TABLE OF CONTENTS

1. Introduction

1.1 Organization and Content

This 2022 Nonresidential and Multifamily Compliance 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 Code) for nonresidential and multifamily buildings. The manual is a reference and instructional guide for anyone involved in the design and construction of energy-efficient nonresidential and multifamily buildings.

New for the 2022 Energy Code, the multifamily requirements have been grouped together regardless of number of stories. For this manual, all multifamily requirements are located in chapter 11. Where the requirements for multifamily common areas follow the nonresidential requirements, chapter 11 refers back to the appropriate nonresidential chapters.

Fourteen chapters make up the manual:

Chapter 1 Introduction of the Energy Code, application, and scope

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

Chapter 3 Building envelope

Chapter 4 Heating, ventilation, and air-conditioning (HVAC) systems and water heating systems

Chapter 5 Indoor lighting

Chapter 6 Outdoor lighting

Chapter 7 Sign lighting for indoor and outdoor applications

Chapter 8 Electrical power distribution

Chapter 9 Solar-ready requirements

Chapter 10 Covered processes requirements.

Chapter 11 Multifamily

Chapter 12 Performance approach

Chapter 13 Commissioning requirements

Chapter 14 Acceptance test requirements

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

1.2 Related Documents

This compliance manual supplements several other documents from the California Energy Commission (CEC):

A. *The 2022 Building Energy Efficiency Standards, Title 24, Part 6 (Energy Code).* This manual explains and supplements the Energy Code, the legal requirements for all covered buildings. This manual explains those requirements in simpler terms but does not replace or supersede them. Readers should have a copy of the Energy Code as a reference.

B. The 2022 Reference Appendices:

- Reference Joint Appendices contain information common to residential and nonresidential buildings.
- Reference Residential Appendices contain information for residential buildings only.
- Reference Nonresidential Appendices contain information for nonresidential buildings only.
- The 2022 Alternative Calculation Method (ACM) Approval and Nonresidential ACM Reference Manuals are specifications for compliance software.

Note: *Multifamily and hotel/motel occupancies – For the location and design data of these occupancies, opaque assembly properties are in the Reference Joint Appendices. Mechanical and lighting information is in the Reference Nonresidential Appendices. Residential water heating information is in the Reference Residential Appendices.*

Material from these documents is not always repeated in this manual. If you are using the electronic version of the manual, there may be hyperlinks to the reference document.

1.3 The Technical Chapters

Each of the 12 technical chapters (3 through 14) begins with an overview followed by each subsystem. For the building envelope, subsections include fenestration, insulation, infiltration, roofing products, and so forth. For HVAC, the subsections include heating equipment, cooling equipment, and ducts. Mandatory requirements and prescriptive requirements are described in each subsection or component. The prescriptive requirements establish the stringency of the Energy Code because they are the basis of the energy budget when the performance compliance method is used.

1.4 Why California Needs the Energy Code

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

1.4.1 Electricity Reliability and Demand

Buildings are a major contributor to electricity demand. The 2000 to 2001 California energy crisis and the East Coast blackout in the summer of 2003 illustrated the fragility of the electric distribution network. System overloads caused by excessive demand from buildings create unstable conditions. Blackouts disrupt business and cost the economy billions of dollars.

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

1.4.2 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 improve air circulation. Poorly designed building envelopes result in buildings that are less comfortable. Oversized heating and cooling systems do not ensure comfort in older, poorly insulated, or leaky buildings.

1.4.3 Economics

Energy efficiency helps create a more profitable operation for building owners. More broadly, the less that California depends on depletable resources such as natural gas, coal, and oil, the stronger and more stable the economy will remain as energy costs increase. Investing in energy efficiency benefits everyone. It is more cost-effective to invest in saving energy than build new power plants.

1.4.4 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 the planet. California is not immune to these problems, but the Appliance Efficiency Regulations, the Energy Code, and utility programs that promote efficiency and conservation help maintain environmental quality. Other benefits include increased preservation of natural habitats, which protects animals, plants, and ecosystems.

1.4.5 Greenhouse Gas Emissions and Global Warming

Burning fossil fuel adds carbon dioxide (CO_2) to the atmosphere, a major contributor to global warming. Carbon dioxide and other greenhouse gases create an insulating layer that leads to global climate change. The CEC's research shows that most sectors of California economy face significant risk from climate change, including water resources (from reduced snowpack), agriculture, forests, and the natural habitats of indigenous plants and animals.

