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1. Introduction

1.1 Organization and Content

This manual is designed to help building owners, architects, engineers, designers, energy consultants, builders, enforcement agencies, contractors and installers, and manufacturers comply with and enforce the California Building Energy Efficiency Standards (Energy Standards) for nonresidential buildings. The manual is written as both a reference and an instructional guide and can be helpful for anyone that is involved in the design and construction of energy efficient nonresidential buildings.

Thirteen chapters make up the manual:

Chapter 1 introduces the Energy Standards and discusses the application and scope.

Chapter 2 reviews the compliance and enforcement process, including design and the preparation of compliance documentation through acceptance testing.

Chapter 3 addresses the requirements for the building envelope.

Chapter 4 covers the requirements for HVAC systems and water heating systems.

Chapter 5 addresses the requirements for indoor lighting.

Chapter 6 addresses the requirements for outdoor lighting.

Chapter 7 addresses the requirements for sign lighting (for both indoor and outdoor applications).

Chapter 8 addresses the requirements for electrical power distribution.

Chapter 9 covers the solar ready requirements.

Chapter 10 addresses covered processes energy requirements.

Chapter 11 covers the performance approach.

Chapter 12 covers the commissioning requirements.

Chapter 13 covers the acceptance test requirements.

Cross-references within the manual use the word 'Section' while references to sections in the Energy Standards are represented by "§."

The first chapter is organized as follows:

1.1 Organization and Content

1.2 Related Documents

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1.4 Why California Needs Energy Standards

1.5 What's New for 2016?

1.6 Mandatory Measures and Compliance Approaches

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1.8 About the Energy Standards

1.2 Related Documents

This compliance manual is intended to supplement several other documents that are available from the California Energy Commission (Energy Commission). These documents include:

A. *The 2016 Building Energy Efficiency Standards, Title 24, Part 6 (Energy Standards)* - This manual supplements and explains the California's energy efficiency standards, which is the main document that describes the requirements that all covered buildings, must comply with; this manual explains those requirements in simpler terms, but it does not replace or supersede them. Readers should have a copy of the Energy Standards to refer to while reading this manual.

B. The Reference Appendices:

- Reference Joint Appendices contain information that is common to both residential and nonresidential buildings.
- Reference Residential Appendices contain information that is for residential buildings only.
- Reference Nonresidential Appendices contain information that is for nonresidential buildings only.
- The Nonresidential Approval and Reference ACM Manuals are primarily a specification for compliance software that is used for compliance purposes.

Note: *High-rise residential and hotel/motel occupancies – For these occupancies' location and design data, opaque assembly properties are located in the Reference Joint Appendices; while mechanical and lighting information is located in the Reference Nonresidential Appendices. Residential water heating information is located in the Reference Residential Appendices.*

Material from these documents is not always repeated in this manual. However, if you are using the electronic version of the manual, there may be hyperlinks that will take you directly to the document that is referenced.

1.3 The Technical Chapters

Each of the eleven technical chapters (3 through 13) begins with an overview, which is followed by a presentation of each subsystem. For the building envelope, subsections include fenestration, insulation, infiltration, etc. For HVAC, the subsections include heating equipment, cooling equipment, and ducts. Mandatory measures and prescriptive requirements are described within each subsection or component. These determine the stringency of the Energy Standards and are the basis of the energy budget when the performance method is used.

1.4 Why California Needs Energy Standards

Energy efficiency reduces energy costs for owners, increases reliability and availability of electricity for the State, improves building occupant comfort, and reduces environmental impact.

1.4.1 Energy Savings

Reducing energy use is a benefit to all. Building owners save money, Californians have a more secure and healthy economy, the environment is less negatively impacted, and our electrical grid can operate in a more stable state. The 2016 Energy Standards (for residential and nonresidential buildings) are expected to reduce the growth in electricity use and reduce the growth in gas use.

1.4.2 Electricity Reliability and Demand

Buildings are one of the major contributors to electricity demand. We learned during the 2000/2001 California energy crisis, and the East Coast blackout in the summer of 2003, that our electric distribution network is fragile and system overloads caused by excessive demand from buildings can create unstable conditions. Resulting blackouts can disrupt business and cost the economy billions of dollars.

Since the California electricity crisis, the Energy Commission has placed more emphasis on demand reduction.

1.4.3 Comfort

Comfort is an important benefit of energy efficient buildings. Energy efficient buildings include high performance windows to reduce solar gains and heat loss, and properly designed HVAC systems, which provide improved air circulation. Poorly designed building envelopes result in buildings that are less comfortable. Oversized heating and cooling systems do not assure comfort in older, poorly insulated, or leaky buildings.

1.4.4 Economics

For the building owner, energy efficiency helps create a more profitable operation. From a broader perspective, the less California depends on depletable resources such as natural gas, coal, and oil, the stronger and more stable the economy will remain in the face of energy cost increases. A cost-effective investment in energy efficiency benefits everyone. In many ways, it is far more cost effective for Californians to invest in saving energy than it is to invest in building new power plants.

1.4.5 Environment

The use of depletable energy has led to oil spills, acid rain, smog, and other forms of environmental pollution that threaten the natural beauty of our planet. California is not immune to these problems, but the Appliance Efficiency Regulations, the Energy Standards, and utility programs that promote efficiency and conservation help to maintain environmental quality. Other benefits include increased preservation of natural habitats which protect animals, plants, and ecosystems.

1.4.6 Greenhouse Gas Emissions and Global Warming

Burning fossil fuel adds carbon dioxide (CO_2) to the atmosphere and is a major contributor to global warming; the atmosphere already contains 25 percent more CO_2 than it did two centuries ago. Carbon dioxide and other greenhouse gasses create an insulating layer around the earth that leads to global climate change. The Energy Commission's research shows that most sectors of the State economy face significant risk from climate change, including water resources (from reduced snow pack), agriculture, forests, and the natural habitats of indigenous plants and animals.

Energy efficiency is a far-reaching strategy that is making an important contribution to the reduction of greenhouse gasses. The National Academy of Sciences has urged the country to follow California's lead on such efforts, saying that conservation and efficiency should be the chief elements in energy and global warming policy. Their first efficiency recommendation was simple: Adopt nationwide energy efficiency building codes.

