Codes and Standards Enhancement (CASE) Initiative

2028 California Energy Code

Healthcare Exceptions

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Executive Summary

This proposal presents updates to selected healthcare facility exceptions for consideration in the 2028 California Energy Code (Title 24, Part 6). The proposals were developed by the Statewide Codes and Standards Enhancement (CASE) Team to reduce unnecessary energy use, improve compliance clarity, preserve patient care requirements, and support California's long-term energy efficiency and greenhouse gas reduction goals. The CASE Report evaluates four measures applicable to nonresidential California Department of Health Care Access and Information (HCAI facilities): Shut-off and Reset Controls, Space Conditioning Zone Controls, Fan Control, and Alterations. All measures involve eliminating existing exceptions for healthcare facilities. The report also adds a sub-definition for HCAI Facility, meaning a health facility regulated by the California Department of Health Care Access and Information and covered by Office of Statewide Health Planning and Development (OSHPD) 1, 2, and 5 or an OSHPD 3 clinic when located within an OSHPD 1, 2, or 5 facility. The proposal excludes facilities with Group R occupancies from the defined scope of healthcare facilities for these changes for alignment with Assembly Bill 130 requirements, as signed into law in 2025.

The Statewide CASE Team engaged the California Energy Commission (CEC), HCAI, American Society for Health Care Engineering (ASHE), the American Hospital Association, manufacturers, builders, architects, engineers, utility incentive program managers, Energy Code analysts, and other code-compliance stakeholders. Workshops were held on September 23, 2025, March 17, 2026, and April 20, 2026. The team worked closely with HCAI to review current exceptions line by line and identify measures that reduce energy use cost-effectively while preserving patient care and reflecting current industry practice.

The Statewide CASE Team recognizes ongoing systemic inequities in environmental and social justice (ESJ) communities and developed the proposal with consideration of potential unintended impacts.

Shut-off and Reset Controls

Proposed Code Change

This measure would limit the existing healthcare facility exception for shut-off and reset controls so that HCAI facilities would be required to provide controls that automatically restart HVAC systems to maintain thermostat setpoints and reset zone or terminal supply airflow to no less than the California Mechanical Code Table 4-A minimums. An exception would prevent systems serving multiple spaces from reducing airflow below the minimum required for any served space.

Benefits of Proposed Change

This measure would capture energy savings by requiring safe airflow turndown in a selection of spaces where CMC Table 4-A permits unoccupied turndown, while retaining the automatic shut-off exception for healthcare systems that must operate continuously.

Compliance and Enforcement

This measure would be implemented through mechanical compliance documentation for applicable healthcare projects; the report identifies NRCC-MCH-E, NRCC-CXR-E, and NRCI-MCH-E as relevant forms and indicates no ACM Reference Manual change for this mandatory measure.

Market Assessment

The incremental cost analysis assumes modern DDC/BAS capabilities are commonly included in California healthcare facilities, with additional cost primarily associated with occupancy sensors, BAS points, and programming.

Cost Effectiveness

The measure was estimated to be cost effective in all 16 California climate zones; the BCR ranges from 4.08 to 11.07.

First-Year Statewide Impacts

Table 1: Summary of Statewide Impacts – Shut-off and Reset Controls

Metric	Total Statewide Impacts [a]
Annual Electricity Savings (GWh)	5.19
Peak Demand Reduction (MW)	0.47
Annual Natural Gas Savings (Million Therms)	0.72
Annual Source Energy Savings (Million kBtu)	67.99
30-Year Long-term System Cost Savings (Million 2029 PV$)	$97.22
Annual Avoided GHG (Metric Tons CO_2e/yr)	4,090

a. Values represent impacts from buildings permitted during the first year the code is in effect. Positive values indicate savings or reductions.

Space Conditioning Zone Controls

Proposed Code Change

This measure would add new prescriptive HCAI facility-specific zone controls requirement for zones or mixed-requirement zones served by VAV systems and designed to CMC Table 4-A, while retaining healthcare exceptions for existing reheating/recooling and VAV zone-control sections where appropriate.

Benefits of Proposed Change

This measure would reduce excessive reheating, recooling, and fan energy by allowing zones to reduce airflow to appropriate minimum ventilation levels while maintaining clinical ventilation requirements.

Compliance and Enforcement

This measure would introduce a new Section 401.3.6.3 pathway for HCAI facilities and would require designers and reviewers to distinguish between standard zones and zones governed by CMC Table 4-A ventilation requirements.

Market Assessment

The report states the cost approach is based on the same integrated controls upgrades as the shut-off/reset measure and conservatively applies $4.31/ft² to each controls measure independently.

Cost Effectiveness

The measure was estimated to be cost effective in all 16 California climate zones; the BCR ranges from 13.65 to 17.62.

First-Year Statewide Impacts

Table 2: Summary of Statewide Impacts – Space Conditioning Zone Controls

Metric	Total Statewide Impacts [a]
Annual Electricity Savings (GWh)	59.70
Peak Demand Reduction (MW)	5.99
Annual Natural Gas Savings (Million Therms)	3.20
Annual Source Energy Savings (Million kBtu)	371.88
30-Year Long-term System Cost Savings (Million 2029 PV$)	787.00
Annual Avoided GHG (Metric Tons CO_2e/yr)	21,865

a. Values represent impacts from buildings permitted during the first year the code is in effect. Positive values indicate savings or reductions.

Fan Control

Proposed Code Change

This measure would remove the fan-control exception for HCAI facilities. This would result in covered cooling systems needing to vary indoor fan airflow as a function of load, including staged or proportional fan control requirements and two-speed fan control during economizer operation where applicable.

Benefits of Proposed Change

This measure would reduce fan energy in healthcare HVAC systems while maintaining minimum ventilation and pressurization requirements. The report notes the proposed strategy does not introduce new equipment or components beyond what is typically installed for current healthcare systems.

Compliance and Enforcement

This measure would update mechanical compliance forms and may require review of supply fan variable-flow controls.

Market Assessment

The report characterizes VFDs, ECMs, VAV terminal units, pressure-independent controls, and BAS/DDC platforms as mature, widely available, and already common in modern healthcare projects.

Cost Effectiveness

Cost effective with infinite BCR in all climate zones because incremental first cost and incremental maintenance/replacement costs are assumed to be zero given VFD/ECM technology being widespread in the market.

First-Year Statewide Impacts

Table 3: Summary of Statewide Savings – Fan Control

Metric	Total Statewide Impacts [a]
Annual Electricity Savings (GWh)	54.27
Peak Demand Reduction (MW)	5.38
Annual Natural Gas Savings (Million Therms)	2.95
Annual Source Energy Savings (Million kBtu)	340.35
30-Year Long-term System Cost Savings (Million 2029 PV$)	$715.81
Annual Avoided GHG (Metric Tons CO_2e/yr)	20,028

a. Values represent impacts from buildings permitted during the first year the code is in effect. Positive values indicate savings or reductions.

Alterations

Proposed Code Change

This measure would remove the blanket healthcare exception for nonresidential alterations and add targeted healthcare exceptions across envelope, space-conditioning/ventilation, and electrical/lighting sections, making HCAI facilities subject to selected alteration requirements such as exterior windows, FEI, altered roofs, and altered indoor lighting systems.

Benefits of Proposed Change

This measure would apply established energy-efficiency requirements to healthcare alterations, improving operating efficiency, reducing demand, supporting resilience, and incrementally modernizing equipment as systems fail or are modified.

Compliance and Enforcement

Would require additional training for HCAI plan reviewers, Inspectors of Record, and field inspectors on when alteration thresholds trigger Energy Code requirements and how to verify compliance in plans and in the field.

Market Assessment

The report states the affected products, services, and design practices are already used in non-healthcare alterations (due to code requirements) and in many healthcare projects as well (on a voluntary basis), although owners and healthcare-specific design teams may need training and case studies.

Cost Effectiveness

The measure is expected to be cost effective because the requirements already apply to other nonresidential buildings and healthcare facilities generally have longer operating hours. Incremental costs were calculated as "break even," meaning that the value was set at a level such that the benefit to cost ratio (BCR) was 1.0 in the most conservative climate zone of each submeasure.

First-Year Statewide Impacts

Table 4: Summary of Statewide Savings – Alterations

Metric	Total Statewide Impacts [a]
Annual Electricity Savings (GWh)	8.30
Peak Demand Reduction (MW)	0.95
Annual Natural Gas Savings (Million Therms)	0.06
Annual Source Energy Savings (Million kBtu)	18.81
30-Year Long-term System Cost Savings (Million 2029 PV$)	$78.54
Annual Avoided GHG (Metric Tons CO_2e/yr)	1,038

a. Values represent impacts from buildings permitted during the first year the code is in effect. Positive values indicate savings or reductions.

Acronyms

Table 5 presents a list of acronyms used in this report. Title24stakeholders.com also maintains a glossary of terms.

Table 5: List of Acronyms

Acronym	Definition
ACM	Alternative Calculation Method
ASHE	American Society for Health Care Engineering
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
ATT	Acceptance Test Technician
BAS	Building Automation System
BCR	Benefit-to-cost Ratio
BEM	Building Energy Modeling
Btu	British Thermal Units
CALGreen	California Green Building Standards Code
Cal/OSHA	California Division of Occupational Safety and Health
CARB	California Air Resources Board
CASE	Codes and Standards Enhancement
CBSC	California Building Standards Commission
CBECC	California Building Energy Code Compliance Software
CBO	Community-Based Organization
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CMC	California Mechanical Code (Title 24, Part 4)
CPUC	California Public Utilities Commission
CSE	California Simulation Engine
CTF	Conduction Transfer Functions
CZ	Climate Zone
DAC	Disadvantaged Community
DDC	Direct Digital Controls
DGS	California Department of General Services
DOAS	Dedicated Outdoor Air System
DOSH	Division of Occupational Safety and Health
DSH	California Department of State Hospitals
ECC	Energy Code Compliance
ECM	Electronic Commutated Motor

Acronym	Definition
EIR	Environmental Impact Report
EPIC	Electric Program Investment Charge
ESJ	Environmental and Social Justice
EUI	Energy Use Intensity
FSOR	Final Statement of Reasons
GHG	Greenhouse Gas
GWh	Gigawatt-Hour
HCAI	California Department of Health Care Access and Information
HVAC	Heating, Ventilation, and Air Conditioning
IDF	Input Data File
IECC	International Energy Conservation Code
IOU	Investor-Owned Utility
ISOR	Initial Statement of Reasons
Kg/s	Kilograms per Second
kWh	Kilowatt-Hour
kWh/year	Kilowatt-Hour Per Year
LED	Light Emitting Diode
LPD	Lighting Power Density
LSC	Long-term System Cost
MeasureSET	CASE Measure Savings Estimation Template
MG	Million Gallons of Water
NAICS	North American Industry Classification System
NPDI	Net Private Domestic Investment
OSHPD	Office of Statewide Health Planning and Development
PV	Present Value
SDD	Standards Data Dictionary
SOC	Standard Occupational Classification
SPMS	Saturation Pressure Measurement Sensors
SRIA	Standardized Regulatory Impact Assessment
UL	Underwriters Laboratories
VAV	Variable Air Volume
VFD	Variable Frequency Drives
W	Watt

1. Introduction

1.1 Report Context

This proposal describes specific energy-efficiency code changes (referred to as “measures”) aimed at reducing wasteful, uneconomic, inefficient, or unnecessary consumption of energy in California. These measures are submitted to the California Energy Commission (CEC) for consideration and potential inclusion in California’s Energy Code (Title 24, Part 6), which sets statewide energy efficiency requirements for newly constructed buildings and for additions and alterations to existing buildings. Measures may also be considered for inclusion in CALGreen (Title 24, Part 11) as voluntary energy efficiency standards, which would take effect only if adopted by a local jurisdiction seeking to exceed the minimum requirements of the Energy Code. Measures submitted to the CEC will be reviewed, may be modified, and may be incorporated into a broader regulatory package proposed and adopted by the CEC. To be included in the Energy Code, proposed measures must be both cost-effective and technically feasible.

1.2 Proposal Sponsors

Three California Investor-Owned Utilities (IOUs)—Pacific Gas & Electric Company, San Diego Gas & Electric, and Southern California Edison jointly sponsored this effort. Where the term “Statewide CASE Team” is used in this report, it refers to the authors and State Building Codes Advocacy activities supported through the Codes and Standards program.

1.3 Proposal Overview

In Title 24, Part 6, healthcare facilities historically have been granted a number of exceptions to mandatory and prescriptive requirements for nonresidential buildings. The Statewide CASE Team proposes to eliminate selected exceptions where they are not otherwise required, with the intent that imposing these provisions on healthcare facilities would result in substantial energy savings.

Certain content is applicable to all measures and, as such, is being provided to the reader in the following subsections.

1.3.1 Acute Psychiatric Hospitals (OSPHD 5)

A key aspect of this CASE study was determining which healthcare facilities types fall under the Department of Health Care Access and Information (HCAI)’s regulatory oversight and licensing authority. This required in-depth research and close coordination with HCAI staff to clarify the various classifications of Office of Statewide Health Planning and Development (OSHPD) facilities and to determine whether HCAI serves as the primary regulatory authority for each type.[1] OSHPD 1 and 2 facilities are clearly in scope and are not discussed here. However, there were some questions regarding OSHPD 5, so details are provided below.

The content that follows provides background for a specific building category, Acute Psychiatric Hospitals (APH), which the Statewide CASE Team understands to be within the scope of HCAI regulations.

The main reference source for the content that follows is Advisor Guides.

