Title 24, Part II of the California Building Code will go into effect on July 1, 2014. This section of the code is focused on increasing the energy efficiency of buildings in California. It contains new regulations that are targeted at improving the energy efficiency standards in the 2008 code by 25% for residential buildings and 30% for nonresidential buildings.

This great stride towards energy efficiency will have significant impacts on the design costs and construction costs of projects submitted for permitting under the new code. This will include tenant improvement projects and renovation projects on existing buildings.

This paper outlines the main areas of the code that will create the largest impacts to the office and industrial facilities that HPA designs for its clients. The new code has three inter-connected documents that total well over 1,500 pages and there has been no field application of the definitions or interpretations regarding current accepted practice. This paper then is meant to be a limited overview and not a comprehensive analysis.

The very short summary on cost impacts:

No one has experience yet as to what an approved project will ultimately require. However, Cushman Wakefield issued a memo in May of 2014 that estimates the following cost impacts:

- Architecture & Engineering design and administration costs: 15% to 20% increase
- New Construction capital costs: 5% to 10% increase
- Tenant Improvement capital costs in existing shell: 10% to 15% increase

While we are unsure of the actual cost impacts, we do know that all aspects of the building systems for envelope, mechanical, electrical, and plumbing are affected by the code. It will also become a general requirement to do a LEED process facsimile involving an energy basis of design, certifications, and commissioning for building systems. The Cushman Wakefield memo also estimates increasing design phase schedules and plan check schedules by 10% to 20%.

It will be several months past the July 1st implementation date before reliable estimates on schedule increases and cost increases can be made, but it is clear that additional time and capital will be required for building projects in California after July 1, 2014. The following portions of this paper go into more detail about the scope and nature of the regulations.
Why does California have an energy efficiency building code?

California has had energy efficiency regulations for almost three decades. The 2013 California Energy Code housed in Title 24 updates the regulations in place since adoption of the 2008 Title 24 code. The pace of change has been accelerated however in the 2013 Code.

This chart indicates the policy maker objectives of the energy efficiency codes in California are being met. California currently has one of the lowest energy consumptions per capita among the fifty states. Only Hawaii, Connecticut, New York, and Rhode Island have lower energy consumption per capita than California. The two least efficient states are Wyoming and Louisiana. They consume over 4 times more energy per capita than California.

California is using the energy efficiency of the Title 24 Code to reach a policy goal of *Net Zero Energy* buildings by 2030. The Net Zero goal is essentially to achieve a building that generates enough energy from renewable sources to compensate for the energy required to build and operate it. The 2013 Energy Code about to be implemented is a long stride towards that policy goal and brings with it significant capital cost impacts.
Overview of impact on building systems over 2008 requirements

Envelope
- Increased cool roof requirements
- Established Air leakage requirements and testing
- Additional fenestration (window) requirements
- Additional Skylight requirements
- Additional roof insulation, wall, and demising wall requirements

Mechanical
- Additional fan control and economizer requirements
- Increased chiller efficiency requirements
- Increased cooling tower efficiency requirements
- Increased motor efficiency requirements
- Increased system power usage and refrigerant material restrictions
- Special refrigerated/frozen storage space requirements
- Additional controls and testing requirements

Electrical
- Established requirements for occupancy sensor controlled power outlets
- Established requirement for panels to be segregated by end use
- Increased requirement for occupancy sensor multiple stage lighting controls and local switching
- Increased requirements for dimmable lighting controls
- Increased requirements for daylighting lighting controls
- Establishes required occupancy lighting controls in warehouse aisles
- Establishes requirements for occupancy and multiple stage lighting controls for site lighting, parking lot lighting, parking garage lighting, and signage
- Increased constraints on power density
- Threshold reductions on remodel projects triggering full Title 24 compliance

It should be noted that unconditioned warehouse spaces will be subject to a significant number of these new requirements in regards to envelope, ventilation, lighting, and power usage.

Establishment of requirements for a building systems compliance approach that incorporates an initial basis of design to guide design, construction, and building commissioning certification processes.