The Energy Standards are expected to have a significant impact on reducing greenhouse gas and other air emissions.

1.5 What's New for 2016

1.5.1 Envelope

1. Revisions to the mandatory requirements for metal framed and demising walls (§120.7(b)).
2. Changes to the prescriptive envelope requirements (§140.3(a)).
3. Revisions to the roof/ceiling insulation tradeoff for aged solar reflectance (Table 140.3 of the Energy Standards).
4. Significant changes to the total skylight area requirement (§140.3(c)4).
5. Revisions to the requirements for all fenestration alterations (§141.0(b)2A).

1.5.2 Lighting

1. Clarification and simplification of existing language; removing exceptions no longer relevant (§130.0 through §130.5 and §140.6 through §140.8).
2. Reductions to Lighting Power Density (LPD) values in Tables 140.6-B, 140.6-C, and 140.6-G.
3. Removal/addition of Power Adjustment Factors (PAFs) (§140.6(a)2).
4. Significant reductions in outdoor lighting power allowances (Table 140.7-A).
5. Clarification and streamlining of alteration requirements, including addition of a new compliance path that allows compliance by reducing the existing lighting power. For indoor lighting, this path foregoes bi-level control requirements but is otherwise identical to the 85 percent or less of lighting power allowance path.

1.5.3 Mechanical

1. Revision of the mandatory requirements for equipment efficiency in Tables 110.2-A through 110.2-K of the Energy Standards.
2. Interlock controls requirements when operable wall or roof openings are present (§140.4(n)).
3. Revisions to fan control system requirements in Table 140.4-D of the Energy Standards.
4. Energy Management Control System (EMCS) to comply with the thermostatic control requirements (§120.2(a)).
5. Changes to the requirements for dampers installed on outdoor air supply and exhaust equipment (§120.2(f)).
6. New section specifying direct digital controls (DDC) applications and qualifications (§120.2(j)).

7. Revisions to the requirements for space conditioning systems with DDC to the zone level (§120.2(k)).
8. New general requirements for pipe insulation (§120.3(a)).

1.5.4 Electrical

1. New definitions of electrical metering, service equipment, plug load, and low voltage dry-type distribution transformer are added to §100.1.
2. Revisions and clarifications of service electrical metering §130.5(a), separation of electrical circuits in §130.5(b), voltage drop in §130.5(c), and circuit controls in §130.5(d).

1.5.5 Covered Processes

1. New mandatory requirements for elevators, escalators and moving walkways (§120.6(f) and §120.6(g)).

1.5.6 Commissioning

1. Revisions to language and content to make §120.8 more clear.

1.6 Mandatory Measures and Compliance Approaches

In addition to the mandatory measures, the Energy Standards provide two basic methods for complying with nonresidential energy budgets: the prescriptive approach and the performance approach. The mandatory measures must be installed with either method, but note that mandatory measures may be superseded by more stringent measures under the prescriptive or performance approach.

1.6.1 Mandatory Measures

With either the prescriptive or performance compliance paths, there are mandatory measures that must always be met. Mandatory measures include infiltration control, lighting systems, minimum insulation levels, and equipment efficiency. The minimum mandatory levels are sometimes superseded by more stringent prescriptive or performance requirements.

1.6.2 Prescriptive Approach

The prescriptive approach (composed of prescriptive requirements described in Chapters 3, 4, 5, 6, 7, and 10) is the most direct approach of the two. Each individual energy component of the proposed building must meet a prescribed minimum efficiency. The prescriptive approach offers relatively little design flexibility, but is easy to use. There is some flexibility for building envelope components, such as walls, where portions of the wall that do not meet the prescriptive insulation requirement may still comply as long as the area-weighted average wall performance complies. If the design fails to meet even one of the requirements, then the system does not comply with the prescriptive approach. In this case, the performance approach provides the most flexibility to the building designer for choosing alternative energy efficiency features.

A. **Building Envelope**. The prescriptive envelope requirements are the required thermal performance levels for each building component (walls, roofs, and floors). These requirements are described in detail in Chapter 3. The stringency of the envelope requirements vary according to climate zone and occupancy type.

B. **Mechanical.** The prescriptive mechanical requirements are described in detail in Chapter 4. The prescriptive approach specifies equipment, features, and design procedures that must be followed, but does not mandate that a particular type of HVAC system be installed.

C. **Indoor Lighting.** The prescriptive lighting power requirements are determined by one of three methods: the complete building method, the area category method, or the tailored method. These three approaches are described in detail in Chapter 5. The allowed lighting under the Energy Standards varies according to the requirements of the particular building occupancy or task requirements

D. **Outdoor Lighting**. The Outdoor Lighting Standards are described in Chapter 6. They set power limits for various applications such as parking lots, pedestrian areas, sales canopies, building entrances, building facades, and signs. The Energy Standards also set minimum requirements for cutoff luminaires and controls. Outdoor lighting compliance is prescriptive in nature and is determined by the lighting application type (general and specific) and the lighting zone for each application. Detailed information on the outdoor lighting power allowance calculations is found beginning in Section 6.4.

1.6.3 Performance Approach

The performance approach (Chapter 11) allows compliance through a wide variety of design strategies and provides greater flexibility than the prescriptive approach. It is based on an energy simulation model of the building. The Energy Standards specify the method for determining an energy budget for the building.

The performance approach requires an approved computer software program that models a proposed building, determines its allowed energy budget, calculates its energy use, and determines when it complies with the budget. Design options such as window orientation, shading, thermal mass, zonal control, and building configuration are all considered in the performance approach. This approach is used because of its flexibility and because it provides a way to find the most cost-effective solution for compliance.

The performance approach requires that the annual Time Dependent Valuation (TDV) energy be calculated for the proposed building or space, and be compared to the TDV energy budget. The performance approach may be used for:

- envelope or mechanical compliance;
- envelope and mechanical compliance;
- envelope and indoor lighting compliance; or
- envelope, mechanical, and indoor lighting compliance.

It is not applicable to outdoor lighting, or to indoor lighting in the absence of envelope compliance. The performance path is not available for sign lighting, exempt process load, some covered process loads (e.g. refrigerated warehouses), or solar ready applications.