California's overarching health care agency is the California Health and Human Services Agency (CalHHS). HCAI, the California Department of Public Health (CDPH), and the Department of Health Care Services (DHCS) all fall under the CalHHS umbrella and play distinct roles in the management and delivery of health care for California.

An "acute psychiatric hospital" is defined in Health and Safety Code Section 1250(b) as: a health facility having a duly constituted governing body with overall administrative and professional responsibility and an organized medical staff that provides 24-hour inpatient care for persons with mental health disorders or other patients referred to in Division 5 OSHPD-2 (SNF) and OSHPD-5 (APH) are regulated under Chapter 16 (model code), commencing with Section 5000, or Division 6 (commencing with Section 6000) of the Welfare and Institutions Code, including the following basic services: medical, nursing, rehabilitative, pharmacy, and dietary services. Table 6 provides the key Statewide CASE Team findings.

Table 6: Summary of Key Differences between OSHPD 1, 2, and 5 Facilities

Category	OSHPD 1: General Acute Care Hospital	OSHPD 2: Skilled Nursing Facility	OSHPD 5: Acute Psychiatric Hospital	Total
Count	1,472	1,185	124	2,781
Total Beds	74,070	115,990	8,531	198,591
Minimum Bed Capacity	0	4	4	0
Maximum Bed Capacity	658	769	1,004	1,004
Average Bed Capacity	50	98	69	71
GSF/ Bed	500–750	700–1,000	1,500–2,500	N/A
EUI	180-260+	150–230	60-90	N/A

[1] Although the state agency itself changed its name from OSHPD to HCAI several years ago, the building classification system continues to use the OSHPD acronym.

Since the statewide floor area of OSHPD 5 facilities is smaller than that of OSHPD 1 and 2, the Statewide CASE Team did not conduct a separate analysis. However, it should be clearly stated that OSHPD 5 facilities are in scope for the measures in this report.

The California Building Code includes additional requirements for psychiatric facilities/spaces:

- **CBC Section 1224.31** relates to medical Psychiatric Nursing Units provided within General Acute Care Hospitals (GACH) **[OSHPD 1]** as a Supplemental Service.
- **CBC Section 1225.6.6** relates to Special Treatment Programs provided within Skilled Nursing Facilities **[OSHPD 2]** as an Optional Service.
- **CBC Section 1228** relates to Acute Psychiatric Hospitals **[OSHPD 5]** and APHs within a GACH.

Table 7 provides additional details comparing OSHPD 1, 2, and 5 facilities.

Table 7: Comparison of OSHPD 1, 2, and 5

Category	OSHPD 1	OSHPD 2	OSHPD 5
Facility Type	General Acute Care Hospital	Skilled Nursing Facility	Acute Psychiatric Hospital
Licensing Agency	CDPH	CDPH	CDPH
Primary Function	Surgery, ICU, ED, imaging, inpatient medical care	Long-term nursing care	Inpatient psychiatric treatment
Patient Acuity	High	Low–moderate	Moderate
Length of Stay	Short (days)	Long (weeks–months)	Medium (days–weeks)
Security Level	Moderate	Low	High (ligature-resistant)
Ventilation Requirements	Highest	Lowest	Moderate
24/7 Operation	Yes	Yes	Yes
Special Rooms	ORs, ICUs, imaging, labs	Therapy, dining, activity	Seclusion, group therapy
Staffing Intensity	Very high	Moderate	High
Jurisdiction	HCAI	HCAI	HCAI
HVAC	6–20 ACH depending on space	2–6 ACH	4–10 ACH
Electrical Load	Very high (ORs, imaging)	Low–moderate	Moderate–high
DHW Load	High	Very high	Moderate
Lighting Load	High	Moderate	High (security + supervision)
Emergency Power	Extensive	Limited	Moderate
GSF/bed	1,500–2,500	500–750	700–1,000
Site EUI	180–260+	60–90	150–230
EUI Notes	Highest due to ORs, imaging, ICU	I2 (Light medical), B and A2 Occupancies	24/7 psych care; no ORs/imaging

1.3.2 Healthcare Exceptions – Proposed Definition for HCAI Facilities

To clarify where the proposed changes apply, the proposal includes a new sub-definition of “healthcare facility” to include only those facility types regulated by OSHPD Applications 1, 2, and 5, and excludes facilities defined in the California Building Code as including a Group R occupancy. See Figure 1 for a Venn Diagram, which demonstrates the relationship between HCAI Facilities and Healthcare Facilities.

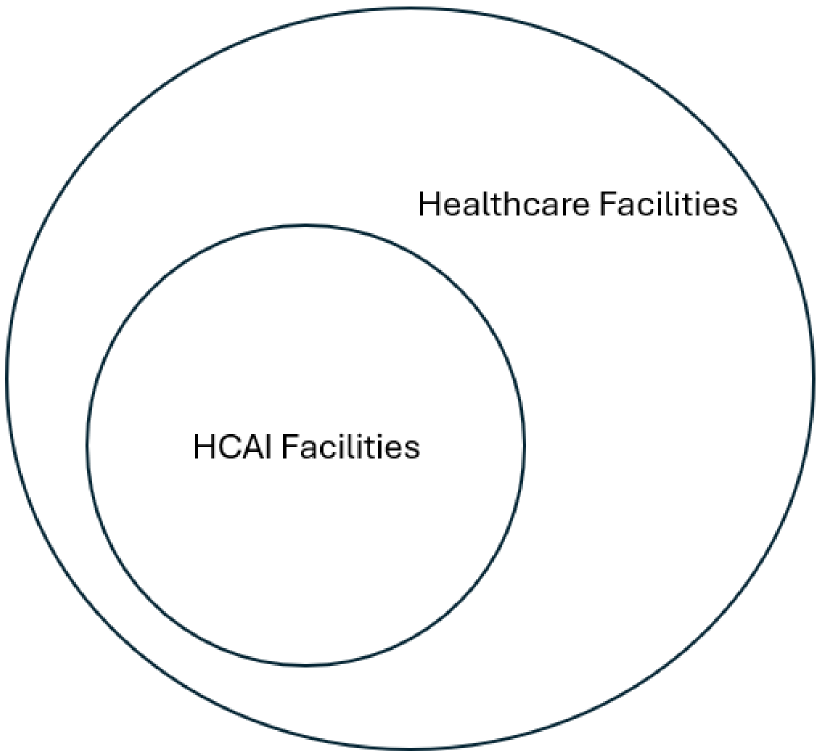

Figure 1: Venn Diagram demonstrating relationship between Healthcare Facilities and HCAI Facilities

1.3.2.1 Energy Code Change Summary

The proposed energy code changes affect Title 24, Part 6. A brief description of these changes is provided below:

Title 24, Part 6

SECTION 201 [100.1] DEFINITIONS

The proposed change would add a definition called “HCAI Facility” to improve the clarity regarding which OSHPD building classifications are in-scope for Title 24 Part 6. The purpose of these changes is to improve the enforceability and clarity of the requirements being proposed in the measures throughout this report.

1.3.2.2 Proposed Language Code: Energy Code (Title 24, Part 6)

The proposed change to the standards, which is applicable to all of the proposed measures in this report, is provided below.

SECTION 201 [100.1] DEFINITIONS

HEALTHCARE FACILITY is a health facility as defined in the California Health and Safety Code Division 2, Chapter 2, Section 1250., or clinic as defined by the California Health and Safety Code Division 2, Chapter 1 Section 1204 that is located within a health facility.

HCAI FACILITY is a health facility regulated by the California Department of Health Care Access and Information and covered by OSHPD Applications 1, 2, and 5. An OSHPD Application 3 clinic is included in this definition when it is located in an Application 1, 2, or 5 facility.

1.4 Stakeholder Engagement to Inform Proposal

When developing the code change proposal and associated technical information presented in this report, the Statewide CASE Team engaged many industry stakeholders including the California Energy Commission (CEC), California Department of Health Care Access and Information (HCAI), American Society for Health Care Engineering (ASHE), American Hospital Association, manufacturers, builders, architects and engineers, utility incentive program managers, Title 24 energy analysts, and others involved in the code compliance process. The proposal incorporates feedback received during public stakeholder workshops that the Statewide CASE Team held on September 23, 2025, March 17, 2026, and April 20, 2026.[2]

When developing this proposal, the Statewide CASE Team worked closely with HCAI to ensure the proposed code changes are feasible and reasonable for the healthcare industry to implement. HCAI is an essential voice in this proposal, as it is responsible for regulating the design and construction of certain licensed healthcare facilities in the state, often proposing code changes and issuing Code Application Notices (CANs) to interpret how Title 24 applies to healthcare facilities. Considering that healthcare facilities are still exempted from many requirements in the California Energy Code, the Statewide CASE Team worked with HCAI to go line by line through current exceptions to determine measures that meet the following criteria: cost-effectively reduce energy use in nonresidential healthcare facilities, preserve patient care, and meet current industry practices for new and existing buildings. The Statewide CASE Team will continue to rely on HCAI's expertise throughout the 2028 Title 24, Part 6 development process to ensure proposed measures can be effectively implemented in the field.

See Appendix E for details on the Statewide CASE Team's stakeholder engagement.

[2] Materials and notes from utility-sponsored stakeholder meetings are available here: https://title24stakeholders.com/measures/2028-cycle/healthcare-exceptions/ .

2. Shut-off and Reset Controls

2.1 Shut-off and Reset Controls – Measure Description

2.1.1 Proposed Code Change

This proposal modifies the overall healthcare facility exception in Section 401.2.2.5 *[Section 120.2(e)]* for shut-off and reset controls for space conditioning systems to limit the exception to those facilities not identified as HCAI facilities (see Section 1.3). The overall healthcare facility exception is retained for automatic shut-off controls in Section 401.2.2.5.1 *[Section 120.2(e)1].* The results of this overall exception removal is that healthcare facilities would be required to have controls that automatically restart the HVAC system as required to maintain thermostat setpoints, in accordance with Section 401.2.2.5.2 *[Section 120.2(e)2]*. Healthcare facilities would also be required to have occupant sensing zone controls in accordance with Section 401.2.2.5.3 *[Section 120.2(e)3],* however, note that space types triggered by this existing code requirement largely do not impact healthcare facilities. Section 401.2.2.5.3 *[Section 120.2(e)3]* deals specifically with hotels and motels and is therefore irrelevant to healthcare facilities, making an exception unnecessary.

This proposal also includes a new mandatory controls provision in Section 401.2.2.5.5, that requires certain spaces to have controls that reset zone or terminal supply airflow to no less than the minimum allowed for that space based on Table 4-A requirements in the CMC (IAPMO 2025).

An exception would be added for systems serving multiple spaces to ensure airflow reductions do not go below the minimum required airflow for any space served.

Table 8 summarizes the scope of the proposed code change.

Table 8: Scope of Proposed Code Change

A ☑ indicates the proposed code change is relevant.

Building Type(s)	Construction Type(s)	Type of Change
☐ Single Family	☑ New Construction	☑ Mandatory
☐ Multifamily	Additions	☐ Prescriptive
☑ Nonresidential (Not Group R uses)	Alterations	☐ Performance

Application Climate Zones	Energy Code Sections	Compliance Forms	Sections of ACM Reference Manuals
Climate Zones 1-16	Section 401.2.2.5 *[120.2(e)]* [a]	NRCC-MCH-E NRCC-CXR-E NRCI-MCH-E	N/A

Third Party Verification)	Updates to Compliance Software
☑ No changes to third party verification	☑ No updates
☐ Update existing verification requirements	☐ Update existing feature
☐ Add new verification requirements	☐ Add new feature

a. New space types are being brought into Title 24 Part 6 for the first time with this measure. This may affect other energy systems within healthcare facilities, e.g., lighting requirements. This may come into play with prescriptive compliance, in the sense that these new space types will have HVAC-related requirements but nothing else. This could be addressed by simply allowing any lighting or other system values for these space types until a future code cycle when efficiency requirements could be set.

2.1.2 Benefits of Proposed Change

Healthcare facilities were included in the purview of the California Energy Code starting with the 2019 edition but were exempted from many energy-saving measures in the code. Several exemptions have remained in place, despite other national codes and standards, such as the International Energy Conservation Code (IECC) and ASHRAE Standard 90.1, which do not include blanket exceptions for healthcare facilities. This presents an opportunity for California hospitals, skilled nursing facilities, and other nonresidential healthcare facilities to align with national codes and standards as well as construction practices in other states. This alignment can help simplify design, engineering, and construction plans for firms that design and build healthcare facilities nationwide. One goal of modifying this exception and adding healthcare-specific requirements, as well as others specified in this CASE Report, is to generate additional energy savings.

The proposed change would yield energy cost savings for healthcare facilities that do not currently have installed and implement setback controls on their HVAC systems. While healthcare facilities will still be exempted from the automatic system shut-off requirement of Section 401.2.2.5 *[120.2(e)]* per Section 407.1.1 of the 2025 CMC, which requires systems to operate continuously, systems within healthcare facilities serve many spaces that are allowed to turndown airflow per Table 4-A of the CMC. By requiring systems that can be set to enable that feature, there is the potential for significant energy savings. While certain spaces in hospitals and other healthcare facilities have specific ventilation requirements that limit the ability to achieve this type of system efficiency, many spaces, such as cafeterias, corridors, and patient rooms, can easily implement this approach. Energy savings would come from allowing HVAC systems to turn down to more efficient levels when serving specific zones and spaces in a healthcare facility where it is safe and allowable to do so.

