate zones.

Prescriptive envelope requirements in Tables 140.3-B and 140.3-C have been updated for Nonresidential Buildings and High-Rise Residential and Hotel/Motels respectively.

The Prescriptive Roof/Ceiling Insulation Tradeoff for Aged Solar Reflectance Table 140.3 has been updated. Requirements apply to roof replacements as well as new installations.
The Future of Envelope Design

- No major changes to envelope requirements in 2019 code… BUT…

- Mechanical and lighting energy budgets will get reduced, affecting use of the Performance method to “trade” envelope features against lighting/mechanical features.

Example:

Many new buildings exceed 40% WWR by using Performance method to take advantage of lighting/mechanical features that exceed Prescriptive requirements. This will no longer be a feasible option with the 2019 code.
New for 2016:

- New Fact Sheets
- Design Review by Architects
- Clarifications of Commissioning Requirements
- Mandatory Insulation for Walls
- Prescriptive Envelope Criteria
Nonresidential Commissioning Standards

- Welcome
- What’s New and Where We’re Headed
- Energy Standards Key Concepts

▶ Nonresidential Commissioning Standards
  - Commissioning Requirements
  - Design Phase Tasks

- Compliance Process Roadmap
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“Building Commissioning is a systematic quality-assurance process that spans the entire design and construction process, including verifying and documenting that building systems and components are planned, designed, installed, tested, operated and maintained to meet the owner’s project requirements.”

- **Title 24, Part 6**
  Building Energy Efficiency Standards: §120.8

- **Title 24, Part 11**
  Green Building Standards Code
  CALGreen: Chapter 5
Commissioning

- Defines commissioning scope
- Defines roles and responsibilities of Cx Team during pre-construction
- OPR and BOD considerations
- Design phase Cx Certifications of Compliance
- Construction/Acceptance/Occupancy Phase Cx
## Cx Requirements in Title 24, Part 6

### Commissioning Requirements

| Requirement                                      | 
|--------------------------------------------------|--------------------------------------------------|
| Owners Project Requirements (OPR)                | §120.8(b)                                        |
| Basis of Design (BOD)                            | §120.8(c)                                        |
| Design Review                                    | §120.8(d)                                        |
| Commissioning in Construction Docs (CD)         | §120.8(e)                                        |
| Commissioning Plan                               | §120.8(f)                                        |
| Acceptance Testing (Functional Testing)*         | §120.8(g)                                        |
| Operation & Maintenance (O&M)Training           | §120.8(h)                                        |
| Commissioning Report                             | §120.8(i)                                        |

### Construction Phase Commissioning

Construction Phase Commissioning is only required for Newly Constructed buildings with NR conditioned space \( \geq 10,000 \text{ ft}^2 \).

See [Cx Fact Sheet](#), [Multifamily Fact Sheet](#) and CEC Blueprints [#107](#), [#109](#), and [#113](#) for more project specific detail.

*Acceptance testing is always required for all Nonresidential buildings, not dependent on size.*
Your project has a Nonresidential conditioned floor area of 8200 ft².

✧ Is a Basis of Design (BOD) required? No

✧ Is a Design Review required? Yes

✧ Is a Commissioning Report required? No
What’s The Difference?

- Title 24 Part 6 (all building systems and components covered by Sections 110.0, 120.0, 130.0 and 140.0 excluding covered process) with occupancy group “A, B, E, F, H, M, R S, and U”
  - Ventilation
  - Space-Conditioning Systems and Controls
  - Water Heating Systems and Controls
- Lighting Systems and Controls
- Electrical Power Distribution
- Envelope (insulation, fenestration, cool roof, etc.)
- Acceptance Testing

- Title 24 Part 11 – in addition to Part 6
  - Renewable Energy Systems
  - Landscape Irrigation Systems
  - Water Reuse Systems
  - Building with occupancy “I” (Institutional) and “L” (Laboratories)

Part 6 vs. Part 11
First Time Build-outs and Tenant Improvements (TI)

- Energy Commission says that local enforcement agency dictates whether Cx is required for entire building prior to TI, or for each individual TI.