Energy efficiency is a far-reaching strategy to reducing greenhouse gases. 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. Its first efficiency recommendation was to adopt nationwide energy efficiency building codes.

The Energy Code is expected to significantly reduce greenhouse gas and other air emissions.

1.4.6 Building Decarbonization

California has nearly 14 million homes and 7.5 million square feet of commercial buildings. These buildings produce a quarter of the state's greenhouse gas (GHG) emissions, making homes and businesses a major factor in climate change. Reducing these emissions, also referred to as building decarbonization, is a key part of California's climate strategy.[1] Of the many tools in the state's building decarbonization toolbox, the Building Energy Efficiency Standards stand out as a proven solution of significance.

In August 2021, the CEC adopted the 2022 Energy Code for newly constructed buildings and additions and alterations to existing buildings. This code blazes a trail for states and governments seeking to decarbonize the building sector aggressively, feasibly and cost-effectively. This update encourages efficient electric heat pumps, establishes electric-ready requirements for newly constructed homes, and strengthens ventilation standards. For the first time in the nation, this update also requires solar photovoltaic systems plus battery systems as the performance standards baseline (standard design) for select nonresidential building types. Over the next 30 years, this code is estimated to provide the state with $1.5 billion in environmental benefits; equivalent to taking nearly 2.2 million cars off the road for a year. The development of this code was a multiyear effort led by the CEC through a robust public process and with support from an expansive network of key market partners such as California's largest utilities, the building community, and environmental advocates.[2]

1.5 What's New for 2022

1.5.1 Envelope

Reduced the allowed area of site-built fenestration that is not rated by the National Fenestration Rating Council from 1,000 square feet (sq. ft) to 200 sq. ft (NA6).

1.5.2 Lighting

1. Changes to indoor and outdoor lighting power allowances to be based on light-emitting diode (LED) lighting technologies (§140.6 and §140.7) Revisions to

[1] AB3232, https://www.energy.ca.gov/media/5968

[2] 2022 code adoption script, https://www.energy.ca.gov/event/meeting/2021-08/energy-commission-business-meeting

lighting power density (LPD) values in Table 140.6-B, 140.6-C, 140.6-D, 140.7-A, and 140.7-B.

2. Revision and streamlining luminaire classification and wattage requirements.
3. New lighting power adjustment for small-aperture tunable white and dim-to-warm LED luminaires.
4. New power adjustment factors (PAFs) for daylighting devices including horizontal slats, light shelves, and clerestory fenestrations (§140.6[a]2L). New prescriptive requirements of daylighting devices including horizontal slats, light shelves, and clerestory fenestrations (§140.3[d]).
5. Clarification and streamlining of manual area controls requirements, multilevel lighting controls requirements, and automatic daylighting control requirements. Restrooms to comply with occupancy sensing control requirements. A new section for indoor lighting control interactions (§130.1).
6. Revision and streamlining of outdoor lighting control requirements (§130.2[c]).
7. Revision and streamlining of requirements for alterations, including the merging of three sections into a single "Altered Indoor Lighting Systems" section, the alignment of two reduced-power options on controls, and trigger threshold of projects more than 5,000 sq. ft. (§141.0[b]2I). Revised and consolidated Table 141.0-F.

1.5.3 Mechanical

1. New mandatory requirements for demand response HVAC controls (§110.12[a] and §110.12[b]).
2. New mandatory requirements for ventilation and indoor air quality (§120.1).
3. Revision of the mandatory requirements for demand control ventilation (§120.1[d]).
4. Healthcare buildings overseen by the California Department of Health Care Access and Information (HCAI) (formerly the Office of Statewide Health Planning and Development (OSHPD)) shall comply with the Energy Code. However, there are exceptions for healthcare facilities to avoid conflicting requirements.
5. Revision of the requirements for occupancy-sensing zone controls (§120.2[e]3).
6. Revision of the mandatory requirements for economizer fault detection and diagnostics (§120.2[i] and §140.9[a]1A).
7. New mandatory requirements for adiabatic condensers for heat rejection for refrigeration systems (§120.6).
8. Revision of the prescriptive requirements for fan power limitation (§140.4[c]).
9. New prescriptive requirements for space-conditioning zone controls (§140.4[d]).
10. New prescriptive requirements for water economizers (§140.4[e]3).
11. New prescriptive requirements for cooling tower efficiency (§140.4[h]5).
12. New prescriptive requirements for exhaust system transfer air (§140.4[o]).