By referencing Table 4-A of the 2025 CMC, this approach ensures a more targeted approach ensures that spaces that cannot be turned down due to specific ventilation requirements are exempted, while all other spaces would be subject to new turndown requirements outlined in Section 401.2.2.5 *[120.2(e)]*. Of the 142 spaces referenced in Table 4-A, just over 70 percent allow unoccupied turndown, so this change would impact a significant portion of the hospital and drive cost-effective savings (Commission 2025). This approach also has the added benefit of aligning more closely with ASHRAE Standard 170 – Ventilation of Health Care Facilities, which was adopted as Table 4-A in the 2025 CMC. This alignment helps reduce code complexity and potential for conflicting code requirements.

At the state level, extending this requirement to all new nonresidential healthcare facilities would have considerable cumulative impacts, as presented in the energy and cost savings section of this report.

2.1.3 Background Information

2.1.3.1 Background Information for Proposed Requirements

Healthcare facility HVAC systems represent one of the most significant and continuous energy loads in California's nonresidential building stock. Historically, healthcare facilities have operated their HVAC systems continuously, always maintaining full airflow and temperature control in all spaces. This practice originated from infection-control concerns and the limitations of older control systems that could not reliably differentiate between critical and non-critical zones.

Over the past decade, both technology and healthcare codes have advanced, making variable operation feasible and safe in many healthcare spaces. ASHRAE Standard 170 introduced explicit provisions allowing temperature and airflow reset during unoccupied or standby conditions, provided that pressure relationships and minimum ventilation rates are maintained in spaces where required. These provisions have since been incorporated into the 2025 CMC.

Notably, CMC Table 4-A now identifies several space types—including certain procedures, diagnostics, and support areas—where unoccupied airflow turndown is permissible. This marks a significant evolution in California’s mechanical design standards, formally acknowledging that many healthcare spaces can safely operate at reduced airflow during unoccupied periods while maintaining required indoor air quality and pressurization.

The proposed update to Title 24, Part 6, Section 401.2.2.5 *[Section 120.2(e)]* builds directly upon this advancement. By referencing the same unoccupied turndown allowances in CMC Table 4-A, the proposed reset control requirement in Section 401.2.2.4 ensures that HVAC systems can automatically respond to occupancy conditions using occupancy-sensing zone controls. When a zone transitions to an unoccupied or standby mode, the system will reduce airflow and adjust temperature setpoints accordingly—fully consistent with both the CMC and ASHRAE 170 frameworks.

In effect, this proposal would not introduce a new operational concept but rather codifies and harmonizes existing guidance from ASHRAE 170 and the 2025 CMC within Title 24, Part 6. The addition of reset control requirements would establish the automation and control logic needed to realize the energy and resilience benefits already envisioned in mechanical design standards. This change would also align California’s Energy Code with the latest clinical ventilation practices, enabling healthcare facilities to operate safely, efficiently, and responsively to actual occupancy conditions.

Initially, all spaces listed in CMC Table 4-A were included in the scope of this code change. However, this raised concerns with HCAI about the number of sensors needed, the complexity of operating a facility with constantly fluctuating air flows, maintaining pressure requirements, and the challenges of sensing occupancy in certain settings such as where occupants may be asleep.

The first list of spaces, identified in Table 401.2.2-A Spaces required to setback and/or shutdown, consisted of higher air change spaces such as those included in ASHRAE 90.1-2022 Addendum bh. Through discussion, the list was expanded to include more space types found in CMC Table 4-A. Discussions included:

- Occupancy sensors are frequently used in individual rooms, such as hotel rooms and private offices for lighting control.
- Zone-level setbacks have been implemented for more than 15 years in critical spaces such as operating rooms.
- Spaces with pressure requirements cannot fully shut off flow per CMC requirements such as operating rooms, which again has been done for over 15 years.
- Sensors that can detect occupancy without movement are already available in the marketplace despite limited adoption in the healthcare market.

The final list of applicable spaces was discussed with HCAI to confirm that it is realistic for each space type to be operated with a setback and/or shutoff. A challenge with the current approach is that care will need to be taken to update Table 401.2.2-A with any changes adopted in CMC Table 4-A in the future.

From a user perspective, it is common for engineers to reference multiple documents when designing and analyzing a hospital. Outside of California, an energy modeler would need to reference ASHRAE standards 90.1, 62.1, and 170 to complete their analysis and compliance work. This same approach would be anticipated for projects in California where an energy modeler would need to reference both CMC and Title 24 Part 6. All of these documents are available for free online, so there should be no accessibility issues.

The technical implementation of this requirement in clinical spaces (i.e., spaces where clinicians interact with patients to provide guidance or care, or spaces where clinical equipment and instruments are prepared) is more complex than in non-clinical spaces, as the dominant technology implemented to meet this requirement is an occupancy sensor, a passive infrared technology that registers movement. In many clinical spaces that allow setbacks, occupants lie motionless or may be asleep, making the traditional occupancy sensor less effective. While some clinical spaces, such as exam rooms, do not allow unoccupied turndown and would be exempt from this requirement, other clinical spaces, such as patient rooms, would be subject to this requirement.

A variety of occupancy counting technologies exist and have been in use for many decades. The premise is that ventilation requirements per Title 24 Part 6, ASHRAE 62.1, etc., use a per-person and/or per-unit area volume calculation. Occupancy levels fluctuate so that when the occupancy rate is below the design level, the volume of outside air may be reduced. This premise has had limited application in healthcare because recent healthcare ventilation requirements have been independent of occupancy levels.

Only in the last few years have standards such as ASHRAE 170 clarified that prescribed airflow rates may not be enforced or may be relaxed when a space is unoccupied. It should be noted that in prior ASHRAE Standard 170 versions, the standard was silent on unoccupied conditions allowing hospitals considerable flexibility in their interpretation of the standard. In healthcare, the focus initially was on operating rooms because they are among the most energy-intensive spaces in the hospital despite it also being considered the most critical environment. For example, hospital operating rooms started implementing occupancy-driven setbacks as far back as 2010 (Practice Greenhealth n.d.).

According to a 2022 survey conducted by Practice Greenhealth, 39 percent of hospitals implement operating room setbacks (see Table 9), and as shown in Table 10, the setbacks are implemented in a variety of ways (Practice Greenhealth 2022).

Table 9: Percentage of Operating Room HVAC Systems Programmed to Reduce Air Changes

Healthcare Facility Cohort	Description of Cohort	Percentage of HVAC system programmed to reduce air changes per hour (HVAC setback) when the operating rooms are unoccupied
All	All hospitals with overnight beds and operating rooms that responded to a given question on either the Partner for Change or the Partner Recognition award application.	39%
Small	Hospitals with fewer than 200 staffed beds. Hospitals in this cohort ranged in size from 10 to 199 staffed beds.	38%
Large	Hospitals with more than 200 staffed beds. Hospitals in this cohort ranged in size from 200 to more than 1,500 staffed beds.	39%
Top 25	Hospitals that have received a Top 25 Environmental Excellence award from Practice Greenhealth	68%
GOR Circle	Hospitals that have received a Greening the OR Circle of Excellence award from Practice Greenhealth	80%

Source: (Practice Greenhealth 2022)

Table 10: Mechanisms Used in Facilities with HVAC Setbacks (n=135)

Mechanism Used	All Cohort	Small Cohort	Large Cohort	TOP 25 Cohort	GOR Circle Cohort
Building automation system	77%	73%	83%	94%	100%
Occupancy sensors	45%	41%	49%	71%	75%
Scheduling system	34%	27%	41%	71%	75%
Mushroom button	7%	8%	6%	12%	0%
Other	10%	9%	10%	35%	38%

Source: (Practice Greenhealth 2022)

The clarified Table 7-1 from ASHRAE 170, that defines which spaces may implement setbacks, was adopted into CMC for the 2025 version as shown in Table 4-A. The mature occupancy sensing market is only recently broadening its scope in healthcare because the regulatory requirements have been clarified. The key difference between past occupancy counting and ventilation reduction projects and applying it in a clinical setting is that a precise number of people need to be counted in non-clinical environments, whereas in clinical settings it is still just a yes/no status for occupied/unoccupied, though that addresses only one aspect of the matter.

The technical implementation of this requirement in clinical spaces is more complex than in non-clinical spaces, as the dominant technology used to meet this requirement is an occupancy sensor, a passive infrared technology that registers movement. In many clinical spaces that allow setbacks, occupants may lie motionless or may be asleep, making the traditional occupancy sensor less effective. While some clinical spaces, such as exam rooms, do not permit unoccupied turndown and are exempt from this requirement, other clinical spaces, such as patient rooms, are subject to it.

That said, a promising new technology available off the shelf today, but uncommonly applied in healthcare, uses an alternate form of infrared sensing to detect warm bodies and artificial intelligence to count the number of people in a room, would potentially provide another compliance option and would be more effective than an occupancy sensor in certain clinical spaces. Using cameras and image recognition for occupancy counting has been around for more than a decade, though it raises privacy concerns. Non-cooperative occupancy sensing solutions have been available for over a decade but never really caught on due to their complexity and potential for inaccuracy (Dong, et al. 2010).

For clinical applications, the total number of people is not relevant; only whether the room is occupied or unoccupied. This relaxes the sensor accuracy requirement for healthcare compared to rooms that follow a ventilation-rate procedure, where the number of occupants is an input to the amount of outside air. A technology that operates in this capacity, called Resense Move,[3] and similar technologies are being piloted with results anticipated in early 2027, well before the adoption of this code change. A technology with the same goal but a different approach is being deployed by EclimAi, using cameras to detect occupancy and AI with edge computing to maintain privacy, ensuring no data goes to the cloud or leaves the facility. These technologies are not laboratory experiments but are already in the field. They are new to healthcare but have already been deployed in non-healthcare settings for occupancy sensing and HVAC control.

2.1.3.2 Background Information on Healthcare Facility Types, Classification, and Enforcement

Healthcare facilities are treated differently in the California Building Code than other nonresidential building types, both in code requirements and enforcement structures.

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[3] Description from the company: *This compact device effectively combines: (1) a thermal sensor for people counting and (2) presence detection, (3) a light sensor, (4) a sound level sensor, (5) a Volatile Organic Compounds (TVOC) sensor, and (6) temperature and (7) humidity sensors (temperature and humidity sensors are not intended for regulation, but to be used as secondary/backup sensors).* https://www.distech-controls.com/products/detail/947946/distech-controls/resense-move.

The California Department of Health Care Access and Information[4] (HCAI) is primarily responsible for overseeing the design, construction, standards development, and enforcement of healthcare facilities in the state, including hospitals, skilled nursing facilities, and other licensed facilities. While healthcare facilities are subject to the California Building Code provisions, including Title 24, Part 6, certain facilities are also subject to specific amendments and interpretations and notices from HCAI known as Code Application Notices (CANs) and Policy Intent Notices (PINs), which modify or recommend code changes based on the unique needs of the healthcare construction space. For example, HCAI was instrumental in adding ASHRAE 170, Tables 7-1 and 8-1 as published to Table 4-A in the 2025 CMC. (California Building Standards Commission 2025)

As outlined in the California Building Code, Chapter 1, some healthcare facilities fall under several different OSHPD classifications (OSHPD 1 through OSHPD 6) and occupancy classifications. Table 11 provides a summary of the types of healthcare facilities in each OSHPD classification and the agency responsible for all, including plan review, inspection, and enforcement, or any of the roles.

CODE APPLICATION NOTICE HSC §129851 states, "The extent of OSHPD's jurisdiction is not simply everything inside the exterior skin (or 5 feet beyond) of those buildings or structures with everything outside the building remaining under the jurisdiction of the local enforcing agencies. Some local jurisdiction is retained inside these buildings, and OSHPD does have some jurisdiction over certain elements of the site or campus outside the building."

This code cycle CASE Report addresses only OSHPD 1, OSHPD 2, and OSHPD 5 facilities, as well as OSHPD 3 clinics located within OSHPD 1, 2, or 5 facilities. To make clear that these measures apply only to selected healthcare facilities, the Statewide CASE Team is proposing a new term, ***HCAI facilities***, to define the covered facilities. The Statewide CASE Team recommends revisiting and revising the Part 6 requirements for other facilities in future code cycles. Table 11 summarizes the OSHPD classes of healthcare facilities that fall under the purview of HCAI in some capacity. Note that the HSC §1250 definition of healthcare facilities is broad and includes some buildings with Group R occupancies (e.g., congregate living health facilities), which is why the Statewide CASE Team took such care to specifically define HCAI Facilities to narrowly cover the aforementioned OSHPD classes.

[4] HCAI was formerly known as the Office of Statewide Health Planning and Development (OSHPD). The agency was renamed to reflect its expanded role in statewide health policy.

Table 11: Healthcare Facility Types, Classification, and Enforcement

OSHPD Classification	Facility Type	Occupancy Classification	Regulating Agency	Agency Reviewing/Inspecting
OSHPD 1	**Hospitals:** general acute care hospitals	Institutional Group I-2	HCAI	HCAI, Local Building Department
OSHPD 2	**Skilled Nursing Facilities:** intermediate care facilities	Institutional Group I-2	HCAI	HCAI
OSHDP 3	**Licensed Clinics:** out-patient clinical services, primary-care clinics, and specialty clinics	Business Group B	HCAI	Local Building Department
OSHPD 4	**Correctional Treatment Centers:** health facility operated by the California Department of Corrections and Rehabilitation (CDCR) or a county, city, or city and county law enforcement agency	Institutional Group I-3	HCAI	HCAI (facilities within OSHPD 1, 2, and 5), CDCR, and Local Building Department
OSHPD 5	**Psychiatric Hospitals:** acute psychiatric hospital	Institutional Group I-2	HCAI	HCAI
OSHPD 6	**Chemical Dependency Recovery Hospital:** not with an acute care hospital building or psychiatric facility	Institutional Group I-2	HCAI	Local Building Department

2.1.4 Modifications to Energy Code Documents

This section provides descriptions of how the proposed code change will affect each Energy Code document. See Section 2.6: Shut-off and Reset Controls - Proposed Language of this report for detailed revisions to code language.