TDV energy is the “currency” for the performance approach. TDV energy not only considers the type of energy that is used (electricity, gas, or propane), but also when it is used. Energy saved during periods when California is likely to have a statewide system peak is worth more than energy saved at times when supply exceeds demand. Appendix JA3 of the Reference Appendices has more information on TDV energy.

Four basic steps are involved:

1. Design the building with energy efficiency measures that are expected to be sufficient to meet the energy budget. (The prescriptive approach requirements in §140.0 through §140.8 provide a good starting point for the development of the design.)
2. Demonstrate that the building complies with the mandatory measures (see Chapters 3 through 10).
3. Using an approved calculation method, model the energy consumption of the building using the proposed features to create the proposed energy budget. The model will automatically calculate the allowed energy budget for the proposed building.
4. If the proposed energy budget is no greater than the allowed energy budget, the building complies.

1.6.3.1 **Compliance Options**

The Energy Standards have mandatory requirements, and prescriptive or performance methods for compliance. They establish a minimum level of performance which can be exceeded by advanced design and construction practices.

The Energy Commission has established a formal process for certification of compliance options of new products, materials, designs or procedures that can improve building efficiency levels established by the Energy Standards. §10-109 allows for the introduction of new calculation methods and measures which cannot be properly accounted for in the current approved compliance approaches.

The Energy Commission encourages the use of energy-saving techniques and designs for showing compliance with the Energy Standards. The compliance options process allows the Energy Commission to review and gather public input regarding the merits of new compliance techniques, products, materials, designs or procedures to demonstrate compliance for newly constructed buildings and additions and alterations to existing buildings.

Approved compliance options encourage market innovation and allow the Energy Commission to respond to changes in building design, construction, installation, and enforcement.

If the performance approach will be used for additions and alterations, see Chapter 11 for details.

1.7 Scope and Application

The Energy Standards apply to both nonresidential and residential buildings. This manual addresses the requirements for nonresidential buildings, including hotels, motels, and high-rise residential buildings (those over three stories above grade in height). The Residential Manual addresses the requirements for low-rise residential buildings, which include single family and duplex residential buildings.

1.7.1 Building Types Covered

The Nonresidential Standards apply to all buildings of the California Building Code (CBC) occupancies of Group A, B, E, F, H, M, R, S, and U. If these buildings are directly or indirectly conditioned, they must meet all mechanical, envelope, indoor, and outdoor lighting requirements of the Standards. Those buildings that are not directly or indirectly conditioned must only meet the indoor and outdoor lighting requirements of the Energy Standards.

The Energy Standards do not apply to CBC Group I or L. This group includes such buildings as hospitals, daycare, nursing homes, and prisons. The Standards also do not apply to buildings that fall outside the jurisdiction of CBC, such as mobile structures. If outdoor lighting is associated with a Group I or L occupancy, it is exempt from the Energy Standards requirement; however, if the outdoor lighting is part of any of occupancy groups listed above, it must comply with the Standards requirements.

1.7.2 Historic Buildings

Exception 1 to §100.0(a) states that qualified historic buildings, as regulated by the California Historical Building Code Title 24, Part 8, or California Building Code, Title 24, Part 2, Volume I, Chapter 34, Division II, are not covered by the Energy Standards. §140.6(a)3Q and Exception 13 to §140.7(a) clarify that indoor and outdoor lighting systems in qualified historic buildings are exempt from the lighting power allowances only if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems in qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other lighting systems in qualified historic buildings must comply with the Standards.

The California Historical Building Code (CHBC) Section 102.1.1 specifies that all non-historical additions must comply with the regular code for new construction, including the Energy Standards. CHBC Section 901.5 specifies that when new or replacement mechanical, plumbing, and/or electrical (including lighting) equipment or appliances are added to historic buildings; they *should* comply with the Energy Standards, including the Appliance Efficiency Regulations.

The California State Historical Building Safety Board has final authority in interpreting the requirements of the CHBC and determining to what extent the requirements of the Standards apply to new and replacement equipment and other alterations to qualified historic buildings. It should be noted that in enacting the CHBC legislation, one of the intents of the Legislature was to encourage energy conservation in alterations to historic buildings (Health and Safety Code Section 18951).

Additional information about the CHBC can be found at:

http://www.dgs.ca.gov/dsa/AboutUs/shbsb.aspx.

Contact the State Historical Building Safety Board at (916) 445-7627.

1.7.3 Low-Rise Residential Buildings

The Residential Energy Standards cover single-family and low-rise residential buildings (occupancy groups R1, R2, and R3) and CBC Group U buildings including:

1. All single-family dwellings of any number of stories.
2. All duplex (two-dwelling) buildings of any number of stories.
3. All multifamily buildings with three or fewer habitable stories above grade (Groups R 1 and R-2).
4. Additions and alterations to all of the above buildings.
5. Private garages, carports, sheds, and agricultural buildings.

Table 1-1: Nonresidential vs. Residential Energy Standards

Nonresidential Standards	Residential Standards
These Standards cover all nonresidential occupancies (Group A, B, E, F, H, M, R, S or U), as well as high-rise residential (Groups R-1 and R-2 with four or more habitable stories), and all hotel and motel occupancies.	These Standards cover all low-rise residential occupancies including:
Offices Retail and wholesale stores Grocery stores Restaurants Assembly and conference areas Industrial work buildings Commercial or industrial storage Schools and churches Theaters Hotels and motels Apartment and multi-family buildings, and long-term care facilities (Group R-2), with four or more habitable stories	All single family dwellings of any number of stories (Group R-3) All duplex (two-dwelling) buildings of any number of stories (Group R-3) All multi-family buildings with three or fewer habitable stories above grade (Groups R-1 and R-2) Additions and alterations to all of the above buildings
Note: The Energy Standards define a habitable story as one that contains space in which humans may live or work in reasonable comfort, and that has at least 50% of its volume above grade.	

1.7.4 Scope of Improvements Covered

The Energy Standards apply to any new construction that requires a building permit, whether for an entire building, for outdoor lighting systems, for signs, or for a modernization. The primary enforcement mechanism is through the building permitting process. Until the enforcement agency is satisfied that the building, outdoor lighting, or sign complies with all applicable code requirements, including the Standards, it may withhold the building permit (or, after construction, the occupancy permit).