Establishment of criteria and methodology for Prescriptive or Performance Compliance approaches.
Prescriptive or Performance?

It is not yet clear whether there are useful heuristics for understanding the conditions that would lead to utilizing either the *Prescriptive* compliance approach or the *Performance* compliance approach.

The *Prescriptive* approach is the most direct methodology. In this approach, each individual energy component of the proposed building is given a set of requirements to be met. There is no flexibility to mix and match more or less efficient components such as using a more efficient roof insulation system to offset a less efficient lighting system. Each component must meet its prescribed requirements regardless of other component choices.

The *Performance* approach allows compliance through a wide variety of design choices and strategies based on a computer simulation of building energy use. This methodology requires the use of an approved computer design software program for the modeling. Currently, none of the software systems in wide use by the industry have been adapted and approved due to the complexity of the new analysis. The specific energy analysis of this methodology focuses on the TDV (Time Dependent Value) aspect of energy usage. This analysis of energy use takes into account energy rates, demand times, and CO2 pricing. The table below is from the 70 plus page 2011 California Energy Commission publication on calculating a TDV.

**Table 1. Key Assumptions in 2013 TDVs**

<table>
<thead>
<tr>
<th>Input</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overview:</strong></td>
<td><strong>TDVs reflect current state policy and energy trends.</strong></td>
</tr>
<tr>
<td>Retail rate escalation</td>
<td>Retail rate escalated at a rate consistent with the E3/CARB 33% RES Calculator impacts; real rate escalation of 2.1%/yr for 2013 – 2020. From 2021 – 2040, rates are escalated at real rate of 1.4%/year, the rate of the “natural gas only” build-out case from the E3/CARB 33% RES Calculator tool.</td>
</tr>
<tr>
<td>CO₂ price</td>
<td>Net present value of 2009 Market Price Referent CO₂ price forecast, which begins at about $14/ton in 2013 and escalates to $57/ton, in real $2010 dollars, by 2040.</td>
</tr>
<tr>
<td>CO₂ price policy</td>
<td>Assume that a CO₂ pricing policy will not further increase rates beyond the retail rate assumptions above (i.e. future CO₂ value is used to offset any impacts to residential retail rates). However, CO₂ prices do affect the electricity market price shape, increasing the value of on-peak electricity.</td>
</tr>
<tr>
<td>Renewable Electricity Standard (RES)</td>
<td>Assume California meets a 33% RES by 2020. The market price shape of electricity is determined by the “High Wind” 33% RES case developed as part of the CEC’s “Electricity System Implications of 33 Percent Renewables” Study completed in June 29, 2009.</td>
</tr>
<tr>
<td>Other Policies (AB 32 Scoping Plan, Once-through cooling regulations)</td>
<td>Assume statewide energy efficiency, rooftop solar PV and combined heat and power generation by 2020 are consistent with the AB 32 Scoping Plan goals and state compliance with proposed regulations on once-through cooling of coastal thermal power plants. The impact of these policies are reflected in the market price shape from the “High Wind” 33% RES case developed as part of the CEC’s “Electricity System Implications of 33 Percent Renewables” Study completed in June 29, 2009.</td>
</tr>
</tbody>
</table>
Impacts on the design process
The new Title 24 codes essentially require a LEED like design and certification process. From section 12 of the 2013 Nonresidential Compliance Manual:

“For all new nonresidential buildings, commissioning shall be included in the design and construction process of the building project to verify that the building energy systems and components meet the owner’s or owner representative’s project requirements.”

If you have been involved in LEED certification you will be familiar with the process and understand the time and consultant costs associated with commissioning. If you haven’t been through the LEED process, understand that it begins at the very early design stages with a Basis of Design program (BOD), a Owner’s Requirements document (OPR), and continues tracking through Design Phase reviews, a Commissioning Plan (Cx Plan), and Functional Performance Testing. All of this is likely documented and managed by a third party consultant. It will add significant administrative time and cost to a building project.