2.1.4.1 Energy Code Change Summary – Title 24 Part 6

The proposed energy code changes affect Title 24, Part 6. A brief description of these changes is provided below:

SECTION 401.2.2.5 *[SECTION 120.2(e)]* – Shut-off and reset controls for space conditioning systems.

Exceptions to Section 401.2.2.5: The proposed change would retain current healthcare exceptions to 401.2.2.5.1 through 401.2.2.5.3 and add a new section specific to HCAI facility systems. The new section will require HCAI facilities to install controls in systems to reset to the minimum occupied or unoccupied turndown air flow as required by Table 401.2-D and allowed per Table 4-A of the California Mechanical Code and based on room occupancy. As noted in footnote ff of Table 4-A, spaces using unoccupied turndown must include a 20-minute timer delay before setting back; however, Title 24, Part6 allows a range of time from 20 to 60 minutes to allow for operational flexibility.

SECTION 401.2.7 [SECTION 120.5] – Mechanical System Acceptance

Exception to Section 401.2.7: The proposed change would remove the exception to section 401.2.7 since the in-scope healthcare facilities would be required to conduct applicable acceptance tests to comply with the newly required measures where exceptions are being removed elsewhere in the code.

2.1.4.2 Reference Appendices Change Summary

The proposed changes could impact the reference appendices, as healthcare facilities would be required to demonstrate compliance with the Shut-off and Reset Controls section of Title 24 Part 6. This modification can assist HCAI with their verification of healthcare facilities with all applicable code requirements, which will now include the energy code. This new requirement will need to be reflected on the compliance forms (see 2.1.4.5 below), and healthcare facilities will need to conduct acceptance testing similar to that for other nonresidential buildings today.

2.1.4.3 Compliance Manuals Change Summary

Chapter 4 - Mechanical Systems of the Nonresidential Compliance Manual would be updated to reflect modifications to the healthcare requirements in Section 401.2.2.5 *[120.2(e)].*

2.1.4.4 Alternative Calculation Method Reference Manual Change Summary

As described in Appendix F, the Statewide CASE Team recommends that several sections of the Nonresidential Alternative Calculation Method (ACM) Reference Manual be updated to improve modeling accuracy of the hospital prototype and account for proposed measure changes. These sections include: 5.1.3 HVAC System Map, 5.4 Space Uses, 5.6 HVAC Zone Level System, 5.7 HVAC Secondary System, and 5.8 HVAC Primary System. Specific changes being proposed are outlined in more detail in Section 2.6.6 ACM Reference Manual.

2.1.4.5 Compliance Forms Change Summary

This proposed change will require the following compliance forms to be updated to include 401.2.2.5 *[120.2(e)]* as a requirement when selecting a healthcare building type. These forms include: NRCC-MCH-E and NRCI-MCH-E Mechanical Systems and NRCI-CXR-E Nonresidential Building Commissioning. As noted in a footnote to Table 8, the proposed change to this measure would create a gap between HVAC-related requirements for newly added health care-related space types and other potential system requirements, such as lighting power density. This change would trigger the need to document compliance with this measure on the compliance forms, but it is important to note that these new space types would not be accompanied with corresponding non-HVAC requirements. It is possible that NRCA-MCH-19-A (occupied standby acceptance testing) would need to be modified as well.

2.1.5 Measure Context

2.1.5.1 Comparable Model Codes or Standards

Energy use and ventilation in healthcare facilities are regulated across various national model codes and standards. In terms of energy efficiency, neither the IECC nor ASHRAE 90.1 includes blanket exceptions for healthcare facilities in the same way as Title 24, Part 6. Instead, these codes and standards provide exceptions for healthcare facilities based on required design airflow rates specified in ASHRAE Standard 170 for hospitals. This ensures that only critical areas, such as an operating room that has specific pressure relationships, unoccupied turndown limitations, and air change rates, are exempt from certain requirements, while other spaces comply fully. The Statewide CASE Team followed this approach by referencing Table 4-A of the 2025 CMC, which is consistent with ASHRAE Standard 170, to exempt critical spaces from 401.2.2.5 *[120.2(e)]*.

ASHRAE Standard 90.1 2022

Section 6.4.3.3 requires similar setback and reset controls during non-use periods and does not include a blanket exception for healthcare facilities. There is an exception for HVAC systems intended to operate continuously.

In late 2025, Addendum bh to ASHRAE 90.1-2022 was approved which requires airflow setbacks for certain clinical spaces. The ASHRAE 90.1 committee limited the scope of the addendum to spaces that are likely to be their own zone where occupancy sensors are realistic to implement. The intent of the addendum is the same as the changes being recommended to Title 24 Part 6. The changes to Title 24 Part 6 are more expansive, as the newer technology identified is readily available for setback today but is rarely applied in healthcare due to slow adoption of any new technology. If this measure were published in 2027 and enforced in 2029, more advanced occupancy sensing and control will be mainstream in healthcare facilities. The change to ASHRAE 90.1-2022 was included into the recently published ASHRAE 90.1-2025, thereby limiting the its scope. Per ASHRAE 90.1 committee members, this content will be revisited in a future continuous maintenance proposal to expand the space type list.

2024 International Energy Conservation Code

Section C403.4.2 also requires similar setback and reset controls during non-use periods and does not include a blanket exception for healthcare facilities. There is an exception for HVAC systems intended to operate continuously.

ASHRAE Standard 170: Ventilation of Health Care Facilities

ASHRAE Standard 170 provides minimum ventilation design requirements and environmental control for healthcare facilities. This standard is used throughout the industry and Tables 7-1 and 8-1 were adopted directly in the CMC as Table 4-A, which is referenced in this proposed code change.

2.1.5.2 Interactions with Other Regulations

This change does not interact with or conflict with any federal laws or regulations. This change does interact with certain state requirements and the California Building Code.

State laws and requirements

Title 24, Part 6 uses the definitions in the California Health and Safety Code Division 2, Chapter 2, §1250 and the California Health and Safety Code Division 2, Chapter 1, Section 1204 to define a healthcare facility. This measure is not proposing to change the existing definition.

Interactions with California Building Code

This proposed measure would interact with the following provisions in the 2025 CMC:

- This proposed code change references Table 4-A to specifically identify, and exempt spaces that do not allow unoccupied turndown from the requirements as outlined in 401.2.2.5 *[120.2(e)].*
- 407.7 Unoccupied Turndown in the 2025 CMC allows air changes to be reduced in spaces that allow unoccupied turndown per Table 4-A. This provision requires the following conditions to be met for these spaces.

    (1) The number of air changes may be reduced to 25 percent of the indicated value in Table 4-A for pressurized spaces when the room is unoccupied.

    (2) The number of air changes per hour indicated is reestablished whenever the space is occupied.

    (3) The pressure relationship with surrounding rooms is maintained when the air changes per hour are reduced.

(4) All operating, class 3 imaging and cesarean delivery rooms shall maintain a minimum of six air changes per hour of total air when not in use.

2.2 Shut-off and Reset Controls - Compliance and Enforcement

2.2.1 Compliance Considerations

Many healthcare facilities impacted by this measure are regulated and enforced by HCAI, which enforce all Title 24 codes, including Part 6. This means that HCAI staff and Inspectors of Record (IORs)—plans examiners and field inspectors—are responsible for confirming compliance with code requirements. HCAI uses a similar plan review and permitting process to that of local jurisdictions, but with a few important distinctions. Once a set of drawings is reviewed and approved by HCAI reviewers, the healthcare facility owner hires OSHPD-certified Inspectors of Record (IORs) to monitor construction progress and note discrepancies between approved plans and field installation. IORs conduct continuous inspections throughout construction and are essential to quality control during construction. In addition to IORs, HCAI field inspectors periodically visit the site to verify compliance.

By modifying the exception for nonresidential healthcare facilities, HCAI plans examiners, field inspectors, and IORs will need to adjust their energy code plan review and inspection process to confirm they are verifying compliance with the updated Title 24, Part 6 requirements. This will not fundamentally change their standard process,[5] but will require additional training and resources to describe the measure and verification steps. Technical resources and training are readily available on Energy Code Ace, among other places, as this measure is required for all other nonresidential building types.

Ensuring compliance will require that plan examiners verify on plans that space-conditioning equipment has controls with the ability to meet the requirements of these new measures to approve a construction permit. Once the equipment is installed, an HCAI field inspector or IOR will confirm the equipment on the plans has been installed and a commissioning agent will confirm the controls are appropriately set. For specific healthcare facilities enforced by local building departments, plan review and inspectors in those departments will enforce this measure in the same way as other nonresidential building types.

Section 7-118, Building energy efficiency program, of the California Administrative Code requires healthcare facilities to comply with Title 24, Part 6, but in its current form, does

[5] HCAI standard permit application, plan review, and inspection process is outlined here - https://hcai.ca.gov/facilities/building-safety/building-and-construction-projects/hcai-standard-project-process/

not provide detailed information on which compliance forms are required. To address this issue and provide additional clarity on required compliance documentation, HCAI has introduced an amendment to 7-118 as part of the 2025 Intervening Code Cycle. As HCAI states in their reason statement for the code change,

> *This section will not create a new requirement for HCAI projects. The language will coordinate documentation requirements in Section 10-103 and applicable signature requirements in HCAI regulations in Sections 7-115 and 7-141…. This amendment is for clarification only and does not materially alter the intent of existing code provisions or impact the cost of compliance.*

While the Statewide CASE Team initially identified this as an issue to compliance and drafted proposed changes to Section 10-103, it is best to defer to HCAI on compliance documentation and the Statewide CASE Team will instead provide input on their proposed approach.[6]

2.2.2 Impact on Market Actors

The proposed change would primarily affect design teams, controls contractors, facility operators, and building inspectors, rather than introducing major new construction requirements. Most California healthcare projects already install equipment with shut-off and reset controls for non-clinical spaces and for some clinical spaces, such as operating rooms, at the owner's discretion, and utilize building automation systems (BAS) capable of supporting these control functions. This change now requires setbacks for clinical spaces, as the ventilation code clearly defines which spaces may be setback and to what extent. Therefore, the proposal leverages existing infrastructure and industry capability, minimizing disruption to the market.

Table 12 summarizes impacts on market actors and suggests outreach and education that might be helpful to prepare market actors for the effective date of the requirements.

[6] The proposed amendments to 7-118 were formally discussed during California Building Standards Commission Health Facilities Code Advisory Committee Meeting on January 28, 2026. https://www.dgs.ca.gov/BSC/Rulemaking/2025-Intervening-Cycle/CAC-Mtgs

Table 12: Impacts on Market Actors and Suggested Training and Education Opportunities

Market Actor	Impact(s)	Suggested Outreach and Education
Owners / Developers[a]	Limited to no impact	Coordination with design professionals and the compliance improvement team to raise awareness.
Design Professionals [b]	Improved awareness that zones that allow unoccupied turndown and exclude specific airflow requirements would be subject to proposed HVAC controls. Aligning this requirement across all NR building types, including hospitals and skilled nursing facilities, may reduce confusion.	Conduct outreach to local ASHRAE chapters, ASHE, and other design organizations. Provide direct training in the form of webinars, lunch and learn, and on-demand training through Energy Code Ace.
Construction Team [c]	Greater number of healthcare HVAC systems with system, fan, and zone controls.	Provide training and resources to construction teams on code change requirements.
HCAI Inspectors [d]	Plans reviewers will need to verify HVAC systems are specified with controls that meet new code requirements. IORs and HCAI inspectors will verify in the field that the system matches the plans, and controls are properly set.	Keep compliance forms the same and inform inspectors of minor change to their mechanical review scope. Provide clear directions to HCAI plans examiners, field inspectors, and IORs on how to review new controls requirements.
Verification Testers [e]	Commissioning agents will need to adjust their mechanical commissioning scope to verify system controls are appropriately set and integrated across the BAS.	Provide training and resources about specific code change requirements.
Manufacturers and Distributors	Increased demand for nonresidential healthcare systems with controls that meet this proposed change.	Awareness that nonresidential healthcare facilities would no longer be exempt from this measure.
Facility Operators	Maintaining shut-off and reset controls in spaces that are allowed per 2025 CMC Table 4-A.	Facility operators will be hesitant to adjust temperature or airflow in healthcare spaces. Training and resources should be provided related to how new requirements interact with Table 4-A, and in which spaces controls should be set.

Controls Contractors [f]	Potentially expanded BAS scope to set occupancy-based scheduling and reset controls in additional spaces.	This is already part of their scope, so limited training and guidance would be needed to verify controls are set in spaces where required.

a. Owner/Developer is funding the project and is the primary decision maker.
b. Design professionals include architects, engineers (mechanical, electrical, plumbing, structural), specification writers, cost estimators, commissioning agents, lighting designers, and energy consultants.
c. Construction team includes general contractors, design-build contractors, installation contractors (e.g., HVAC, plumbing, electrical), commissioning agents, and tradespeople.
d. HCAI plans reviewers, building inspectors, specialty inspectors, and possibly third-party plan review and inspection.
e. Verification testers include commissioning agents, ECC Raters, and Acceptance Test Technicians.
f. Service supporting integration of BAS controls across HVAC, lighting, and other equipment.

The 2028 CASE Methodology Report presents a quantitative assessment of how changes to the California building code impact builders, building designers and energy consultants, and building owners and occupants. The analysis in the methodology report is not specific to the code changes presented in this report. The following provides a qualitative description of how this specific code change affects various market actors, and additional quantitative analyses of its potential impacts on building industry subsectors.