The Energy Standards apply only to the construction that is the subject of the building permit application (with the exception of existing spaces that are "conditioned" for the first time, in which case existing envelope components, and existing lighting systems, whether altered or not, must also show compliance with the Standards).

Other than for lighting, the Energy Standards apply only to buildings that are directly or indirectly conditioned by mechanical heating or mechanical cooling.

1.7.5 Speculative Buildings

1.7.5.1 Known Occupancy

Speculative buildings of known occupancy are commonly built by developers. For example, if a big box retail center or an office building were built on speculation, the owner would usually know the ultimate occupancy of the space, but might not know the actual tenants. For this type of building, the owner has two compliance choices:

1. Declare the building to be unconditioned space, forcing tenants to be responsible for envelope, interior lighting, possibly some exterior lighting, and mechanical compliance. This option may be very costly as most envelope and mechanical measures are far more expensive when they are installed in the building after the shell is completed (see discussion below).
2. Include envelope compliance as well as mechanical and/or lighting compliance, when those systems are to be installed prior to leasing.

There are several potential pitfalls with delaying envelope compliance. For example, tenants may have a difficult time showing compliance, depending on fenestration areas and glass efficiency. An energy code update between the time of shell construction and energy compliance for a tenant improvement could make compliance even more difficult. Constructing a “big box” style building without skylights, where skylights are required under the prescriptive approach, will also create a compliance challenge (and possibly impose large costs to retrofit skylights). In most instances, upgrading the envelope later increases total construction costs, as it is easier to install envelope features at time of construction than afterwards. And for buildings that are certain to be conditioned, some enforcement agencies require envelope compliance at the time of shell construction.

For information about energy compliance for tenant improvements in existing buildings, see Section 1.7.12.

An obvious example is declaring the shell to be unconditioned, not insulating the shell and having to insulate the shell as part of the tenant improvement that adds air conditioning. This increases the final cost of the building and should render the shell less valuable for spaces that are ultimately going to be conditioned.

A less obvious example is the shell of a building that will ultimately become a big box retail store or a warehouse with lighting power densities greater than 0.5 W/ft², ceiling heights greater than 15 feet, and an enclosed area greater than 5,000 ft². Such occupancies are prescriptively required to have skylights and daylighting controls. Installing skylights in the roof of the speculative building shell is less expensive than retrofitting them later. This should be considered when designing speculative shell buildings for big box retail or warehouse markets, as they will be more saleable than those requiring skylight retrofits.

Because compliance may be demonstrated for each component separately, the owner can simply demonstrate that the systems being built meet the Energy Standards. The remaining construction and Standards compliance work can be dealt with as each tenant obtains building permits for work in their individual spaces.

1.7.5.2 **Unknown Occupancy**

Speculative buildings are often built for which the ultimate occupancy is determined at the time of leasing and not during construction of the building shell. The structure, for example, could be used as an office, a warehouse, a restaurant, or retail space. Because the Energy Standards treat these occupancies in a similar fashion, the fact that the ultimate occupancy is unknown is not significant. The major items affected by the ultimate occupancy have to do with lighting and ventilation requirements. If, at the time of permitting, a tenant is not identified for a multi-tenant space, the “All other areas” lighting power density allowances from Energy Standards Table 140.6-C shall be used.

The major problem that can occur with this type of building comes when the owner elects to declare it an unconditioned building and defer Standards compliance until such time as a tenant installs mechanical space conditioning equipment.

1.7.6 Mixed and Multiple Use Buildings

Because the Energy Standards are different for residential, high-rise residential, and nonresidential buildings, and because mixed-use buildings occasionally include more than one type of nonresidential occupancy, there is potential for confusion in application. The Energy Standards address these circumstances regarding mixed-use buildings:

1.7.6.1 Mixed Low-Rise Residential and Nonresidential Occupancies.

When a building includes both low-rise residential and nonresidential occupancies, the requirements are different depending upon the percentages of the conditioned floor that is occupied by each occupancy type:

A. Minor Occupancy (Exception 1 to §100.0(f).) When a residential occupancy occurs in the same building as a nonresidential occupancy, and if one of the occupancies is less than 20 percent of the total conditioned floor area, the smaller occupancy is considered a “minor” occupancy. Under this scenario, the entire building may be treated as if it is the major occupancy for the purpose of envelope, HVAC, and water heating. Lighting requirements in §140.6 through §140.8 or §150.0(k) must be met for each occupancy separately. The mandatory measures applicable to the minor occupancy, if different from the major occupancy, would still apply.

B. Mixed Occupancy. When residential occupancy is mixed with a nonresidential occupancy, and if neither occupancy is less than 20 percent of the total conditioned floor area, these occupancies fall under different sets of Standards and must be considered separately. Two compliance submittals must be prepared, each using the calculations and documents of its respective Standards. Separate compliance for each occupancy, to their respective Standards, is an option when one of the occupancies is a minor occupancy, as discussed in the paragraph above.

1.7.6.2 Different Nonresidential Occupancies.

When multiple occupancies, such as office, restaurant, and retail fall under the Nonresidential Standards, they would be treated under the same compliance approach as separate occupancies. In general, all nonresidential occupancies have the same envelope requirements and can be treated the same across all nonresidential occupancies. High-rise residential and hotel-motel guest rooms have different envelope requirements from the nonresidential envelope requirements and should be treated differently. Lighting and mechanical requirements vary among the various types of space usage categories and should also be treated differently according to each occupancy type.

A. Hotel/Motel and Nonresidential Occupancies. A hotel/motel with guest rooms, restaurants, sports facilities, and/or other nonresidential occupancies is defined as hotel/motel occupancy. The only variance is that the guestroom envelope and lighting and HVAC control requirements are different from the nonresidential occupancy energy requirements that would apply to the “common” areas of the building.

Example 1-1

Question

A 250,000 ft² high-rise office building includes a small 900 ft² apartment on the first floor for use by visiting executives. This is clearly a residential occupancy, so is the apartment required to meet the residential requirements of the Energy Standards, and if so which ones – high rise residential or low rise residential?

Answer

No. First of all, the apartment occupies less than 20 percent of the total conditioned floor area, so it is a minor occupancy and may be treated as part of the office occupancy. Second, since it is located on the first floor of the building it is technically a low rise residential building. As a result, all of the residential mandatory measures apply.