13. New prescriptive requirements calling for heat pump water heaters for smaller school buildings, higher efficiency for high-capacity gas water heating; hotel/motels are required to meet reorganized multifamily water heating requirements. (§140.5)
14. New requirements for Dedicated Outside Air Systems (§140.4[p]).
15. New requirements for Exhaust Air Heat Recovery(§140.4[q]).

1.5.4 Electrical

1. Healthcare facilities overseen by the (OSHPD) have to comply with the applicable requirements of Section 130.5 for electrical power distribution systems. There are exceptions for healthcare facilities to avoid potentially conflicting requirements for healthcare facilities.

1.5.5 Covered Processes

1. New mandatory requirements for controlled environmental horticulture systems (§120.6[h]).
2. New mandatory requirements for steam traps (§120.6[i]).
3. New mandatory requirements for compressed air systems (§120.6[e]).
4. New mandatory requirements for computer rooms, including uninterruptible power supplies, and revisions to existing prescriptive requirements for economizers for computer rooms (§120.6[j], §140.9[a], and §141.1[b]).
5. New mandatory requirements for transcritical CO_2 refrigeration systems (§120.6[b]).

1.5.7 Multifamily

1. The new chapter 11 of this manual consolidates multifamily compliance into one chapter.
2. The 2022 Energy Code grouped all multifamily building requirements together, regardless of number of stories, and relocated all relevant multifamily code to sections § 160.0 through 180.2.
3. Revisions to language and content to §160.0

1.6 Mandatory Requirements and Compliance Approaches

1.6.1 Mandatory Requirements

With either the prescriptive or performance compliance paths, there are mandatory requirements that always must be met. Mandatory requirements 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 requirements described in Chapters 3, 4, 5, 6, 7, 10, and 11) requires each component of the proposed building to meet a prescribed minimum efficiency. The approach offers little flexibility but is easy to use. If the design fails to meet even one requirement, then the system does not comply with the prescriptive approach. In this case, the performance approach provides more 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 Chapter 3. The only flexibility is if portions of an envelope component do not meet a requirement, a weighted average of the component can be used to demonstrate compliance. The stringency of the envelope requirements varies according to climate zone and occupancy type.
B. **Mechanical**. The prescriptive mechanical requirements are described in Chapter 4. The prescriptive approach specifies equipment, features, and design procedures but does not mandate the installation of a particular HVAC system.
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 approaches are described in Chapter 5. The allowed lighting varies according to the requirements of the building occupancy or task requirements.
D. **Outdoor Lighting**. Outdoor lighting standards are described in Chapter 6, setting power limits for various applications such as parking lots, pedestrian areas, sales canopies, building entrances, building façades, and signs. The Energy Code also set minimum requirements for cutoff luminaires and controls. Detailed information on the outdoor lighting power allowance calculations is in Section 6.4.

1.6.3 Performance Approach

The performance approach (Chapter 12) allows greater flexibility than the prescriptive approach. It is based on an energy simulation model of the building.

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

The performance approach may be used for:

- Envelope or mechanical compliance alone.

- Envelope and mechanical compliance.
- Envelope and indoor lighting compliance.
- Envelope, mechanical, and indoor lighting compliance.

Indoor lighting compliance must be combined with envelope compliance. The performance approach does not apply to outdoor lighting, sign lighting, exempt process load, some covered process loads (for example, refrigerated warehouses), or solar-ready applications.

Time-dependent valuation (TDV) energy and Hourly Source Energy (HSE) are the "currency" for the performance approach. TDV energy considers the utility costs associated with the type of energy (electricity, gas, or propane) and the time when it is saved or used. Energy saved when California is likely to have a statewide system peak is worth more than when supply exceeds demand. Appendix JA3 of the Reference Appendices has more information on TDV energy. Like TDV, HSE considers the type of energy (electricity, gas, or propane), but is based on the amount of long-term depletable energy resources used to meet the energy demand of the building in each hour. HSE values are very similar to the long-term hourly utility greenhouse gas emissions and a strong metric for encouraging building decarbonization.