Building owners. The proposed code change would have incremental costs and would reduce building owners' utility bills throughout the measure lifetime. See the 2028 CASE Methodology Report for a description of how LSC savings relate to occupant utility bill savings.

Builders. The proposed change would likely affect commercial builders; however, it would likely not impact firms focused on the construction or retrofitting of industrial buildings, utility systems, public infrastructure, or other heavy construction. The proposed change would not affect all firms and workers in the commercial building industry equally; instead, it would primarily affect specific subsectors within the industry. Table 13 shows the commercial building subsectors that the Statewide CASE Team expects to be impacted by the changes proposed in this report.

Table 13: Specific Subsectors of the California Commercial Building Industry Impacted by Proposed Change to Code/Standard by Subsector in 2025 (Estimated)

Construction Subsector	Establishments*	Employment	Annual Payroll (Billions $)
Commercial Building Construction	5,491	87,450	$10.6
Nonresidential Electrical Contractors	3,245	72,794	$7.8
Nonresidential Plumbing & HVAC Contractors	2,270	55,182	$5.8
Other Nonresidential Equipment Contractors	580	9,749	$1.1

Source: (State of California Employment Development Department n.d.)

*An establishment is single economic unit, typically at one physical location, that engages in one, or predominantly one, type of economic activity for which a single industrial classification may be applied. Many businesses are composed of multiple establishments. US Bureau of Labor Statistics, Handbook of Methods. https://www.bls.gov/opub/hom/cew/concepts.htm

If the proposal is adopted, then the California Building Energy Code Compliance Software (CBECC) will be modified based on the proposed changes to the ACM Reference Manual, as described in Section 2.6.6.

2.2.3 Cost of Enforcement

The Statewide CASE Team acknowledges that changes to the code will impact enforcement costs. This report is an evaluation of specific measures and the collective impact of all proposed changes for the 2028 Title 24, Part 6, which may represent an increase in training and/or workload for enforcement personnel.

This measure would require HCAI plan reviewers and inspectors to update their processes and receive training on new code requirements. However, review of this measure can be integrated into existing plan review and field inspection processes and should not add significant review time or cost. Note that, as described below in Section 2.4, this measure is very cost effective even with conservative incremental first costs.

2.3 Shut-off and Reset Controls - Market and Economic Analysis

2.3.1 Market Structure and Availability

2.3.1.1 Current Market Structure and Availability

The technologies and design practices required to implement HVAC reset and turndown controls are fully mature and widely available in today’s nonresidential and healthcare building market. The measure relies primarily on capabilities that already exist in Direct

Digital Control (DDC) and BAS, which are standard in nearly all new California healthcare projects.

- **Controls Vendors and Manufacturers:**
  Major suppliers such as Siemens, Johnson Controls, Schneider Electric, Honeywell, Trane, and Distech include setback, turndown, and ventilation reset logic as standard features in their BAS platforms. These systems natively support scheduling, occupancy sensing, and demand-based control sequences.

- **Design Engineers and Commissioning Providers:**
  Most mechanical design firms and commissioning agents in California—including Mazzetti, Arup, HDR, and HGA—routinely specify and verify similar control sequences in other nonresidential occupancies. Extending these practices to healthcare projects requires little to no retraining.

- **Contractors and Integrators:**
  Controls contractors already install and program occupancy-based scheduling and reset functions as part of standard BAS scope. The measure simply formalizes those functions as a mandatory requirement rather than a project-specific option.

- **Equipment Manufacturers:**
  Modern air-handling units, VAV terminal boxes, and fan coils are delivered "controls-ready," with integrated sensors, actuators, and variable-speed drives that enable airflow and temperature reset and turndown.

Because the proposed requirement uses existing infrastructure—standard BAS hardware, occupancy sensors, and control sequences—no significant new capital investment or specialized workforce training is necessary. Implementation is expected to be rapid once the exemption is removed. The measure effectively codifies current best practice and accelerates a transition already underway in leading health systems seeking to meet decarbonization and resilience goals.

2.3.1.2 Market Challenges and Solutions

While the proposed measure leverages widely available technology, several market and implementation challenges could influence adoption speed and consistency across the healthcare sector. These barriers are primarily related to institutional practices, risk perception, and coordination, rather than technology availability. Table 14 displays a summary of market challenges and solutions related to this measure.

Table 14: Market Challenges and Solutions

Challenge	Description / Root Cause	Proposed or Existing Solutions
1. Infection-control and safety concerns	Facility managers are often hesitant to reduce airflow or adjust temperature in any healthcare space for fear of violating infection-control requirements or HCAI approvals.	Alignment with ASHRAE 170 and 2025 CMC Table 4-A explicitly confirms which spaces may safely turn down and reduce airflow. The proposed measure references these same criteria, providing clear guardrails that maintain compliance while allowing control flexibility.
2. Cultural resistance to operational change	Many hospitals default to continuous 24/7 HVAC operation as a “safe” choice, regardless of occupancy.	Develop concise owner/operator guidance showing real-world examples (e.g., Kaiser Permanente, University of California Health) that demonstrate safe, verified implementation. Include case studies in IOU training materials to normalize practice.
3. Commissioning and verification gaps	Inconsistent trend logging or verification can lead to reset logic being disabled post-occupancy.	Expand commissioning checklists and trending templates in the Title 24 Compliance Manual. Encourage utility new construction programs to verify functionality and provide feedback loops to HCAI reviewers for healthcare facilities.
4. Fragmented responsibility between design and operations	Controls sequences are often value-engineered or overridden after hand-off to facilities staff.	Promote integrated design-to-operations workflows and require documentation of occupancy-based controls in the facility’s BAS sequence of operations. Utility-sponsored training or incentive programs can reinforce this hand-off.
5. Limited awareness among plan reviewers	Some HCAI officials may not yet be familiar with occupancy-based reset logic in clinical settings.	Provide statewide education modules and a one-page review checklist for enforcement staff. Emphasize that airflow turndown follows the 2025 CMC framework.

2.3.2 Design and Construction Practices

2.3.2.1 Current Design and Construction Practices

Under the current California Energy Code, licensed healthcare facilities are exempt from the HVAC shut-off and reset control requirements of Section 401.2.2.5 *[Section120.2(e)].* As a result, most hospitals, large medical facilities, and skilled nursing facilities in California are designed with continuously operating HVAC systems, regardless of actual occupancy or space utilization patterns.

2.3.2.2 Health and Safety Considerations

The proposed code change would not alter or supersede any existing federal, state, or local regulations pertaining to patient safety, infection control, or worker protection. All existing requirements enforced by the California Department of Public Health (CDPH), the California Division of Occupational Safety and Health (DOSH), and HCAI remain fully applicable.

Complying with the proposed measure would not create any adverse health or safety impacts for patients, staff, or maintenance personnel. The proposed shut-off and reset control requirements are consistent with provisions already included in ASHRAE Standard 170 and the 2025 CMC Table 4-A, both of which permit unoccupied airflow turndown and temperature reset while maintaining required pressure relationships and minimum ventilation rates.

2.3.2.3 Design and Construction Challenges and Solutions

Through targeted conversations with engineers, controls integrators, commissioning providers, facility managers, and HCAI reviewers, the Statewide CASE Team identified potential design and construction challenges that informed the final proposal.

The first concern raised by designers was whether shut-off and reset controls would conflict with required minimum air-change rates in clinical spaces. In response, we added a focused requirement for all zones covered under CMC Table 4-A, ensuring ventilation and infection-control requirements remain fully protected.

Facility managers expressed hesitation about shifting away from long-standing “always-on” operating practices, so the proposal was aligned directly with ASHRAE 170 and the 2025 CMC, which stakeholders agreed provides clear operational guardrails.

Commissioning providers also emphasized the need for reliable verification; this is addressed by relying on standard BAS trend logs and functional testing already included in healthcare commissioning scopes. For teams that require support adapting to these refined design strategies, the training and education efforts described in Table 12 in Section 2.2.2 will ensure designers, integrators, and operators can implement the measure consistently and confidently.

2.3.3 Impacts on Jobs and Businesses

The Statewide CASE Team does not anticipate significant employment or financial impacts on any particular sector of the California economy. However, the proposed change may have modest impacts on employment in California. The Statewide CASE Team estimates the proposed change would affect statewide employment and economic output directly and indirectly through its impact on builders, designers, energy consultants, and building inspectors. Table 15, Table 16, and Table 17 outline the statewide implications for these job categories. For more information on the Statewide CASE Team's economic impacts methodology, see the 2028 CASE Methodology Report.

The Statewide CASE Team does not anticipate that the proposed changes would lead to the creation of new types of jobs or the elimination of existing types of jobs. In other words, the Statewide CASE Team's proposed change would not result in economic disruption to any sector of the California economy. Rather, it would lead to modest changes in the employment of existing jobs.

Table 15: Estimated Impact that Adoption of the Proposed Measure would have on the California Nonresidential Construction Sector

Type of Economic Impact	Employment (Jobs)	Labor Income (Million)	Total Value Added (Million)	Output (Million)
Direct Effects (Additional spending by Commercial Builders)	0.3	$0.02	$0.03	$0.04
Indirect Effect (Additional spending by firms supporting Commercial Builders)	0.1	$0.01	$0.01	$0.02
Total Economic Impacts	**0.4**	**$0.03**	**$0.04**	**$0.06**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.[7]

Table 16: Estimated Impact that Adoption of the Proposed Measure would have on the California Building Designers and Energy Consultant Sectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building designers and energy consultants)	0	$27,992	$27,712	$43,802
Indirect Effect (Additional spending by firms supporting building designers and energy consultants)	0	$8,335	$11,584	$18,647
Total Economic Impacts	**0**	**$36,327**	**$39,296**	**$62,449**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

[7] IMPLAN® model, 2020 Data, IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

Table 17: Estimated Impact that Adoption of the Proposed Measure would have on California Building Inspectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building inspectors)	0	$7,600	$9,013	$10,952
Indirect Effect (Additional spending by firms supporting building inspectors)	0	$704	$1,096	$1,909
Total Economic Impacts	**0**	**$8,304**	**$10,109**	**$12,861**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

The proposed change represents a modest adjustment that is not expected to excessively burden or competitively disadvantage California businesses, nor is it expected to lead to a competitive advantage for California businesses. Therefore, the Statewide CASE Team does not expect the proposed code changes to result in the creation of new businesses or the elimination of existing ones.

The proposed code changes would apply to all businesses operating in California, regardless of whether the business is incorporated inside or outside of the state.[8] Therefore, the Statewide CASE Team does not anticipate that the proposed changes would have an advantageous or an adverse effect on the competitiveness of California businesses.

The Statewide CASE Team derived a reasonable estimate of the change in investment by California businesses based on the estimated change in economic activity associated with the proposed measure and its expected effect on business income. The Statewide CASE Team's IMPLAN modeling resulted in an estimated $12,672 increase in California business income resulting from the proposed code change. The Statewide CASE Team assumed that net business investment is positively correlated with business income and that a portion of business income will be allocated to net business investment.

To estimate the portion of business income that will be allocated to net investment, the Statewide CASE Team analyzed national data on corporate profits and net capital investment by businesses that expand a firm's capital stock (referred to as net private domestic investment, or NPDI).[9] As Table 18 shows, between 2020 and 2024, NPDI as a percentage of corporate profits ranged from a low of 18 percent in 2020 due to the

[8] Gov. Code, §§ 11346.3(c)(1)(C), 11346.3(a)(2); 1 CCR § 2003(a)(3) Competitive advantages or disadvantages for California businesses currently doing business in the state.

[9] Net private domestic investment is the total amount of investment in capital by the business sector that is used to expand the capital stock, rather than maintain or replace due to depreciation. Corporate profit is the money left after a corporation pays its expenses.

worldwide economic slowdowns associated with the COVID-19 pandemic to a high of 28 percent in 2022, with an average of 23 percent. While only an approximation of the proportion of business income used for net capital investment, it provides a reasonable estimate of the proportion of incremental income that business owners would reinvest into expanding their capital stock.

Table 18: Net Domestic Private Investment and Corporate Profits, U.S.

Year	Net Domestic Private Investment by Businesses, Billions of Dollars	Corporate Profits After Taxes, Billions of Dollars	Ratio of Net Private Investment to Corporate Profits (Percent)
2020	389	2,212	18
2021	545	2,888	19
2022	825	2,951	28
2023	836	3,069	27
2024	885	3,441	26
5-Year Average	Intentionally blank	Intentionally blank	23

Source: (Federal Reserve Economic Data (FRED) n.d.)

Given the estimated total increase in California business income and net business investment ratio described above, the Statewide CASE Team estimates the proposed code change would result in a $2,975 increase in net private investment by California businesses.

2.3.4 Economic and Fiscal Impacts

Economic and fiscal impacts for all measures are addressed in Section 6: Economic and Fiscal Impacts.

2.4 Shut-off and Reset Controls - Cost Effectiveness

2.4.1 Cost Effectiveness Methodology

The Statewide CASE Team collaborated with CEC staff to confirm that the cost-effectiveness methodology aligns with CEC guidelines, including cost inclusion parameters. The 2028 CASE Methodology Report and Appendix A provide reproducibility details.

Per California Law (Public Resources Code 25000), a measure is considered cost effective if its BCR is 1.0 or greater, amortized over the economic life of the structure. The Statewide CASE Team calculates BCR by dividing total dollar benefits by total dollar costs over a 30-year analysis period.

Benefits are based on Long-term System Cost (LSC), which assigns an hourly dollar value to energy use. LSC hourly factors weigh the long-term value of each hour differently, where times of peak demand are valued more than off-peak hours. These factors are not utility rates, forecasts, or bill estimates. The CEC develops and publishes LSC hourly conversion factors for each code cycle.