1.7.7 High-rise Residential

High-rise residential buildings (four habitable stories or more) are covered by this manual and the Nonresidential Energy Standards.

The Energy Standards apply separately to the living quarters and to other areas within the building. Living quarters are those non-public portions of the building in which a resident lives. High-rise residential dwelling units must incorporate the envelope and mechanical elements of the Nonresidential Energy Standards, with the lighting and service hot water needs of residential buildings. Outdoor lighting, including parking lots and garages for eight or more vehicles, and for indoor or outdoor signs (other than exit signs), must comply with the Nonresidential Energy Standards. Exit signs must comply with the Appliance Efficiency Regulations.

The following subsections discuss the special compliance requirements that apply to high-rise residential occupancies.

1.7.7.1 Mandatory Measures

The mandatory measures for nonresidential envelope, mechanical, indoor lighting, outdoor lighting, and signs apply to high-rise residential buildings. Special requirements for high-rise residential buildings are summarized below:

1. Living quarters must meet the applicable indoor lighting requirements for residential buildings.
2. Outdoor lighting must meet the applicable outdoor lighting requirements of the Nonresidential Energy Standards.
3. Indoor and outdoor signs (other than exit signs) must comply with the Nonresidential Energy Standards. Exit signs must comply with the Appliance Efficiency Regulations.
4. High-rise residential occupancies must meet setback requirements applicable to residential occupancies.
5. Readily accessible area switching controls are not required in public areas provided switches that control the lights in public areas are accessible to authorized personnel.
6. Automatic lighting shut-off controls are not required for living quarters.

1.7.7.2 Prescriptive Compliance

The prescriptive requirements for envelope, mechanical, and lighting apply to high-rise residences. The following summarizes the special prescriptive requirements for high-rise residential buildings:

1. The envelope must meet the prescriptive envelope criteria for high-rise residential buildings (Energy Standards Table 140.3-C).
2. High-rise residential living quarters are not required to have economizer controls.
3. High-rise residential living quarters are exempt from the nonresidential lighting power density requirements. However, lighting within the dwelling units must meet the lighting requirements of §150.0(k) that governs lighting in all spaces (including kitchen lighting requirements) except closets less than 70 ft² floor area. See Chapter 6 of the Residential Compliance Manual.
4. Each occupancy (other than living quarters) in the high-rise residence must comply with the Nonresidential Lighting Standards.

5. For compliance with water heating requirements, use the Residential Energy Standards.

1.7.7.3 **Performance Compliance**

The rules for high-rise residential performance compliance are identical to the performance compliance rules for all nonresidential buildings. The area of each function of a high-rise residence is input into approved compliance software along with its corresponding envelope, mechanical, and lighting features. The compliance software will automatically calculate an energy budget for the standard design, and the proposed design's energy use.

1.7.8 Hotels and Motels

This section discusses both the similarities and differences between the requirements for a hotel/motel and other nonresidential or high-rise residential buildings.

The design of a hotel or motel is unique in that the design must incorporate a wide variety of occupancies and functions into one structure. The occupancies range from nonresidential occupancies to hotel/motel guest rooms. Design functions that affect guests range from the "experience of arrival" created through the main lobby's architectural features to the thermal comfort of the guest rooms. Other functions that hotel/motel designs must address include restaurants, kitchens, laundry, storage, light assembly, outdoor lighting, sign lighting, and other items that are necessary to the hotel/motel function. In short, these structures can range from simple guest rooms with a small office, to a structure encompassing a small city.

Like other occupancies, compliance is submitted for the features covered in the permit application only. The nonresidential areas must meet the envelope, mechanical, indoor lighting, outdoor lighting, and sign lighting portions of the Nonresidential Standards. The guest room portions of hotels/motels must meet the envelope, mechanical, and lighting provisions applicable only to hotels/motel guest rooms. In essence, each portion of the building individually complies with the provisions applicable to that occupancy.

Since hotel/motels are treated as a mixture of occupancies covered by the Energy Standards, the concepts presented at the beginning of each chapter apply to hotels/motels as they would any other nonresidential occupancy.

1.7.8.1 **Mandatory Measures**

The mandatory measures for envelope, mechanical, indoor lighting, outdoor lighting, and sign lighting apply to hotels/motels. The following bullets describe special requirements or exceptions for hotel/motel buildings:

1. Hotel/motel guest rooms must meet the applicable Residential Lighting Standards.
2. Outdoor lighting must meet the applicable Outdoor Lighting Standards.
3. Indoor and outdoor signs (other than exit signs) must comply with the Nonresidential Standards. Exit signs must comply with the Appliance Efficiency Regulations.
4. Hotel and motel guest room thermostats shall have numeric temperature settings.
5. Readily accessible area switching controls are not required in public areas provided switches that control the lights in public areas are accessible to authorized personnel.
6. Automatic lighting shut-off controls are not required for hotel/motel guest rooms.

1.7.8.2 **Prescriptive Compliance**

The prescriptive requirements for envelope, mechanical, and lighting apply to hotel/motels. The following prescriptive requirements are specific to hotel/motels:

1. Hotel/motel guest rooms must meet the prescriptive envelope criteria for high-rise residential buildings rather than the prescriptive criteria for nonresidential buildings.
2. Hotel and motel guest rooms are not required to have economizer controls.
3. Guest rooms in hotel/motels are exempt from the lighting power density requirements. However, lighting must meet the residential requirements of §150.0(k).
4. Each occupancy (other than guest rooms) in the hotel/motel must comply with the Nonresidential Lighting Standards.
5. For compliance with water heating requirements, use the residential compliance.

1.7.8.3 **Performance Compliance**

The rules for performance compliance are identical to the rules for complying for all other nonresidential and high-rise residential buildings. The area of each function of a hotel/motel is input into the approved compliance software along with its corresponding envelope, mechanical, and indoor lighting features. The computer software program will automatically calculate an energy budget for the standard design, and the proposed design's energy use. The proposed design must be less than or equal to the standard design for the building to comply.