See Chapter 12 if the performance approach will be used for additions and alterations.

1.6.3.1 Compliance Options

The CEC has a formal process for certification of compliance options for new products, materials, designs, or procedures that can improve building efficiency. Section 10-109 allows the introduction of new calculation methods and requirements that cannot be properly accounted for in the current approved compliance approaches. The compliance options process allows the CEC to review and gather public input about 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 CEC to respond to changes in building design, construction, installation, and enforcement.

1.7 Scope and Application

The Energy Code applies to nonresidential and residential buildings. This manual addresses the requirements for nonresidential buildings, including hotels, motels, and multifamily buildings. The Residential Manual discusses the requirements for single-family residential buildings.

1.7.1 Building Types Covered

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

The Energy Code does not apply to CBC Group L. The standards also do not apply to buildings that fall outside the CBC's jurisdiction, such as mobile structures. If outdoor lighting is associated with a Group L occupancy, it is exempt. If the outdoor lighting is part of any other occupancy groups listed, it must comply.

1.7.2 Historical Buildings

Exception 1 to §100.0(a) states that qualified historical 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 Code. Section 140.6(a)3Q and Exception 13 to §140.7(a) clarify that indoor and outdoor lighting systems in qualified historical buildings are exempt from the lighting power allowances only if they consist solely of historical lighting components or replicas of historical lighting components. If lighting systems in qualified historical buildings contain some historical lighting components or replicas of historical components, combined with other lighting components, only those historical or historical replica components are exempt.

The California Historical Building Code (CHBC) Section 102.1.1 specifies that all nonhistorical additions must comply with the regular code , including the Energy Code. CHBC Section 901.5 specifies that when new nonhistorical mechanical, plumbing, or electrical (including lighting) equipment or appliances or a combination is is installed historic buildings, they *must* comply with the Energy Code and Appliance Efficiency Regulations unless historical significance or characteristic features are threatened.

The California State Historical Building Safety Board has final authority for interpreting the requirements of the CHBC and determining to what extent the requirements of the Energy Code apply to new and replacement equipment and other alterations to qualified historic buildings. In enacting the CHBC legislation, the Legislature wants 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 Residential Buildings

The 2022 Energy Code has grouped all multifamily building requirements together, regardless of number of stories, and relocated all relevant multifamily code language to Sections 160.0 through 180.2 of the Energy Code. Requirements specific to single-family buildings continue to be found in Sections 150.0 through 150.2. Table 1-1 describes how single-family and multifamily buildings are classified.

Table 1-1: Nonresidential vs. Residential Energy Standards

Nonresidential Standards	Multifamily Standards	Single-Family Standards
These standards cover all nonresidential occupancies (Group A, B, E, F, H, I, M, S, or U), and all hotel and motel occupancies.	These standards cover residential occupancy groups R-2, R-3, and R-4 as described below.	These standards cover residential occupancies as described below:
Offices Retail and wholesale stores Grocery stores Restaurants Assembly and conference areas Industrial work buildings Commercial or industrial storage Schools and churches Theaters Hospitals Hotels and motels	A building of occupancy group R-2, other than a hotel/motel building or timeshare property. A building of occupancy group R-3 that is a nontransient congregate residence, other than boarding houses of more than 6 guests and alcohol or drug abuse recovery homes of more than 6 guests. A building of Occupancy Group R-4.	A building of occupancy group R-3 with two or less dwelling units. A building of occupancy group R-3, other than a multifamily building or hotel/motel building. A townhouse. A building of occupancy group R-3.1. A building of occupancy group U when located on a residential site.

Notes: Occupancy groups are defined in Chapter 3 of the California Building Code (Title 24, Part 2, Volume I). Any buildings of occupancy group R that are not identified under the single-family or multifamily columns are considered hotel/motel buildings. For more on hotel/motel buildings and their occupancy groups, see Section 1.7.8 of this manual.