Costs include first costs and ongoing maintenance costs assessed over the 30-year period. Benefits and costs are evaluated incrementally, relative to the most recently adopted Energy Code. The analysis excludes design costs and incremental code compliance verification costs.

2.4.2 Energy and Energy Cost Savings Results

Because this measure applies to nonresidential healthcare facilities, the Statewide CASE Team modeled the hospital and skilled nursing facility (SNF) prototypes to represent the energy, cost, and emissions. The Statewide CASE Team conducted significant research and made substantial updates to the existing hospital prototype due to its energy use index (EUI) misalignment with real-world hospital data and developed the SNF prototype as one did not previously exist. This work is summarized in Appendix F. CBECC 2025 2.0, EnergyPlus 25.1, and new 2028 metric files (weather, emissions, source energy factor, and LSC cost) were used as the basis for the analysis.

2.4.2.1 Measure Specific Baseline vs. Proposed Assumptions

Because hospitals are currently exempt from the proposed shut-off and reset controls, the Statewide CASE Team could not use a code minimum baseline and instead had to establish common construction practices in hospitals as the baseline scenario. Through conversations with healthcare design and engineering firms and hospital owners, the Statewide CASE Team used the following baseline.

- System type: CAV HVAC systems that operate on a continuous schedule, without automatic shut-off or setback functionality during unoccupied hours.
- Control features: No occupancy sensing; no heating setback or cooling setup logic.

The proposed model assumes a hospital that is fully compliant with the proposed code change. Importantly, spaces that cannot be turned down as outlined in Table 4-A of the 2025 CMC were not equipped with controls and were assumed to be the same as the baseline. As previously mentioned, this represents approximately 30 percent of the total space in a hospital facility.

- Each space is equipped with an occupancy sensor communicating to the BAS
- The analysis assumes occupancy-based controls consistent with the proposed code language.

- Automatic heating-setback/cooling-setup sequences per Title 24 §401.2.2.5 *[120.2(e)]*
- Airflow turndown to the minimum occupied or unoccupied air flow as allowed based on room occupancy

2.4.2.2 Results

Energy savings (electricity, natural gas, and source energy) and peak demand reductions per unit are presented in Table 19 and Table 20. For hospital prototypes, first-year per-unit electricity savings range from -0.25 to 0.57 kWh/yr-ft², natural gas savings range from 4.11 to 13.84 kBtu/yr-ft², source energy savings range from 2.82 to 12.57 kBtu/yr-ft², and peak electrical demand reductions range from -0.03 to 0.05 W/ft², depending on climate zone. Climate zone 16 shows slightly negative electricity and LSC savings for the hospital prototype because the reduction in heating energy is offset by an increase in fan energy, resulting in a small net increase in electricity consumption despite continued natural gas and source energy savings.

For SNF prototypes, first-year per-unit electricity savings range from 1.39 to 2.07 kWh/yr-ft², natural gas savings range from 9.81 to 16.30 kBtu/yr-ft², source energy savings range from 10.56 to 16.92 kBtu/yr-ft², and peak demand reductions range from 0.14 to 0.19 W/ft², depending on climate zone.

Table 21 presents total per-unit energy cost savings for newly constructed buildings and additions in terms of LSC savings realized over a 30-year period, in 2029 present-value dollars (2029 PV$). The LSC methodology allows peak electricity savings to be valued more than electricity savings during non-peak periods. Table 21 presents a breakdown of total LSC savings from electricity and natural gas cost savings for the prototypical building. Total 30-year LSC savings range from 7.25 to 19.67 2029 PV$ per square foot across climate zones.

Table 19: Energy and Energy Cost Savings – Per Square Foot – New Construction and Additions– Hospital

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	0.57	0.05	13.84	12.57	15.53
2	0.16	0.01	9.45	7.94	7.77
3	0.39	0.03	10.97	9.72	11.33
4	0.02	-0.01	7.98	6.47	5.39
5	0.41	0.03	10.98	9.72	11.38
6	0.45	0.03	10.95	9.66	11.91
7	0.48	0.04	11.46	10.17	12.74
8	0.21	0.01	9.73	8.26	8.37
9	0.26	0.02	10.33	8.82	9.23
10	0.01	0.00	8.02	6.50	4.97
11	0.26	0.03	10.04	8.72	9.56
12	0.35	0.03	10.93	9.59	10.97
13	0.15	0.01	9.26	7.87	7.80
14	0.08	0.00	8.31	6.84	6.09
15	0.14	0.00	7.81	6.56	7.06
16	-0.25	-0.03	4.11	2.82	-0.60

Table 20: Energy and Energy Cost Savings – Per Square Foot – New Construction and Additions– SNF

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	1.41	0.14	15.59	15.40	24.02
2	1.53	0.16	14.84	14.86	24.28
3	1.73	0.17	16.30	16.51	27.43
4	1.59	0.16	13.44	13.78	23.67
5	1.72	0.17	15.35	15.64	26.37
6	2.07	0.19	16.22	16.92	30.67
7	2.01	0.19	16.19	16.74	30.06
8	1.96	0.18	15.16	15.82	28.34
9	1.83	0.17	15.00	15.39	26.91
10	1.81	0.17	14.44	14.94	26.30
11	1.66	0.16	14.67	14.94	25.43
12	1.67	0.16	14.96	15.24	25.76
13	1.72	0.16	14.52	14.92	25.84
14	1.64	0.16	12.73	13.16	23.64
15	1.85	0.16	13.42	14.08	26.51
16	1.39	0.15	9.81	10.56	19.03

Table 21: 2029 PV LSC Savings Over 30-Year Period of Analysis – Per Square Foot – New Construction and Additions – Hospital and SNF Prototypes

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	6.89	12.04	18.92
2	4.82	9.55	14.37
3	6.92	10.85	17.77
4	4.37	8.34	12.70
5	6.86	10.51	17.38
6	8.44	10.97	19.41
7	8.51	11.15	19.67
8	6.40	9.95	16.35
9	6.12	10.18	16.31
10	4.61	8.89	13.50
11	6.10	9.80	15.91
12	6.54	10.35	16.88
13	5.59	9.42	15.01
14	4.81	8.31	13.11
15	6.31	8.53	14.84
16	2.09	5.16	7.25

2.4.3 Incremental First Cost

Consistent with the baseline assumptions for hospitals described in Section 2.4.2, the Statewide CASE Team assumed required control capabilities—such as scheduling and temperature/airflow reset—were already included in modern DDC and BAS commonly installed in California healthcare facilities.

The proposed design adds control features that would enable and support the three new construction measures within this CASE Report, namely Shut-off and Reset Controls, Space Conditioning Zone Controls, and Fan .[10] Each space includes the addition of an occupancy sensor communicating to the BAS, enabling:

- The analysis assumes occupancy-based controls consistent with the proposed code language
- Automatic heating-setback/cooling-setup sequences per Title 24 §401.2.2.5 *[120.2(e)]*

[10] Note that the Statewide CASE Team does not envision first costs associated with the Fan control measure. See Section 4.4.3 for more information.

- Fan-power reduction consistent with §401.3.14 *[140.4(m)]* (e.g., proportional control)

Table 22 outlines the total incremental cost across the proposed control measures, shut-off and reset, space conditioning, and fan control per room. Costs were gathered in November 2025. The following hardware and labor assumptions were used:

- BAS points: 1 point per space (occupancy/standby signal)
- Programming: 3–4 hours per space @ $400 per hour ⇒ $1,200–$1,600 per space (includes scripting, testing, graphics update, and commissioning)

Table 22: Total Incremental Costs Per Room Across Three Control Measures

Room Types Included	Device Cost	Installed Cost (device + wiring + mount)	BAS Points	Programming (3–4 hr. @ $400/hr.)	Installed Subtotal / Room
Patient Rooms, Offices, Corridors, Nurse Stations, Support Spaces, and Similar Areas	$200	$250 – $400	1	$1,200 – $1,600	$1,450 – $2,000

Assuming each space is roughly 400 ft², the total installed cost is $3.63/ft² (low) to $5.00/ft² (high). As a conservative estimate, the Statewide CASE Team used the median cost of $4.31/ft² and applied this figure separately to the Shut-off and Reset Controls measure and the Space Conditioning Zone Controls measures. That is to say, each measure was analyzed as if it were being pursued independently, even though in reality, the incremental costs would enable all three new-construction fan-related measures in this CASE Report, resulting in cost synergies and greater overall savings.

To validate assumptions grounded in current industry practice and pricing, these costs have been validated through outreach to multiple market participants:

- Two national controls contractors active in hospital BAS retrofits.
- A health-system facilities engineer and an HCAI plan reviewer to verify constructability, infection-control compatibility, and commissioning effort.

2.4.4 Incremental Maintenance and Replacement Costs

Description of the incremental maintenance and replacement costs, as well as estimation of present value of maintenance and replacement costs, are provided in the 2028 CASE Methodology Report.

There are ongoing costs associated with maintaining sensors and control systems; however, most hospitals do not contract separately for this maintenance and replacement because the aggregate expense of such agreements is significant relative to their total operating budgets. In practice, maintenance of these devices is absorbed by in-house engineering and facilities staff.

At the same time, networked sensors and advanced control logic often reduce maintenance costs by improving system awareness. Operators receive earlier fault indications and can respond before equipment degradation results in major repairs. In effect, the addition of sensors supports preventive maintenance that offsets its own service burden.

Because the expense of maintenance and replacement is offset by the savings from early fault, no significant incremental cost is anticipated. Accordingly, within the long-term cost framework used for this analysis, the maintenance estimate in the model is set to zero. No specific data is collected by the hospital owners on this cost line item as the cost is relatively small compared to the first cost and energy savings.

2.4.5 Cost Effectiveness

Results of the per-unit cost-effectiveness analysis are presented in Table 23 new construction and additions.

In the table below, all values are presented in 2029 present value dollars (2029 PV$). Benefits represent 30-year LSC savings and other savings, including incremental first-cost savings if the proposed first cost is less than the current first cost, incremental maintenance cost savings if the proposed maintenance costs are less than the current maintenance costs, and incremental residual value if proposed residual value is greater than current residual value at the end of the 30-year period of analysis. Costs represent the total incremental PV cost, including incremental equipment, replacement, and maintenance costs over the period of analysis. The analysis treats a negative incremental maintenance cost as a positive benefit. If total incremental costs are zero, the BCR is considered infinite. Costs and other savings are discounted at a real (inflation-adjusted) three percent rate. If there are no total incremental PV costs, the BCR is infinite.

Table 23: 30-Year Cost-Effectiveness Summary Per Square Foot – New Construction and Additions, Hospital and SNF Prototypes

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	18.92	1.78	10.66
2	14.37	1.78	8.09
3	17.77	1.78	10.01
4	12.70	1.78	7.15
5	17.38	1.78	9.78
6	19.41	1.78	10.93
7	19.67	1.78	11.07
8	16.35	1.78	9.21
9	16.31	1.78	9.18
10	13.50	1.78	7.60
11	15.91	1.78	8.96
12	16.88	1.78	9.51
13	15.01	1.78	8.45
14	13.11	1.78	7.38
15	14.84	1.78	8.36
16	7.25	1.78	4.08

2.5 Shut-off and Reset Controls - Statewide Impacts

2.5.1 Statewide Energy and Energy Cost Savings

See the 2028 CASE Methodology Report for details on how statewide savings are calculated. Appendix C presents the assumptions on the percentage of the total construction forecast that the proposed measure would impact.

For more details on the methodology and context about estimating the current market share rate, as well as statewide energy and energy cost savings, see the 2028 CASE Methodology Report.

The tables below present the first-year statewide energy and LSC savings from newly constructed buildings and additions (Table 24) by climate zone.

2.5.2 Statewide Greenhouse Gas Emissions Reductions

Table 24 presents the statewide impacts of the proposed code change for newly constructed healthcare facilities and additions. Statewide first-year savings are estimated at 5.19 GWh of electricity, 0.72 million therms of natural gas, and 67.99 million kBtu of source energy, along with a peak demand reduction of 0.47 MW. The proposed code change is also expected to provide approximately $97.22 million in 30-year present-valued lifecycle cost savings (2029 PV$).

Table 25 presents the estimated first-year reduction in GHG emissions resulting from the proposed code change. In this initial year, the Statewide CASE Team expects to avoid 4,090 metric tons of carbon dioxide equivalent (CO_2e) emissions. These reductions, along with their associated monetary value, were calculated using hourly GHG emissions factors published alongside the LSC hourly factors and source energy hourly factors in the research versions of CBECC, as well as data from the CEC's 2028 Metrics Report. See the 2028 CASE Methodology Report for additional information.

Table 24: Statewide Energy and LSC Impacts – New Construction and Additions

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2029 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (million 2029 PV$)
1	32,760	0.03	0	0	0.45	$0.62
2	194,760	0.14	0.01	0.02	2.09	$2.80
3	831,780	0.77	0.07	0.11	10.35	$14.78
4	424,350	0.27	0.03	0.04	3.99	$5.39
5	89,820	0.08	0.01	0.01	1.09	$1.56
6	338,040	0.37	0.03	0.04	4.25	$6.56
7	439,560	0.48	0.04	0.06	5.63	$8.64
8	480,330	0.44	0.04	0.06	5.42	$7.86
9	892,800	0.79	0.07	0.11	10.22	$14.56
10	722,970	0.53	0.05	0.08	7.14	$9.76
11	159,030	0.13	0.01	0.02	1.78	$2.53
12	829,170	0.73	0.07	0.1	9.83	$14.00
13	318,690	0.25	0.02	0.04	3.41	$4.78
14	137,250	0.1	0.01	0.01	1.29	$1.80
15	82,170	0.07	0.01	0.01	0.79	$1.22
16	49,680	0.02	0	0	0.29	$0.36
Total	**6,023,160**	**5.19**	**0.47**	**0.72**	**67.99**	**$97.22**

Table 25: First-Year Statewide GHG Emissions Impacts

Construction Type	Reduced GHG Emissions from Electricity Savings (Metric Tons CO_2e)	Reduced GHG Emissions from Natural Gas Savings (Metric Tons CO_2e)	Total Reduced GHG Emissions (Metric Ton CO_2e)	Total Monetary Value of Reduced GHG Emissions ($)
New Construction & Additions	329	3,762	4,090	664,538
Total	**329**	**3,762**	**4,090**	**664,538**

2.5.3 Statewide Water Use Impacts

The proposed code change would not result in water use impacts.