- Check with local enforcement agency to confirm policy.

http://www.energy.ca.gov/efficiency/blueprint/
“Commissioning applies to mechanically heated or cooled nonresidential portions of newly constructed mixed occupancy buildings, regardless of the percentage of nonresidential space.”
## Who can act as the Design Reviewer per 120.8(d)?

<table>
<thead>
<tr>
<th>Building Size</th>
<th>&lt; 10,000 ft²</th>
<th>10,000-50,000 ft²</th>
<th>&gt; 50,000 ft²</th>
<th>Complex systems in buildings &gt; 10,000 ft²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowed Design Reviewer</td>
<td>Signer may be the <strong>Engineer</strong>, <strong>Contractor</strong>, or <strong>Architect</strong> of record</td>
<td>Signer shall be the qualified in-house <strong>Engineer</strong> or <strong>Architect</strong> with no other project involvement, or a <strong>third party Engineer</strong>, <strong>Architect</strong>, or <strong>Contractor</strong></td>
<td>Signer shall be third party <strong>Engineer</strong>, <strong>Architect</strong>, or <strong>Contractor</strong></td>
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</table>

*Per §10-103(a)1: NEW for 2016*

In addition to the licensed Engineer, a **licensed Architect or licensed Contractor** representing services performed under the supervision of the licensed Engineer may be the reviewer and signee of record.
1. Is Commissioning required on the renovation of a existing 30,000 SF warehouse?
   a. Yes
   b. No
   c. It depends on the local jurisdiction’s policies

2. Why or why not?
   Because it is an existing building.
Design Phase Tasks
Design Phase Roles and Responsibilities

Owner or Owner’s Representative
✧ Develop OPR (typically with Cx Agent’s help)
✧ Arrange for Cx Process
✧ Attend Design Phase Cx Kickoff Meeting
✧ Review Cx Plan

Commissioning Coordinator/Authority (Cx Agent)
✧ Help develop OPR and review BOD
✧ Participate in Design Phase Cx Kickoff
✧ Review Design
✧ Develop Cx Plan
✧ Develop or review checklists and functional performance test plans
Design Phase Roles and Responsibilities

**Design Team**
- Facilitate completion of OPR and respond with BOD
- Include Cx process activities in project schedule
- Schedule/attend Design Phase Cx kickoff
- Include T24 requirements in design and compliance documents
- Specify Cx and delineate T24 acceptance tests in Construction Documents
- Review Cx Plan

**General Contractor, Subcontractors, Construction Manager**
- Include Cx cost in contract price
- Include Cx activities in contracts
- Review Cx Plan
- Coordinate acceptance testing and functional testing with subs
Owner’s or Owner Representative’s Project Requirements (OPR). The energy-related expectations and requirements of the building shall be documented before the design phase of the project begins. This documentation shall include the following:

1. Energy efficiency goals;
2. Ventilation requirements;
3. Project documentation requirements, including facility functions and hours of operation, and need for after hours operation;
4. Equipment and systems expectations; and
5. Building envelope performance expectations. (NEW for 2016)
BOD Considerations

Section 120.8(c)

Basis of Design (BOD). Completed at design phase, explains how design of building systems and components meets the OPR, and updated as necessary during the design and construction phases. It covers:

1. Heating, ventilation, air conditioning (HVAC) systems and controls;
2. Indoor lighting system and controls;
3. Water heating systems and controls; and
4. Any building envelope component considered in the OPR. (NEW for 2016)