Source: California Energy Commission

1.7.4 Scope of Standard Requirements

The Energy Code applies to any construction that requires a building permit, whether for newly constructed buildings, outdoor lighting systems, signs, or additions or alterations to them. The primary enforcement mechanism is 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 Energy Code, it has the authority to not approve the building or occupancy permit.

The Energy Code applies only to the construction subject to the building permit application. An existing space that is "conditioned" for the first time is an addition, and all the existing components, whether altered or not, must comply with the Energy Code. (See §100.1 addition or newly conditioned space.)

Other than for lighting, the Energy Code requirements apply only to buildings that are directly or indirectly conditioned.

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 was built on speculation, the owner would know the ultimate occupancy of the space but might not know the specific tenant. For this 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 requirements are far more expensive when they are installed in the building after the shell is built.
2. Include envelope compliance as well as mechanical or lighting compliance or both when those systems are to be installed prior to leasing.

A potential pitfall with delaying envelope compliance is that tenants may have a difficult time showing compliance. An Energy Code update between the time of shell construction and energy compliance for a tenant improvement could make compliance 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 retrofit costs). In most cases, delaying the envelope increases construction costs. If a building is likely to be conditioned, some enforcement agencies require envelope compliance when the shell is constructed.

Section 1.7.12 has information about energy compliance for tenant improvements in existing buildings.

1.7.5.2 Unknown Occupancy

Speculative buildings may be built, and the ultimate occupancy is determined only when the building is leased. The structure could be an office, a restaurant, or retail space. The Energy Code building envelope requirements treat these occupancies similarly. The major differences are the lighting and ventilation requirements. If a tenant is not identified during the permitting time, the “all other areas” lighting power densities in Table 140.6-C are used.

Deferring compliance by calling the building unconditioned will cause problems when the first tenant installs mechanical space-conditioning equipment.

1.7.6 Mixed- and Multiple-Use Buildings

1.7.6.1 Mixed Residential and Nonresidential Occupancies

When a building includes both residential and nonresidential occupancies, the requirements depend on the percentages of conditioned floor area for each occupancy type:

A. **Minor Occupancy** (Exception 1 to §100.0[f]). When a residential occupancy is 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 applicant may choose to treat the entire building as if it is the major occupancy for envelope, HVAC, and water-heating compliance. Lighting requirements in §140.6 through §140.8 or §150.0(k) must be met for each occupancy separately. The mandatory requirements that apply to the minor occupancy, if different from the major occupancy, would still apply.

B. **Mixed Occupancy.** When a residential occupancy is mixed with a nonresidential occupancy, and if neither occupancy is less than 20 percent of the total conditioned floor area, two compliance submittals are prepared, each using the calculations and documents of the respective standards. Separate compliance for each occupancy is an option when one of the occupancies is a minor occupancy.

1.7.6.2 Multiple Nonresidential Occupancies

When a building consists of multiple nonresidential occupancies, they are considered separate occupancies. Most occupancies have the same envelope requirements. Lighting and mechanical requirements vary among the various usage categories and are treated according to each appropriate occupancy type.

Example 1-1

Question

A 250,000 sq. ft high-rise office building includes a small 900 sq. ft apartment on the first floor that visiting executives use. Is the apartment required to meet the residential requirements of the Energy Code?

Answer

No. 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.

1.7.7 Multifamily Buildings

Multifamily buildings are covered by chapter 11 of this manual.

1.7.8 Hotels and Motels

This section discusses the similarities and differences among the requirements for a hotel/motel and other nonresidential buildings.

Hotels or motels are unique in that the design incorporates 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 arrival experience created through the architectural features of the main lobby to the thermal comfort of the guest rooms. Other functions that designs must address include restaurants, kitchens, laundry, storage, assembly, outdoor lighting, and sign lighting. These structures can range from simple guest rooms with a small office to a structure encompassing a small city (§100.1 "HOTEL/MOTEL").

The 2022 Energy Code expanded on the definition of “Hotel/Motel” to include the following:

- A building of Occupancy Group R-1,
- Vacation timeshare properties and hotel or motel buildings of Occupancy Group R-2, and
- The following types of Occupancy Group R-3:
    - Congregate residences for transient use,
    - Boarding houses of more than 6 guests, and
    - Alcohol or drug abuse recovery homes of more than 6 guests.