1.7.9 Live-Work Spaces

Live-work buildings are a special case of mixed occupancy buildings, as they combine residential and nonresidential uses within individual units. In general, the low-rise or high-rise residential requirements (depending on the number of habitable stories) apply since these buildings operate (and are conditioned) 24 hours per day. Lighting in designated workspaces is required to show compliance with the Nonresidential Lighting Standards (§140.6).

1.7.10 Unconditioned Space

An unconditioned space is neither directly nor indirectly conditioned. Both the requirements for lighting and minimum skylight area apply to unconditioned space. Some typical examples of spaces that may be unconditioned:

- Enclosed parking structures
- Automotive workshops
- Enclosed entry courts or walkways
- Enclosed outdoor dining areas
- Greenhouses
- Loading docks
- Warehouses
- Mechanical/electrical equipment rooms

Keep in mind that these kinds of spaces are not always unconditioned. The specifics of each case must be determined.

1.7.11 Newly Conditioned Space

When previously unconditioned space becomes conditioned, the space is then considered an “addition” and all the building’s components must then comply as if it were a new building.

This situation has potentially significant construction and cost implications. For example, if an unconditioned warehouse is upgraded with a heating system, thus becoming conditioned space, the building envelope must comply with the current envelope requirements and the lighting system must be brought into conformance with the current lighting requirements, including mandatory wiring and switching. If the envelope has large windows, it is conceivable that some would have to be eliminated or replaced with more efficient windows. If the lighting system is inefficient, fixtures might have to be removed and new, more efficient fixtures installed.

This requirement can cause difficulty when the owner of a building seeks exemption from complying with the Energy Standards by erecting a shell with no plans to condition it.

For example, the owner of an office building obtains a permit for the structure and envelope, but wishes to leave the space conditioning and lighting improvements to the tenants. If that owner claims unconditioned status for that building, the owner does not have to demonstrate compliance with the envelope requirements of the Standards, but does have to demonstrate compliance with the lighting requirements. If at the time of permitting a tenant is not identified for a multi-tenant space, the “All other areas” lighting power density allowances from Energy Standards Table 140.6-C shall be used. However, as soon as the tenant applies for a permit to install the HVAC equipment, the envelope and any existing lighting to remain must then be brought into full compliance with the requirements for the occupancy designated.

This is the only circumstance when systems, other than those subject to the current permit application, fall under the Standards. If the building was initially designed in a way that makes this envelope compliance difficult, the building envelope may require expensive alterations to bring it into compliance.

Many enforcement agencies require the owner to sign an affidavit at the time of the initial building permit for the shell, acknowledging the potential difficulties of future envelope or lighting compliance.

To minimize Energy Standards compliance difficulties, the recommended practice is to demonstrate energy compliance at the time the envelope is built, and to demonstrate compliance for the lighting systems when lighting systems are installed.

1.7.12 New Construction in Existing Buildings

Tenant improvements, including alterations and repairs, may 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, mechanical, or lighting systems. Whatever the case, the system or systems being installed are considered to be new construction, and must comply with some or all of the current Standards, depending on the extent of the changes (see following sections).

The only circumstance when systems other than those subject to the current permit application come under scrutiny is when the tenant improvement results in the conditioning of previously unconditioned space.

1.7.13 Alterations to Existing Conditioned Spaces

§141.0(b)

An alteration is any change to a building's water heating system, space conditioning system, indoor lighting system, outdoor lighting system, sign lighting, or envelope that is not an addition. Alterations or renovations to existing conditioned spaces have their own rules for energy compliance.

In summary, the alteration rules are:

1. The Energy Standards apply only to those portions or components of the systems being altered (altered component); untouched portions or components need not comply with the Standards.
2. If an indoor lighting, outdoor lighting, or sign lighting alteration increases the energy use of the altered systems, the alteration must comply with the current Standards.
3. Alterations must comply with the mandatory measures for the altered components.
4. New systems in the alteration must comply with the current Standards.
5. In an existing unconditioned building, where evaporative cooling is added to the existing unaltered envelope and lighting, does not need to be brought into compliance with current Standards.
6. Mechanical system alterations are governed primarily by the mandatory measures.

Beyond meeting all mandatory requirements, alterations must also comply either with applicable prescriptive requirements discussed in Chapters 3 through 8; or must comply using the performance path. Within the performance approach, changes to the existing building, such that the entire building (existing and alteration) may comply is explained in Chapter 11. Keep in mind that performance credit is given only for systems that are actually changed under the current permitted scope of work.

Example 1-2

Question

An owner wants to add less than 50 ft² of new glazing in an old nonresidential building in climate zone 3. What are the applicable requirements for the new glazing?

Answer

Exception to §141.0(b)2Ai exempts up to 50 ft² of added windows from the RSHGC and VT requirements in Table 141.0-A. Therefore, the new glazing must meet only the climate zone 3 U-factor requirement of 0.58.

Example 1-3

Question

A building owner wants to change existing lighting fixtures with new ones. Do the Energy 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)2I. 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 Energy 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 1-6

Question

A building owner wants to replace an existing chiller. No other changes will be made to the HVAC system. Do the Energy Standards restrict the change in any way?

Answer

The mandatory efficiency requirements would govern the efficiency of the new chiller. The other parts of the system are unchanged and therefore unaffected by the Energy Standards.

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 Energy 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.

1.7.14 Additions

§141.0(a)

An addition is any change to a building that increases floor area and conditioned volume. Additions involve either:

- the construction of new, conditioned space and conditioned volume;
- the installation of space conditioning in a previously unconditioned space; or
- the addition of unconditioned space.

The mandatory measures and either the prescriptive or the performance requirements apply. For conditioned space, the heating, lighting, envelope, and water heating systems of additions are treated the same as for new buildings.

If the existing mechanical system(s) is simply extended into the addition, Exception 1 to §141.0(a) applies. Unconditioned additions shall only comply with indoor, outdoor lighting, and sign lighting requirements of the Standards. Refer above to Section 1.7.11 for further discussion of previously unconditioned space.

There are three options for the energy compliance of additions under the Energy Standards:

Option 1 – Addition Alone

Treat the addition as a stand-alone building with adiabatic walls to conditioned space, (§141.0(a)1 and §141.0(a)2Bi). This option can use either the prescriptive or the performance approach. Adiabatic means the common walls are assumed to have no heat transfer between the addition and the adjacent conditioned space, and are ignored entirely.