Which of these do you have primary responsibility for?
Commissioning Resources

- Chapter 12 of the Title 24, Part 6 Nonresidential Compliance Manual
- Energy Code Ace Fact Sheet
- Energy Code Ace Application Guide (Nonresidential Envelope)
- CEC Blueprints #107 & #109
- California Commissioning Collaborative
- ASHRAE Guideline 0-2013
- Energy Code Ace Decoding Talk (archived)
In this short activity, you will work in groups to develop an agenda for a Design Review Kickoff Meeting. Be ready to share your answers!
Activity 4-1 Debriefing

- Who would attend your meeting?
  - Owner or Owner’s Representative
  - Architect
  - Design Reviewer
  - Project Manager
  - Design Engineer(s)

- When during design would you hold it?
  - During Pre-Design

- What might you discuss during the meeting?
  - Project Scope
  - Design Elements and Assumptions
  - Energy Standards Requirements
  - Recommended Energy Efficiency Measures
Key Points

- If Nonresidential occupancy < 10,000 ft$^2$, then:
  - Only requirements are Design Review §120.8(d) and Construction Documents §120.8(e)
- If Nonresidential occupancy ≥ 10,000 ft$^2$, then:
  - All of the requirements §120.8(b)-(i) apply, in addition to
    requirements from Title 24, Part 11 (CALGreen)
- Design Reviewer and signee of record can be...
  - Licensed engineer, or
  - Licensed architect or licensed contractor under the supervision of the licensed engineer
- Designers need to start addressing Cx requirements during Pre-design
  - OPR & BOD
  - Design Review Kickoff
  - Design Review & Compliance Forms

Commissioning Summary
Compliance Process Roadmap

- Welcome
- What’s New and Where We’re Headed
- Energy Standards Key Concepts
- Nonresidential Commissioning Standards

▶ Compliance Process Roadmap
  - When Compliance Tasks Occur, and Who Does What
  - Key Areas of Collaboration and System Interactions
  - Steps to Compliance from Inception to Occupancy

- Nonresidential Solar Ready Standards
- Nonresidential Envelope Standards
- Nonresidential Daylighting Standards
- Applying the Standards to Your Job: Developing Design Recommendations
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HELPING YOU PLAY YOUR CARDS RIGHT
When Compliance Tasks Occur
## Project Schedule Overview

<table>
<thead>
<tr>
<th>Task</th>
<th>RFP and Statement of Work</th>
<th>Pre-Design</th>
<th>Schematic Design</th>
<th>Design Development</th>
<th>Construction Documents</th>
<th>Construction Permit</th>
<th>Construction</th>
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<tbody>
<tr>
<td>Include Compliance Tasks and Costs into Contract Documents</td>
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<td>Commissioning Kickoff with Owner—Design Review Requirements*</td>
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<td>Determine Compliance Strategies</td>
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<td>Verify Compliant Design</td>
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<td>Submit for Plan Check</td>
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<td>Construction Phase Commissioning Activities*</td>
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<td>As-Built Drawings and Forms</td>
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*if applicable
Key Areas of Collaboration and System Interactions
As the code becomes more stringent, **integrated design practices** will be necessary to meet requirements.

**Key Concepts**

- Early engagement of MEP Engineers, Energy Consultant, and General Contractor
- Collaborative design decisions based on system interactions
- “Preventative Medicine” to identify and mitigate potential issues and inefficiencies early
Cost Benefits of Early Coordination

*In traditional Paulson/MacLeamy curves, “Cost Effectiveness” is noted as “Influence,” and “Effort” is noted as “Cumulative Cost.”
Roles and Responsibilities in Practice

- **Project Facilitator**
  - Manages relationship with Owner
  - Facilitates project team coordination

- **Envelope Designer**
  - Aesthetic identity of project
  - Drives other design features

- **Architect**
  - Project Facilitator; Envelope Designer

- **Owner**
  - Decision Maker and Occupant

- **General Contractor**
  - Builder

- **Commissioning Design Reviewer**
  - Reviewer and Advisor

- **Energy Consultant**
  - Energy Efficiency Advisor; Modeler

- **MEP Engineers**
  - Mechanical, Electrical, Plumbing Designer; Modeler
Collaborative Decision Making

- Determine early on what design features do NOT meet Prescriptive requirements so that the other design professionals can work together on solutions.