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 Energy Code. The guest room portions of hotels/motels must meet the envelope, mechanical, and lighting provisions applicable only to hotel/motel guest rooms. 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 Code, the concepts at the beginning of each chapter apply to hotels/motels as they would any other nonresidential occupancy.

1.7.8.1 Mandatory Requirements

The mandatory requirements for envelope, mechanical, indoor lighting, outdoor lighting, and sign lighting apply to hotels/motels. The following describes special requirements or exceptions:

- Hotel/motel guest rooms must meet the applicable residential lighting standards.
- Outdoor lighting must meet the applicable outdoor lighting standards.
- Indoor and outdoor signs (other than exit signs) must comply with nonresidential Energy Code. Exit signs must comply with the Appliance Efficiency Regulations.
- Hotel and motel guest room thermostats shall have numeric temperature settings (Section 120.2(c)1A).
- 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.

- Automatic lighting shutoff 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:

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

1.7.8.3 Performance Compliance

The rules for performance compliance are based on the prescriptive and mandatory requirements for hotel/motels. However, the performance compliance approach can provide more flexibility than prescriptive compliance because of the ability to trade improvements in energy efficiency in one building component for reductions in efficiency in others.

To use the performance approach, the proposed building is modeled in compliance software. Proposed building details such as, building areas and occupancies for each area (including hotel/motel, nonresidential, and other occupancies if present) and envelope, mechanical and lighting specifications are input into the software. Based on the proposed design, the compliance software calculates standard design energy budgets. To comply, the proposed design energy use must be less than or equal to the standard design energy budget’s. Details on the performance approach are covered in chapter 12 of this manual.

1.7.9 Live-Work Spaces

Live-work buildings combine residential and nonresidential uses within individual units. In general, the 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

These 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 an addition, and all the components of the building must comply as if it were a newly constructed building with few exceptions, as described in Section 141.0(a) of the Energy Code.

This situation has potentially significant construction and cost implications. 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 conform with the current lighting requirements, including mandatory wiring and switching. If the envelope has large windows, some may have to be eliminated or replaced with more efficient windows. If the lighting system is inefficient, new and more efficient fixtures might have to be installed.

For example, the owner of an office building obtains a permit for the structure and envelope but wants the tenants to handle conditioning and lighting improvements. If that owner claims unconditioned status for that building, the owner does not have to comply with the envelope requirements of the standards. The owner does have to demonstrate compliance with the lighting requirements. If a tenant is not identified for a multitenant space during the permitting time, the "all other areas" lighting power density allowances from Energy Code Table 140.6-C shall be used. When the tenant applies for a permit to install the HVAC equipment, the envelope and any existing lighting to remain must fully comply 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 Energy Code. If the building was initially designed in a way that makes 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 difficulties, the recommended practice is to demonstrate energy compliance when the envelope is built and comply with the lighting systems during installation.

1.7.12 New Construction in Existing Buildings

Tenant improvements, including alterations and repairs, are new construction in an existing building. For example, the base building was constructed, but the individual tenant spaces were not completed. Tenant improvements can include work on the envelope, mechanical, or lighting systems. The system or systems being installed are 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 time systems other than those subject to the current permit application are involved 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 the water heating system of a building, 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 separate rules for energy compliance.

In summary, the alteration rules are the following:

1. The Energy Code applies only to those portions or components of the systems being altered (altered component). Untouched portions or components need not comply with the standards.
2. Alterations must comply with the mandatory requirements for the altered components.
3. New systems in the alteration must comply with the current standards.
4. An existing unconditioned building, where evaporative cooling is added to the existing unaltered envelope and lighting, does not need to comply with current standards.
5. Mechanical system alterations are governed primarily by the mandatory requirements.

Beyond meeting all applicable mandatory requirements, alterations must also comply with applicable prescriptive requirements discussed in technical chapters or use the performance approach. Within the performance approach, the option to show changes to the existing building (existing and alteration) is explained in Chapter 12. Performance credit is given only for systems that are changing under the current permitted scope of work.

Example 1-2

Question

An owner wants to add less than 50 sq. ft of new glazing in an existing nonresidential building in Climate Zone 3. What are the applicable requirements for the new glazing?