Option 2 – Existing-Plus-Addition

Model the combination of the existing building with the addition (§141.0(a)2Bii). This is a performance approach option only. Under this scenario, the proposed energy use is calculated based on existing building features that remain unaltered and all alterations (actual values of the proposed alterations) plus the proposed addition. The standard design (allowed) energy budget is calculated based on:

1. The existing building features that remain unaltered.; and
2. All altered features modeled to meet requirements of §141.0(b); and
3. The addition modeled to meet requirements of §141.0(a)1.

If the proposed building energy use is less than or equal to the standard design energy budget, then the building complies. The standard design for any alterations to the existing lighting or mechanical systems is based on the requirements for altered systems in §141.0(b).

This compliance option will generally ease the energy requirements of the addition only if there are energy improvements to the existing building. It may allow the designer to make a relatively energy inefficient addition comply depending on the nature and scope of the energy improvements to the existing building.

Option 3 – Whole Building as All New Construction

The existing structure combined with the addition can be shown to comply as a whole building meeting all requirements of the Energy Standards for new construction for envelope, lighting and mechanical. This method is only practical if the existing building is at or will be improved to the overall level of the current Energy Standards.

Example 1-8

Question

A restaurant adds a conditioned greenhouse-style dining area with very large areas of glazing. How can it comply with the Standards?

Answer

Because of its large glass area, it will not comply on its own. By making substantial energy improvements to the existing building (envelope, lighting, and mechanical features), or by upgrading the existing building so that the entire building meets the requirements for new construction, it is possible for the combined building to comply. The performance approach would be used to model the entire building as an existing-plus-addition.

To accumulate enough energy credit that can be used to offset (trade off against) the large glazing area in the addition, several design strategies are available including:

1) Envelope improvements to the existing building which exceed the performance of the requirements in §141.0(b)1 and §141.0(b)2A and B; and/or

2) New indoor lighting in the existing building which has a lower Installed Lighting Power Density (LPD) than the Allowed LPD in §140.6; and/or,

3) Existing building mechanical system improvements that exceed the requirements of §141.0(b)2C, D, and E.

1.7.15 Changes of Occupancy

A change of occupancy alone does not require any action under the Energy Standards. If changes (alterations) are made to the building, then the rules for alterations or additions apply (see Sections 1.7.13 and 1.7.14).

If the change in occupancy involves converting from a residential to a nonresidential occupancy or vice versa (changes defined by CBC occupancy), then the Standards applicable to the new occupancy would govern any alterations made to the building. For example, if a home is converted to law offices, and a new lighting system is installed, the Nonresidential Lighting Standards would apply. If a new HVAC system is installed, all the nonresidential HVAC requirements would have to be met.

If no changes are proposed for the building, it is advisable to consider the ventilation requirements of the new occupancy. For example, if a residence is converted to a hair salon, the ventilation rates of the building should be considered. With new sources of indoor pollution, the existing residential ventilation rates would likely not be adequate for the new uses. However, no change is required by the Energy Standards.

1.7.16 Repairs

A repair is the reconstruction or renewal of any part of an existing building for the purpose of its maintenance. Repairs shall not increase the preexisting energy consumption of the required component, system, or equipment. Therefore, the Energy Standards do not apply to repairs.

Example 1-9

Question

If a space were 1,000 ft², how large would the heating system have to be to make the space directly conditioned?

Answer

The heating system would have to be larger than 10 Btu/(hr-ft²) x 1,000 ft² = 10,000 Btu/hr output to meet the definition of directly conditioned space.

Example 1-10

Question

A water treatment plant has a heating system installed to prevent pipes from freezing. The heating system exceeds 10 Btu/(hr-ft²) and operates to keep the space temperature from falling below 50°F. Is this plant directly conditioned?

Answer

Not if the heating system is sized to meet the building load at 50°F and is thermostatically controlled to prevent operating temperatures above 50°F. The definition of directly conditioned space excludes Process Spaces that have space conditioning designed and controlled to be incapable of operating at temperatures above 55°F at design conditions. Under these conditions, the space is not directly conditioned.

Example 1-10

Question

A process load in a manufacturing facility is generating heat inside the building shell. The manufacturing facility will install space cooling to keep the temperature from exceeding 90°F. If the thermostat will not allow cooling below 90°F (i.e., the temperature is kept at 90°F all the time), is this facility directly conditioned, if the mechanical cooling exceeds 5 Btuh/hr-ft²?

Answer

No, this facility is not a directly conditioned space. The definition of directly conditioned space excludes spaces where the space conditioning system is designed and controlled to be incapable of operating at temperatures below 90°F at design conditions.

Example 1-12

Question

A natural gas kiln in a factory is located within the building shell and its capacity exceeds 10 Btu/(hr-ft²). Is the space within the shell considered directly conditioned space if there is no HVAC system installed in the building?

Answer

No, since the heat from the kiln is an Exempt Process Load and not part of heat that is transferred across

the building envelope components, and there is no HVAC system installed, the space is not considered a directly conditioned space and the shell does not have to meet the Energy Standards envelope requirements; however, the space must still meet the lighting requirements of the Energy Standards.

Example 1-13

Question

If in example above mechanical cooling with the capacity that exceeds 5 Btuh/hr-ft^2 is added to the building to keep the temperature from exceeding 85°F, does the space considered directly conditioned and must the envelope meet the Energy Standards requirements?

Answer

No, the definition of Directly Conditioned Space excludes conditioning for Process Loads.

Example 1-14

Question

If a computer room is cooled with the capacity that exceeds 5 Btuh/hr-ft^2 and is controlled to a temperature of 75°F, does the space have to meet the envelope requirement of the Standards?

Answer

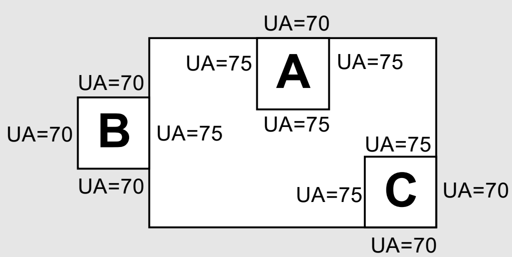
No. Computer rooms are a Covered Process. There are no envelope requirements in either §120.6 or §140.9.