- Multi-disciplinary teams are more effective at brainstorming innovative solutions.

- Be open to suggestions, and actively solicit input. Even if you don’t implement their exact idea, it may spark an innovative idea of your own.
Order of Energy Use Design Priority

**Priority 1:**
- Passive
  - Climate Zone
  - Existing Conditions
  - Natural
  - Man Made
  - Orientation

**Priority 2:**
- Passive & Active
  - Massing
  - Envelope
  - Internal and External Loads

**Priority 3:**
- Active
  - Products
  - Technologies
  - Controls, BAS, and Renewables
Steps to Compliance from Inception to Occupancy
Navigator Ace

- Step by step guide to the compliance process
- Covers Residential and Nonresidential
- Prescriptive and Performance Approaches
- Easy to follow flowchart
- Color-coded for primary responsible party
- Each step expands with detailed information

SEE IT IN ACTION
Navigator Ace: Sample Step Demo

- Print-ready PDF pop up
- Hyperlinks to resources and tools
- Team coordination guidance
- Tips and tricks including trainings

Tips & Tricks:
- Looking for a Certified Energy Analyst (CEA) may be valuable for finding qualified energy modeling personnel. Visit the California Association of Building Energy Consultants (CABEC) website here to find a CEA.
- ROEs offer modeling training through the regional Education Centers:
  - PG&E User Calendar
  - SCE Class Calendar
  - SDG&E Class Calendar
  - Southern California Edison Calendar

2016 NR Perf Full Guide_12.8.16(2).pdf
2016 NR Presc Full Guide_12.8.16(1).pdf
Project Inception

- Include code compliance tasks and associated costs in your Statement of Work, project schedule, and budget.

- If your project requires Commissioning, coordinate with the Project Owner and Commissioning Agent to understand the Owner’s Project Requirements (OPR) utilizing the NRCC-CXR checklists.

- Use the OPR to develop the Basis of Design (BOD).

- Determine who will be responsible for completing various NRCC (Certificate of Compliance) documentation. Energy consultant? Mechanical engineer? Lighting? How will it all be brought together?
Determine which Part 6 requirements and NRCC forms are applicable.

Coordination required to determine who will document applicable building features with compliance forms (NRCC).

Use CEC approved compliance software to inform design decisions.

Close coordination is necessary with entire project team to verify compliance.

- Energy Consultant
- Owner
- Architect / Designer
- MEP Engineers
- Lighting Designer
**Coordinate and Document Design Phase Commissioning Activities**

*if applicable

<table>
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<th>Pre-Design</th>
<th>Schematic Design</th>
<th>Design Development</th>
<th>50-90% Construction Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Select Design Reviewer&lt;br&gt;• Select CxA (recommended, not required)&lt;br&gt;• Draft OPR</td>
<td>• Draft BOD&lt;br&gt;• Hold Design Cx Kickoff meeting [NRCC-CXR-01-E]</td>
<td>• Draft Cx specifications&lt;br&gt;• 100% DD: Perform preliminary design review [NRCC-CXR-02-E; NRCC-CXR-03-E; NRCC-CXR-04-E] (recommended, not required)</td>
<td>• Finalize Cx specifications&lt;br&gt;• Perform final design review [NRCC-CXR-02-E; NRCC-CXR-03-E; NRCC-CXR-04-E]&lt;br&gt;• Draft Cx Plan</td>
</tr>
</tbody>
</table>

- Required on all Newly Constructed buildings with nonresidential conditioned space.
- This requirement includes mixed use nonresidential spaces in hotel/motel and high-rise residential buildings.
- Incorporate Commissioning related documents into construction document package.
Coordinate with Contractor to ensure requirements are understood in construction documents.

Incorporate any design changes that occur in the field (submittal process).