Answer

Exception 2 to §141.0(b)2Aii exempts up to 50 sq. ft of added windows from the relative solar heat gain coefficient (RSHGC) and visual transmittance (VT) requirements in Table 140.3-B, 140.3-C, and 140.3-D. The new glazing must meet only the Climate Zone 3 U-factor requirement in Table 141.0-A.

Example 1-3

Question

A building owner wants to change existing lighting fixtures with new ones. Does the Energy Code 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. 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 reposition the light fixtures in the affected rooms. Does the Energy Code apply to the work?

Answer

Each of the newly arranged rooms must have light switches. Since there is no change in the connected lighting load or the exterior envelope, only the mandatory light switching requirements in §130.1 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. Does the Energy Code apply to the work?

Answer

There would be no change in the load on the system nor any increase in the overall capacity, so the Energy Code 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. Does the Energy Code 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 unaffected by the Energy Code.

Example 1-7

Question

A building has a high ceiling space, and the owner wants to build a new mezzanine space. There will be no changes to the building envelope or the central HVAC system. There will be new lighting installed. How does the Energy Code 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 Energy Code. 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 the:

- Construction of new conditioned space and conditioned volume.
- Installation of space conditioning in a previously unconditioned space.
- Addition of unconditioned space.

Mandatory requirements and either prescriptive or performance requirements apply. For conditioned space, the heating, lighting, envelope, and water-heating systems of additions are treated the same as those 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 comply only 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 Code:

Option 1 – Addition Alone

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

Option 2 – Existing-Plus-Addition-Plus-Alteration

Using performance compliance, model the combination of the existing building, any alterations to the existing building, plus the addition (§141.0[a]2Bii). In this scenario, the proposed energy use is calculated based on existing building features that remain unaltered, the alterations to the existing building, and the proposed addition. The standard design (allowed) energy budget is calculated by approved software based on:

1. The existing building features that remain unaltered.
2. All altered features modeled to meet requirements of §141.0(b).
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 up for an inefficiency of the addition depending on the nature and scope of improvements to the existing building.

Option 3 – Whole Building as All Newly Constructed

The existing structure combined with the addition can be shown to comply as a whole building meeting all requirements of the Energy Code for newly constructed buildings for envelope, lighting, and mechanical. This is the most stringent and is practical only if the existing building will be improved to the overall level of the current Energy Code.

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 Energy Code?

Answer

Because of the 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 newly constructed buildings, 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 one or a combination of the following:

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

2) New indoor lighting in the existing building that has a lower installed lighting power density (LPD) than the allowed LPD in §140.6

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

1.7.15 Change of Occupancy

A change of occupancy alone without any tenant improvements or other changes does not require any action under the Energy Code. If alterations are made to the building, then the rules for alterations or additions for the new occupancy apply. (See Sections 1.7.13 and 1.7.14.)

If no changes are proposed for the building, consider the ventilation requirements of the new occupancy. For example, if a residence is converted to a hair salon, with new sources of indoor pollution, existing residential ventilation rates would likely be inadequate. The Energy Code requires no changes. If changes are made, then those alterations are required to comply.

1.7.16 Repairs

A repair is reconstructing or renewing any part of an existing building for maintaining it. Repairs shall not increase the preexisting energy consumption of the required component, system, or equipment. The Energy Code does not apply to repairs.

Example 1-9

Question

If a space were 1,000 sq. ft, 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 British thermal units (Btu)/hour (hr)-sq. ft =(hr-ft²) x 1,000 sq. ftft² = 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-sq. ftft²) and operates to keep the space temperature from falling below 50 degrees Fahrenheit (°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 111

Question

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

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 in the building shell, and its capacity exceeds 10 Btu/(hr-sq. ft). 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 Code envelope requirements. However, the space must still meet the lighting requirements of the Energy Code.

Example 1-13

Question

If in the example above mechanical cooling with the capacity that exceeds 5 Btu/hr-sq. ft is added to the building to keep the temperature from exceeding 85°F, is the space considered directly conditioned, and must the envelope meet the Energy Code 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 Btu/hr-sq. ft and is controlled to a temperature of 75°F, does the space have to meet the envelope requirements of the Energy Code?