2.5.4 Statewide Material Impacts

The proposed code change would not result in a meaningful change to materials.

2.5.5 Environmental Impacts

This measure reduces energy use and overall emissions from hospitals across California and does not result in any adverse environmental effects. Statewide emissions impacts from this change are summarized in Table 25.

2.5.6 Other Non-Energy Impacts

If the proposed enhanced space conditioning systems controls are properly implemented in healthcare facilities, it has the potential to improve occupant comfort. In a hospital environment, occupant comfort can dramatically improve the experience for the patient and improve their overall well-being.

2.6 Shut-off and Reset Controls - Proposed Language Code

2.6.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents should be marked with dark blue underlining (new language) and ~~strikethroughs~~ (deletions). New to the 2028 energy code is to italicize defined terms when the terms are being used in its defined context. In-line comments that are not part of the proposed code language but are used to help describe the purpose of what is proposed are included with greyed highlight and italics.

Markups are provided to the restructured 2025 Energy Code that the CEC developed in response to feedback that aligning the structure of Title 24, Part 6 with other parts of the California Building Standards Code (Title 24) would improve readability, usability, and navigation.[8] New section numbers are shown as bold followed square brackets that document the section in the 2025 Title 24, Part 6 section numbers prior to the restructuring. For example, “Section 601.1 [Section 130.0(a)] General” contains the content that is in the current Section 130.0(a).

Posting the proposed code language in this format is useful as it helps describe how the Energy Code changes proposed for nonresidential occupancies are isolated from the requirements for residential occupancies which are prohibited from being changed until the 2031 code cycle by Assembly Bill 130.

2.6.2 Administrative Code (Title 24, Part 1)

There are no proposed changes to Title 24, Part 1.

2.6.3 Energy Code (Title 24, Part 6)

SUBCHAPTER 4 SPACE-CONDITIONING AND VENTILATION

SECTION 401 NONRESIDENTIAL AND HOTEL/MOTEL

(NEWLY CONSTRUCTED, ADDITIONS, ALTERATIONS)

SECTION 401.2.2 *[Section 120.2]* **Controls for space-conditioning systems.**

SECTION 401.2.2.5 *[120.2(e)]* **Shut-off and reset controls for space-conditioning systems.**

Each space-conditioning system shall be installed with controls that comply with the following:

~~**Exception to Section 401.2.2.5:** Systems serving healthcare facilities.~~

401.2.2.5.1 *[Section 120.2(e)1]* **Automatic shut-off.**

The control shall be capable of automatically shutting off the system during periods of nonuse and shall have:

1. An *automatic time switch control* device complying with Section 600.2 *[Section 110.9]* with an *accessible manual* override that allows operation of the system for up to 4 hours; or
2. An occupancy sensor; or
3. A 4-hour timer that can be manually operated.

Exception 1 to Section 401.2.2.5.1: Mechanical systems serving retail stores and associated *malls*, restaurants, grocery stores, churches and theaters equipped with 7-day programmable timers.

Exception 2 to Section 401.2.2.5.1: Systems serving *hotel/motel* guest rooms, if they have a *readily accessible manual* shut-off switch.

Exception 3 to Section 401.2.2.5.1: Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.

Exception 4 to Section 401.2.2.5.1 Systems with full load demands of 2 kW or less, if they have a readily accessible manual shut-off switch.

Exception 5 to Section 401.2.2.5.1: Systems serving *healthcare facilities.*

…

401.2.2.5.5 *[New Section]* **Turndown controls in *HCAI facilities*.**

In *HCAI facilities*, each space included in Table 401.2.2-A (curated from Table 4-A of the California Mechanical Code) and/or Section 401.2.1.2.5 shall turn down airflow where permitted and the serving HVAC system shall have controls that reset zone or terminal supply airflow to no less than the minimum allowed for that space stated in Table 4-A of the CMC based on occupied or unoccupied status. A user defined delay between 20-minutes and 60-minutes shall be programmed into the control system to confirm unoccupied status prior to switching to unoccupied status.

Table 401.2.2-A: Spaces required to setback and/or shutdown

CMC Table 4-A Space Grouping	Space Type
DIAGNOSTIC AND TREATMENT	Bronchoscopy, sputum collection, and pentamidine administration; Cancer treatment area; Call 1 imaging room (CT Scan, Fluoroscopy room, MRI room, Negative-pressure x-ray room); Class 2 imaging room (Angiography room, Cardiac catheterization lab, Electroconvulsive therapy procedure room, Interventional imaging procedure room); Class 3 imaging room (Hybrid operating room); Dental treatment; Dialysis treatment area; Dialyzer reprocessing room; Gastrointestinal endoscopy procedure room; General examination room; Hydrotherapy; Medication preparation room; Nuclear medicine hot lab; Speech therapy room; Physical therapy; Occupational therapy; Special examination room; Ultrasound.

NURSING UNITS AND OTHER PATIENT CARE AREAS	Cesarean delivery room; Delivery room; Labor/delivery/recovery (LDR) room; Labor/delivery/recovery/postpartum (LDRP) room; Lactation room; Operating room; Cystoscopy room; Patient room; Patient bedroom, behavioral room; Pediatric playroom; Post-anesthesia care unit (PACU) and recovery; Procedure room; Recreation/activity room; Seclusion room; Sterile processing room; Treatment room.
SUPPORT SERVICES	Blood bank/tissue storage; Blood draw/phlebotomy; Food preparation areas; Laboratory work area, bacteriology; Laboratory work area, biochemistry; Laboratory work area, cytology; Laboratory work area, general; Laboratory work area, glasswashing; Laboratory work area, histology; Laboratory work area, media transfer; Laboratory work area, microbiology; Laboratory work area, nuclear medicine; Laboratory work area, serology; Laboratory work area, sterilizing; Pharmacy Services: Pharmacy Areas (Drug room); Toilet room; Warewashing.

Note: Space types listed in this table may or may not have additional energy efficiency requirements throughout Title 24 Part 6.

Exception 1 to Section 401.2.2.5.5 : Where a zone or system serves multiple spaces, airflow shall not be reduced below the most restrictive applicable minimum required for any space served.

Exception 2 to Section 401.2.2.5.5: Spaces individually designated as emergency operation spaces, which are clinical spaces required for emergency operation where an airflow setback would interfere with clinical functions. Each space shall be exempted individually, and departmental and whole building exemptions shall not be granted.

…

401.2.7 *[Section 120.5]* **Mechanical system acceptance.**

Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 401.2.7.1 through 401.2.7.19.

Before an occupancy permit is granted, the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements.

When certification is required by Title 24, Part 1, Section 10-103.2, the acceptance testing specified by Section 401.2.7 [Section 120.5(a)] shall be performed by a certified mechanical acceptance test technician (CMATT). If the CMATT is operating as an employee, the CMATT shall be employed by a certified mechanical acceptance test employer. The CMATT shall disclose on the certificate of acceptance a valid CMATT certification identification number issued by an approved acceptance test technician certification provider. The CMATT shall complete all certificate of acceptance documentation in accordance with the applicable requirements in Section 10-10i(a)4.

~~**Exception to Section 401.2.7:** Systems serving healthcare facilities.~~

…

2.6.4 Reference Appendices

There are no proposed changes to the Reference Appendices.

2.6.5 Compliance Manuals

The Statewide CASE Team will provide the CEC with recommended revisions to compliance manuals after the 45-Day Language is published.

2.6.6 ACM Reference Manual

There are no proposed changes directly related to this proposed change. As discussed in Appendix F, the Statewide CASE Team recommends updates to the hospital prototype and a new SNF prototype to align with standard practices. These updates necessitate corresponding revisions to the ACM Reference Manual that are presented in that appendix.

2.6.7 Compliance Forms

As discussed in Section 2.1.4.5, the NRCC-MCH-E and NRCI-MCH-E Mechanical Systems and NRCC-CXR-E Nonresidential Building Commissioning compliance forms would be updated to reflect the proposed change. NRCC-PRF-E, supporting the performance approach, may also need to be modified. NRCA-MCH-19-A, which covers the occupied standby acceptance test, may require modification. The Statewide CASE Team can support the CEC in implementing these updates if the proposed change is adopted.

3. Space Conditioning Zone Controls

3.1 Space Conditioning Zone Controls - Measure Description

3.1.1 Proposed Code Change

The proposed code change adds a new subsection to **Section 401.3.6 *[140.4(d)],* Space conditioning zone controls** that addresses the more complex issue of zone controls in larger healthcare facilities. The addition of this healthcare subsection makes it necessary to move the blanket healthcare facility exception to 401.3.6 to the subsections (401.3.6.1 and 401.3.6.2) where the exception would still apply.

The new requirements in Section 401.3.6.3 *[Section 140.4(d)]* would apply to occupied and unoccupied zones in HCAI facilities (see Section 1.3) and would also account for zones with multiple code or standard references, such as Title 24 Part 6 and CMC, served by VAV that are systems. The volume of air to these zones would not be allowed to exceed the minimum ventilation rates defined by either Table 4-A of the CMC or the applicable referenced design standard for the space, for both occupied and unoccupied zones, while accounting for ventilation, temperature, humidity, and pressure requirements.

To support this change, a new definition of *Zone, Mixed Requirement* is proposed, as is the approach to establishing ventilation rates for *Zone, Mixed Requirement* zones. This requirement is intended to apply to zones with spaces covered by multiple ventilation codes, such as Title 24 Part 6 and the CMC. For example, an exam room with an adjacent office served by the same reheat coil and controlled by the same thermostat would be covered by the new *Zone, Mixed Requirement* provision.

Table 26 summarizes the scope of the proposed code change.

The proposed code change would retain the healthcare exception for Sections 401.3.6.1 and 401.3.6.2 *[Sections 140.4(d)1 and 140.4(d)2],* which require zone controls that prevent reheating, recooling, or simultaneous heating and cooling, or limiting the volume of air that is reheated. This exception is retained because 1) it is not feasible for healthcare facilities to completely prevent reheat, given the high ventilation requirements, and 2) the measures are primarily geared towards non-clinical spaces, creating implementation challenges for healthcare facilities.

Table 26: Scope of Proposed Code Change

A ☑ indicates the proposed code change is relevant.

Building Type(s)	Construction Type(s)	Type of Change
☐ Single Family	☑ New Construction	☐ Mandatory
☐ Multifamily	☑ Additions	☑ Prescriptive
☑ Nonresidential (Not Group R uses)	☐ Alterations	☐ Performance

Application Climate Zones	Energy Code Sections	Compliance Forms	Sections of ACM Reference Manuals
Climate Zones 1-16	Part 6, Section 100.1 Part 6, Section 140.4(d)	NRCC-MCH-E, NRCI-MCH-E, NRCC-PRF-E, 2025-NRCA-MCH-07-A	5.6 HVAC Zone Level System 5.7 HVAC Secondary System, 5.8 HVAC Primary System

Third Party Verification)	Updates to Compliance Software
☑ No changes to third party verification	☐ No updates
☐ Update existing verification requirements	☐ Update existing feature
☐ Add new verification requirements	☑ Add new feature

3.1.2 Benefits of Proposed Change

In addition to the goal of paving the way for reviewing and potentially modifying other healthcare exceptions in future code cycles, as described in Section 2.1.5, this proposed measure would provide significant benefits at the individual healthcare facility.

Reheating air that has been cooled, cooling air that has been heated, or mixing supply air with air that has been mechanically heated or cooled increases mechanical load and energy use. Subsection 401.3.6.3 will limit the amount of airflow to the zones, reducing the amount of air that is reheated, recooled, or simultaneously heated or cooled. This will provide the following benefits:

- Building design reduces unnecessary heating and cooling loads – less reheating and recooling of air will reduce mechanical loads and heating/cooling demand.
- Decrease fan energy – limiting airflow to the zones during low-load conditions reduces fan energy use and prevents unnecessary air from being conditioned, distributed, and potentially reheated and recooled.
- Extend service life and reduce maintenance frequency – reducing simultaneous heating and cooling decreases mechanical wear on fans, heating coils, cooling coils, and terminal units.

By referencing Table 4-A of the CMC, this will create a more targeted approach for the requirement and ensure the minimum air change requirements are preserved for all spaces. This approach also has the added benefit of aligning more closely with HCAI requirements and ASHRAE Standard 170, which was fully adopted as Table 4-A in the 2025 code cycle. This alignment helps to reduce code complexity and potential for conflicting code requirements.

This measure would also have a direct impact on reducing energy consumption, energy costs, emissions, and strain on the grid. At the state level, by extending this requirement to all new hospitals and nonresidential healthcare facilities, the cumulative impacts are considerable and presented in the energy and cost savings section of this report.