Example 1-15

Question

The accompanying sketch shows a building with three unconditioned spaces (none has a direct source of mechanical heating or cooling). The air transfer rate from the adjacent conditioned spaces is less than three air changes per hour. The area weighted heat transfer coefficients of the walls (UA) are shown on the sketch. The roof/ceiling area weighted heat transfer coefficients (UA) for each of the three unconditioned spaces is 90 Btu/Hr -°F.

Are any of these spaces indirectly conditioned?



Answer

Because the air change rate is low, we evaluate each space on the basis of heat transfer coefficients through the walls and roof. It is further assumed that the floors are adiabatic. Therefore, the heat transfer will be proportional to the area weighted heat transfer coefficients of the walls and roof/ceilings.

SPACE A: The area weighted heat transfer coefficient to directly conditioned space is 3 x (75 Btu/Hr-°F) = 225 Btu/Hr-°F. The area weighted heat transfer coefficient to the outdoors or to unconditioned space is 70 Btu/Hr-°F + 90 Btu/Hr-°F = 160 Btu/Hr-°F. Since the heat transfer coefficient from Space A to the conditioned space is greater than heat transfer coefficient from Space A to outside, Space A is considered indirectly conditioned.

SPACE B: The area weighted heat transfer coefficient to directly conditioned space is 75 Btu/Hr-°F. The area weighted heat transfer coefficient to the outdoors or to unconditioned space is (3 x 70 Btu/Hr-°F) + 90 Btu/Hr-°F = 300 Btu/Hr-°F. Since the heat transfer coefficient from Space B to the conditioned space is less than the heat transfer coefficient from Space B to outside, Space B is considered unconditioned.

SPACE C: The area weighted heat transfer coefficient to directly conditioned space is (2 x 75 Btu/Hr-°F = 150 Btu/Hr-°F. The area weighted heat transfer coefficient to the outdoors or to unconditioned space is (2 x 70 Btu/Hr-°F) + 90 Btu/Hr-°F = 230 Btu/Hr-°F. Since the heat transfer coefficient from Space C to the conditioned space is less than the heat transfer coefficient from Space C to outside, Space C is considered unconditioned.

Example 1-116

Question

In a four-story building, first floor is retail, second and third floors are offices, and the fourth floor is residential (as defined in the CBC). Is the residential space high-rise or low-rise?

Answer

It is a high-rise residential space. Even though there is only one floor of residential occupancy, the building has four habitable stories, making it a high-rise building.

1.8 About the Energy Standards

1.8.1 History

Section 25402 of the Public Resources Code

The Legislature adopted the Warren-Alquist Act which created the California Energy Commission (Energy Commission) in 1975 to deal with energy-related issues, and charged the Energy Commission with the responsibility to adopt and maintain Energy Efficiency Standards for new buildings. The first Standards were adopted in 1978 in the wake of the Organization of Petroleum Exporting Countries (OPEC) oil embargo of 1973.

The Act requires that the Energy Standards be cost effective “when taken in their entirety and amortized over the economic life of the structure.” It also requires that the Energy Commission periodically update the Standards and develop manuals to support the Energy Standards. Six months after publication of the manuals, the Act directs local building permit jurisdictions to withhold permits until the building satisfies the Standards.

The “First Generation” Standards for nonresidential buildings took effect in 1978, and remained in effect for all nonresidential occupancies until the late 1980s, when the “Second Generation” Standards took effect for offices, retail, and wholesale stores.

The next major revision occurred in 1992 when the requirements were simplified and consolidated for all building types. At this time, major changes were made to the lighting requirements, the building envelope, and fenestration requirements, as well as the HVAC and mechanical requirements. Structural changes made in 1992 led the way for national standards in other states.

The Standards went through minor revisions in 1995, but in 1998, lighting power limits were reduced significantly, because at that time, electronic ballasts and T-8 lamps were cost effective and becoming common practice in nonresidential buildings.

The California electricity crisis of 2000 resulted in rolling blackouts through much of the State and escalating energy prices at the wholesale market, and in some areas of the State in the retail market as well. The Legislature responded with AB 970, which required the Energy Commission to update the Energy Standards through an emergency rulemaking. This was achieved within the 120 days prescribed by the Legislature and the 2001 Standards (or the AB 970 Standards) took effect mid-year 2001. The 2001 Standards included requirements for high performance windows throughout the State, more stringent lighting requirements and miscellaneous other changes.

The Public Resources Code was amended in 2002 through Senate Bill 5X to expand the authority of the Energy Commission to develop and maintain standards for outdoor lighting and signs. The Energy Standards covered in this manual build from the rich history of Nonresidential Energy Standards in California and the leadership and direction provided over the years by the California Legislature.

The 2008 Standards were expanded to include refrigerated warehouses and steep-sloped roofs for the first time.

The 2013 Energy Standards reflected many significant changes as well as expanded its scope. Some changes included Fault Detection and Diagnostic devices, economizer damper leakage and assembly criteria, air handler fan control for HVAC systems, updates to the low-sloped cool roofs requirements for nonresidential buildings, and for the first time, set minimum mandatory measures for insulation in nonresidential buildings. Expanding the scope of the Standards included newly regulated covered processes such as: parking garage ventilation, process boiler systems, compressed air systems, commercial refrigeration, laboratory exhaust, data center (computer room) HVAC, and commercial kitchens.

The 2016 Energy Standards are current with ASHRAE 90.1 national consensus standards. Changes were made to clarify the Energy Standards and resolve compliance concerns.

Example 1-17

Question

If a building is LEED certified does it still need to meet the 2016 Energy Standards?

Answer

Yes.

1.8.2 California Climate Zones

Since energy use depends partly upon weather conditions, which vary throughout the State, the Energy Commission has established 16 climate zones representing distinct climates within California. These 16 climate zones are used with both the residential and the nonresidential Standards. The boundaries are shown in and detailed descriptions and lists of locations within each zone are available in Reference Joint Appendix JA2.

Cities may occasionally straddle two climate zones. In these instances, the exact building location and correct climate zone should be verified before any calculations are performed. If a climate zone boundary line splits a single building, it must be designed to the requirements of the climate zone in which 50 percent or more of the building is contained.

Figure 1-1: California Climate Zones