Answer

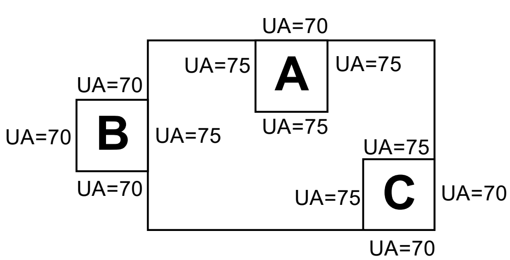
No. Computer rooms are a covered process. There are no envelope requirements in either §120.6 or §140.9.

Example 115

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, each space is evaluated on the basis of heat transfer coefficients through the walls and roof. It is further assumed that the floors are adiabatic. 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 1-16

Question

In a four-story building, the first floor is retail, second and third floors are offices, and the fourth floor is residential. 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 Code

1.8.1 History

Section 25402 of the Public Resources Code

The Legislature adopted the Warren-Alquist Act (the act), which created the Energy Resources and Conservation Development Commission (California Energy Commission, or CEC) in 1975 to deal with energy-related issues and charged the CEC to adopt and maintain energy efficiency standards for new buildings. The first standards were adopted in 1978 in the aftermath of the Organization of Petroleum Exporting Countries (OPEC) oil embargo of 1973.

The act requires that the Energy Code be cost-effective “when taken in their entirety and amortized over the economic life of the structure.”

The CEC is required to periodically update the standards. One hundred eighty (180) days after the approval of the standards, manuals must be published to support the Energy Code. . The Energy Code (Part 6) goes into effect along with the other Parts of the California Building Standards Code (Title 24) on the stautorily required triennial update cycle. The act directs local building permit jurisdictions to not approve permits until the building satisfies the requirements of the standards.

The first-generation standards for nonresidential buildings took effect in 1978. Second-generation standards took effect for offices, and retail and wholesale stores, in 1984 and 1985, respectively.

The next major revision occurred in 1992 when the requirements were simplified and consolidated for all building types. Major changes were made to lighting, building envelope, fenestration, and 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. In 1998, lighting power limits were reduced significantly because electronic ballasts and T-8 lamps were cost-effective and becoming commonplace in nonresidential buildings.

The California electricity crisis of 2000 resulted in rolling blackouts through much of the state. This crisis produced escalating energy prices at the wholesale market and in some areas in the retail market. The Legislature responded with Assembly Bill 970 (Ducheny, Chapter 329, Statutes of 2000), which required the CEC to update the Energy Code through an emergency rulemaking. This rulemaking was achieved within the 120 days required by the Legislature. The 2001 Standards (or the AB 970 Standards) took effect mid-2001. The 2001 Energy Code included requirements for high-performance windows throughout California, more stringent lighting requirements, and other changes.

The Public Resources Code was amended in 2002 through Senate Bill 5X (Machado, Chapter 852, Statutes of 2008) to expand the authority of the CEC to develop and maintain standards for outdoor lighting and signs. The Energy Code covered in this manual builds on the rich history of Nonresidential Energy Code in California and the leadership and direction provided by the California Legislature over the years.

The 2008 Energy Code was expanded to include refrigerated warehouses and steep-sloped roofs.

The 2013 Energy Code reflected many significant changes and expanded the 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 requirements 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 Code was current with ASHRAE 90.1 national consensus standards. Changes were made to HVAC controls, indoor and outdoor lighting, advanced building control systems, and covered processes, including new requirements for elevators, escalators, and moving walkways.

The 2019 Energy Code updated the indoor and outdoor lighting requirements to assume the use of LED lighting, updated indoor air quality requirements, and expanded to include requirements for healthcare facilities for the first time.

For a detailed list of the changes to the 2022 Energy Code, see Section 1.5 of this chapter, or view our 2022 Building Energy Efficiency Standards Summary found at https://www.energy.ca.gov/sites/default/files/2021-08/CEC_2022_EnergyCodeUpdateSummary_ADA.pdf.

Example 1-17

Question

Does a LEED-certified building still need to meet the 2022 Energy Code?

Answer

Yes.

1.8.2 California Climate Zones

Since energy use depends partly upon weather conditions, the CEC established 16 climate zones representing distinct climates within California. These 16 climate zones are used with residential and the nonresidential standards. Information is available by zip code and in several formats (http://energy.ca.gov/maps/renewable/building_climate_zones.html).

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

Source: California Energy Commission