Changes to products or systems during construction could cause the energy model to be revised if the Performance Approach is pursued.

Compliance documentation must be updated and resubmitted if changes to design occur in the field.
Compliance Process Summary

- Incorporate compliance tasks and costs into Statement of Work and project schedule documents.
- Early coordination reduces compliance issues later.
- Envelope design efficiency dictates sizing of other systems, and affects overall energy performance.
Applying the Standards to Your Job: Developing Recommendations

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**Applying the Standards to Your Job: Developing Design Recommendations**

- Case Study: Reaching ZNE Economically
- Activity: Improve Design Beyond Compliance

- Course Conclusion
Case Study: Reaching ZNE Economically
Case Study: Reaching ZNE Economically

Case study courtesy of Sharp Development, 2016
Case Study: Reaching ZNE Economically

Developer Goals

- Create a healthy and positive work environment for the occupants
  - Natural light
  - Thermal comfort
  - Natural ventilation
  - Exceptional acoustics
  - Constant connection to nature
- Minimize the impact on the environment
  - Zero Net Electricity (ZNE) operationally
  - Carbon neutral
  - Minimize water use
  - Highly sustainable construction methods and materials

Accomplish this at a price point that will operationally be more profitable than the standard way of renovating to city code.
Case Study: Reaching ZNE Economically

EXISTING CONDITIONS

- 30,000 SF square one-story office warehouse built in 1973
- Uninsulated concrete walls, wood roof and single pane windows
- DARK, DINGY and UNRENTABLE!
Case Study: Reaching ZNE Economically

HIGH PERFORMANCE ENVELOPE
Case Study: Reaching ZNE Economically

PASSIVE THERMAL COMFORT
Case Study: Reaching ZNE Economically

INTEGRATED ROOF PLANNING
CASE STUDY: REACHING ZNE
Economically

BUSINESS CASE FOR ZERO ENERGY COST

• ADDITIONAL COST TO RENOVATE SUSTAINABLY VS. LESS EXPENSIVE STANDARD METHOD OF RENOVATING => ($49.84 / SF)

• ADDITIONAL VALUE CREATED DUE TO A REDUCTION IN OPERATING EXPENSES AND RESERVE REQUIREMENTS => $52.94 / SF

• ADDITIONAL VALUE DUE TO ACCELERATED LEASE-UP TIME VS. AVERAGE MARKET DOWNTIME => $22.81 / SF

• ADDITIONAL VALUE DUE TO RECEIVING A PREMIUM IN RENT OVER THE TOP OF THE MARKET RENTS => $34.47 / SF
Activity: Improve Design Beyond Compliance
In this activity, you will work in groups to evaluate how the design’s energy efficiency could be further improved.

- Sketch any details illustrating the proposed renovations.
- Note any corresponding requirements on the plans.
- WOW US!! Sell us your ideas and be able to back them up with energy statistics on why your building design is helping achieve our ZNE goals.

How can Winchester Warehouse achieve Zero Net Energy?

What we’ve done to the building so far:

- Replace all the existing single pane windows and storefronts.
- Remove existing roll-up doors and replace with storefronts.
- Replace the existing roofing (remove existing to roof deck).
- Insulate the roof and walls.
How did you do?

Was your perspective shifted on how to improve existing buildings in ways that could go beyond code?
Thank you for participating today

Please remember to complete the Course Evaluation form!

We welcome your opinions about what you liked about this class and your suggestions for improving it.

Contact | Role       | Email                                           | Phone          |
---------|------------|-------------------------------------------------|----------------|
Ying Wang| Instructor | yingwang@okapiarchitecture.com                  | 818.726.4825   |
Susan Di Giulio | Instructor | smd.zinnerconsultants@gmail.com | 310.770.4207   |
Ying Wang| Coordinator| yingwang@okapiarchitecture.com                  | 818.726.4825   |
Lance Williams | Manager  | lance@okapiarchitecture.com                     | 323.646.6146   |

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