Unconditioned Space
Many of the facilities designed by HPA have large unconditioned warehouse spaces. The 2013 Title 24 code has new definitions for what constitutes an ‘unconditioned space’. Most of the warehouse type spaces we have been designing will continue to be defined as unconditioned space and not require the types of controls and systems associated with the code for insulation envelopes and mechanical HVAC. They will however, be required to comply with all power and lighting requirements.

Of particular note is that there are new requirements for ‘smart controls’ in the warehouse areas. Daylighting system will be mandatory under the prescriptive compliance approach with multi-level controls. Occupancy sensors will be mandatory for warehouse aisle lighting as well.

The diagram on the next page is taken from the 2013 Nonresidential Compliance Manual as the definition of ‘Unconditioned Space’.
Tenant Improvement and renovations to existing facilities
Owners should be aware that the new code significantly reduces the threshold for triggering full compliance with the 2013 regulations. Essentially, any TI in a shell built before July 1st will trigger full compliance with the new code in terms of systems involved in that TI. There is a significant difference between an ‘addition’ and an ‘alteration’. Alterations do not add to the overall energy loads and require only the systems involved in the specific work to be brought into 2013 regulation compliance. Additions add to the overall volume or system loads and require that the entire building systems be brought into 2013 compliance.

Removal and replacement, or even removal and reinstallation of more than 10% of lighting fixtures in a space will trigger full compliance for all 2013 lighting regulations for that space.

Tenant improvements, including alterations and repairs, will be considered new construction in an existing building. For example, the base building has been constructed, but the individual tenant spaces have not been completed. Tenant improvements can include work on the envelope, the mechanical, or the lighting systems. Any system being worked on must fully comply with the 2013 regulations.

When a previously unconditioned space in a building becomes conditioned it is considered an ‘addition’ and all the buildings components must then comply as if it were a new building under the 2013 code.

Specific examples taken from the 2013 Nonresidential Compliance Manual:

Example 1-3
Question:
A building owner wants to change existing lighting fixtures with new ones. Do the Standards restrict the change in any way?

Answer:
If more than 10 percent of the fixtures are replaced in the permitted space (excluding enclosed spaces where no new lighting fixtures are proposed), or the connected load is increased, the Standards will treat this as a new lighting system that must comply with §141.0(b)2l. Any applicable mandatory requirement affected by the alteration applies, and the mandatory switching requirements would apply to the improved system if the circuiting were altered. Appliance Efficiency Regulations requirements for ballasts would also apply.

Example 1-4
Question:
A building owner wants to rearrange some interior partitions and re-position the light fixtures in the affected rooms. Do the Standards apply to the work?
Answer:

Each of the newly arranged rooms must have its own light switches. Since there is no change in the connected lighting load or the exterior envelope, only the mandatory light switching requirements would apply.

Example 1-5

Question:

A building owner wants to rearrange some duct work and add some additional fan coils to an existing HVAC system to improve comfort. Do the Standards apply to the work?

Answer:

There would be no change in the load on the system nor any increase in its overall capacity, so the Standards would not apply to the central system. Only the duct construction requirements apply to altered ducting.

Example 1-7

Question:

A building has a high ceiling space and the owner wants to build a new mezzanine space within it. There will be no changes to the building envelope or to the central HVAC system. There will be new lighting installed. How do the Standards apply?

Answer:

Since a mezzanine does not add volume, it is an alteration, not an addition. The existing systems are not affected unless they are altered. The new lighting must comply with all requirements of the Standards. The envelope is unchanged, so there are no requirements for it. The mechanical system duct work is simply extended without increase in system capacity, so only the duct construction and insulation requirements apply.
There will be many questions about the new 2013 regulations that will only be answered as interpretations are applied by plan check in the local agencies. Owners and contractors should expect that there will be an increase in the time and cost of design processes and an increase in the hard construction costs as well. At HPA we are unsure as to the exact magnitude of all the costs associated with the new code. Until some actual experience is gained, the Cushman Wakefield estimates cited at the start of this paper should be incorporated into project budgets for any facilities applying for permit after July 1.