3.1.3 Background Information

Zone controls, as referenced in Section 401.3.6 *[Section 140.4(d)],* are the mechanisms that allow each space (or group of similar spaces) to independently regulate temperature and airflow, so the HVAC system delivers only the conditioning needed. This is typically achieved through thermostats, DDC systems, VAV terminal boxes, and sensors that detect temperature and occupancy. These controls help ensure that spaces are not over-cooled or overheated, and that unnecessary reheating or recooling is minimized.

When zone controls are properly configured, the HVAC system avoids delivering cold air to a space only to warm it back up, or vice versa. Instead, the system modulates airflow and temperature based on actual demand. Reducing reheating and recooling significantly lowers the heating and cooling loads placed on boilers, chillers, and air-handling units. In hospitals where systems run 24/7 and airflow volumes are very high, this strategy can save considerable heating and cooling energy, especially during morning warm-up and afternoon peak periods.

In the past decade, zone control technology has improved in reliability, cost effectiveness, and ease of integration. Modern DDC systems now include, as standard capabilities, that previously required custom programming. VAV boxes, pressure-independent controls, and digital thermostats are now common in nearly all large healthcare projects. In addition, the 2025 CMC and ASHRAE Standard 170 have clarified which clinical spaces may safely reduce airflow under certain conditions, giving designers clearer operational boundaries. These changes make it much easier to implement zone-control strategies while still meeting the strict air-change and pressurization requirements that exist in healthcare spaces.

The Statewide CASE Team is aware, based on design work, that several California healthcare systems, such as Kaiser Permanente and University of California Health, have already implemented zone-level reheat and airflow optimization strategies as part of decarbonization strategies. These projects demonstrate that zone control can safely and effectively be applied in complex healthcare environments and can deliver substantial energy savings without impacting clinical operations.

3.1.4 Modifications to Energy Code Documents

This section provides descriptions of how the proposed code change will affect each Energy Code document. See Section 3.6: Shut-off and Reset Controls - Proposed Language of this report for detailed revisions to code language.

3.1.4.1 Administrative Code Change Summary

The proposed energy code changes affect Title 24, Part 1.

Title 24, Part 1

CHAPTER 2 *[SECTION 100.1]* – DEFINITIONS:

Zone, Mixed Requirement is a newly proposed definition which describes a mixed zone, which is referenced in 140.4(d)3, and outlines the general approach to establish the mixed requirement zone ventilation rate.

3.1.4.2 Energy Code Change Summary

The proposed energy code changes affect Title 24, Part 6.

Title 24, Part 6

SECTION 401.3.6 *[SECTION 140.4(d)]* – Space Conditioning Zone Controls.

Section 401.3.6.3 *[New Section]*: The proposed change would require that HCAI facilities with spaces served by VAV systems reduce the amount of primary air supplied to the space to the minimum allowed ventilation rates, per CMC Table 4-A or ASHRAE 62.1. This would limit the amount of, recooling, or simultaneous heating and cooling, while ensuring minimum ventilation is achieved.

Exceptions to Section 401.3.6 *[140.4(d)]:* Additionally, the proposed change would modify the existing healthcare exception to only be applicable to Sections 401.3.6.1 and 401.3.6.2.

3.1.4.3 Reference Appendices Change Summary

The proposed changes may impact the reference appendices. Although the measure is intended to modify the healthcare exception and does not fundamentally alter the mechanical system requirements in Section 401.3.6, some adjustments to the existing acceptance test requirements may be needed to change to address the differential pressurization requirements across rooms. Though fundamentally, it is expected that the existing acceptance test language should be sufficient for healthcare facilities.

3.1.4.4 Compliance Manuals Change Summary

Chapter 4 - Mechanical Systems of the Nonresidential Compliance Manual would be updated to reflect modifications to the healthcare requirements in Section 401.3.6 *[140.4(d)]*.

3.1.4.5 Alternative Calculation Method Reference Manual Change Summary

The Statewide CASE Team recommends that several sections of the Nonresidential ACM Reference Manual be updated to improve modeling accuracy of the hospital prototype and account for proposed measure changes. These sections include: 5.1.3 HVAC System Map, 5.4 Space Uses, 5.6 HVAC Zone Level System, 5.7 HVAC Secondary System, and 5.8 HVAC Primary System. Specific changes being proposed are described in more detail in Section 2.6.6ACM Reference Manual.

3.1.4.6 Compliance Forms Change Summary

This proposed change will require the following compliance forms to be updated to include Section 401.3.6 *[140.4(d)]* as a requirement when selecting a healthcare building type. These forms include: NRCC-MCH-E and NRCI-MCH-E Mechanical Systems. NRCC-PRF-E, supporting the performance approach, may also need to be modified. 2025-NRCA-MCH-07-A, which handles supply fan variable flow controls, may require modification.

3.1.5 Measure Context

3.1.5.1 Comparable Model Codes or Standards

ASHRAE Standard 90.1 2022

Section 6.5.2.1 requires zone control that prevents reheating, recooling, or simultaneous heating and cooling. This section also imposes similar requirements and alternative compliance options for systems with and without DDC. This section does not include a blanket exception for healthcare facilities, but it does include an exception based on airflow rate requirements.

2024 International Energy Conservation Code (IECC)

Section C403.6.1 requires systems serving multiple zones to be VAV and include controls to reduce zone reheating, recooling, or mixed heating and cooling. Unlike Title 24, Part 6, and ASRHAE 90.1-2022, this IECC section does not provide a compliance option for non-DDC systems. Requirements for systems with DDC are similar to Title 24, Part 6. This section also includes an exception based on, “airflow rate required to comply with applicable codes or accreditation standards such as pressure relationships or minimum air change rates.”

ASHRAE Standard 170: Ventilation of Health Care Facilities

Standard 170 provides minimum ventilation design requirements and environmental control for healthcare facilities. This standard is used throughout the industry, and Tables 7-1 and 8-1 are adopted directly into the CMC as Table 4-A, which is referenced in this proposed code change.

3.1.5.2 Interactions with Other Regulations

This change does not interact or conflict with any federal laws and regulations. This change does interact with certain state requirements and the California Building Code.

State laws and requirements

Title 24, Part 6 uses the definitions in the California Health and Safety Code Division 2, Chapter 2, §1250 and the California Health and Safety Code Division 2, Chapter 1, Section 1204 to define a healthcare facility. This measure is not proposing to change the existing definition.

Interactions with California Building Code

This proposed measure interacts with the 2025 CMC by referencing Table 4-A to help target the proposed change for specific spaces in healthcare facilities.

3.2 Space conditioning Zone Controls - Compliance and Enforcement

3.2.1 Compliance Considerations

The Statewide Case Team does not anticipate any additional compliance considerations for this measure apart from what was described in Section 2.2.1.

3.2.2 Impact on Market Actors

Because this measure applies to space conditioning zone controls, it will affect the same set of market actors identified in Section 2.2.2. Designers, control contractors, commissioning providers, facility managers, and enforcement staff will interact with the measure in similar ways as they do for other HVAC control requirements. No new market participants are introduced, and the roles and responsibilities remain consistent with standard design, construction, and commissioning workflows for nonresidential HVAC systems.

3.2.3 Compliance Software Updates

If the proposal is adopted, then CBECC will be modified based on the proposed changes to the ACM Reference Manual, as described in Section 3.6.6.

3.2.4 Cost of Enforcement

The Statewide CASE Team acknowledges that changes to the code will impact enforcement costs. This report is an evaluation of specific measures, and the collective impact of all proposed changes for the 2028 Title 24, Part 6 may represent an increase in training and/or workload for enforcement personnel.

While this modification will require additional education and training for HCAI plan reviewers and HCAI and IOR inspectors, the Statewide CASE Team does not anticipate that the addition of this measure will increase the cost of enforcement for HCAI. Review of this measure can be easily integrated into existing plan review and field inspection processes and will not add significant review time or cost. The prescriptive process includes comparing design and code minimum supply and outdoor airflow rates, whether setback capabilities are in place per code or beyond code and the preprogrammed setback flow rates. Performance compliance path will compare the code-required supply and outdoor air flows in the baseline and the setback schedules. The setback schedules, like nearly all schedules, shall be the same in the baseline and proposed models unless an exceptional calculation is applied.

3.3 Space Conditioning Zone Controls - Market and Economic Analysis

3.3.1 Market Structure and Availability

3.3.1.1 Current Market Structure and Availability

The technologies and design strategies required to comply with healthcare changes to Section 401.3.6 *[Section 140.4(d)]* are fully mature, widely available, and already standard practice across the nonresidential building controls industry. The key market actors who manufacture, supply, install, program, and commission these systems are the same as those identified in Section 2.2.2. This section highlights the major entities in the California market and the overall readiness of the supply chain.

3.3.1.2 Market Challenges and Solutions

The Statewide CASE Team determined that the proposed zone-control strategies are readily available and fully mature in the market based on engagement with controls manufacturers, distributors, and commissioning providers. All major BAS vendors operating in California, including Siemens, Johnson Controls, Honeywell, etc., have the required sequences (airflow modulation, reheating/recooling limitation, deadband control, and temperature reset) in their existing DDC platforms. Because these systems have been widely deployed in nonresidential buildings for over a decade, there is substantial market experience demonstrating product reliability, vendor stability, and consistent field performance. As a result, products and system capabilities are already available from several manufacturers, ensuring robust competition and supply diversity before the effective date of Title 24, Part 6, 2028.

For the small subset of market actors with limited experience applying reheat-reduction logic in healthcare settings, the proposal is supported by a targeted training and education effort described in Section 2.2. These activities will ensure all designers, contractors, and facility operators are prepared for consistent implementation.

3.3.2 Design and Construction Practices

3.3.2.1 Current Design and Construction Practices

Best practices for designing zone-level space conditioning controls in large commercial and healthcare buildings have been well established for more than a decade. Modern HVAC systems, particularly VAV air distribution systems, are designed to allow independent temperature control for each space or zone, minimizing reheating, recooling, and simultaneous heating and cooling. The current state of practice is described below.

Zone-Level Temperature and Airflow Control

In most modern healthcare facilities, each space (or group of similar spaces) is served by a VAV terminal unit equipped with:

- A zone thermostat or digital sensor
- A DDC module with airflow measurement capability
- A modulating damper to vary air volume
- A modulating reheat coil valve

Best practice is to use pressure-independent VAV control, which ensures each zone receives the correct airflow even when system pressure fluctuates. This allows precise control, reduced reheat, and stable comfort. To minimize reheat energy, standard design practice includes:

- Supply-air temperature reset at the air-handling unit (AHU)
- Airflow minimum reset, where non-critical zones reduce minimum airflow based on load, temperature, or occupancy

These control sequences are already used in office buildings, laboratories, and higher-education facilities. Hospitals often use the same technologies but currently operate them more conservatively due to historical Title 24, Part 6 exemptions.

3.3.2.2 Health and Safety Considerations

The proposed code change does not alter or supersede any existing federal, state, or local regulations pertaining to patient safety, infection control, or worker protection. All existing requirements enforced by the California Department of Public Health (CDPH), the California DOSH, and HCAI remain fully applicable.

Complying with the proposed measure is not expected to create any adverse health or safety impacts for patients, staff, or maintenance personnel. The proposed space conditioning zone controls requirements are consistent with provisions already included in ASHRAE Standard 170 and the 2025 CMC Table 4-A, both of which permit unoccupied airflow turndown and temperature reset while maintaining required pressure relationships and minimum ventilation rates.

3.3.2.3 Design and Construction Challenges and Solutions

There are few design and construction challenges associated with implementing zone-level reheat and recool reduction in healthcare facilities, and stakeholder feedback confirmed these challenges are manageable with standard practices. The primary concern raised by designers was ensuring that the measure would not conflict with required minimum air-change rates in clinical spaces; this has been fully resolved by reducing airflow only to the minimum allowable range for each zone governed by 2025 CMC Table 4-A. Facility managers expressed caution about changing long-standing "always-on" operational habits; aligning the proposal with ASHRAE 170 and CMC provisions helps reduce this concern. Overall, the technical challenges identified through stakeholder engagement can be addressed with modest training, proper sequence documentation, and standard commissioning practices, as described further in Table 12 in Section 2.2.2.

3.3.3 Impacts on Jobs and Businesses

The Statewide CASE Team does not anticipate significant employment or financial impacts on any particular sector of the California economy. However, the proposed change may have modest impacts on employment in California. The Statewide CASE Team estimates the proposed change would affect statewide employment and economic output directly and indirectly through its impact on builders, designers, energy consultants, and building inspectors.

Table 27, Table 28, and Table 29 outline the statewide implications for these job categories. For more information on the Statewide CASE Team's economic impacts methodology, see the 2028 CASE Methodology Report.

The Statewide CASE Team does not anticipate that the proposed changes would lead to the creation of new types of jobs or the elimination of existing types of jobs. In other words, the Statewide CASE Team's proposed change would not result in economic disruption to any sector of the California economy. Rather, it would lead to modest changes in the employment of existing jobs.

Table 27: Estimated Impact that Adoption of the Proposed Measure would have on the California Nonresidential Construction Sector

Type of Economic Impact	Employment (Jobs)	Labor Income (Million)	Total Value Added (Million)	Output (Million)
Direct Effects (Additional spending by Commercial Builders)	29	2	3	4
Indirect Effect (Additional spending by firms supporting Commercial Builders)	7	1	1	2
Total Economic Impacts	**36**	**3**	**4**	**6**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.[1]

Table 28:Estimated Impact that Adoption of the Proposed Measure would have on the California Building Designers and Energy Consultant Sectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building designers and energy consultants)	0	$27,992	$27,712	$43,802
Indirect Effect (Additional spending by firms supporting building designers and energy consultants)	0	$8,335	$11,584	$18,647
Total Economic Impacts	**0**	**$36,327**	**$39,296**	**$62,449**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

Table 29:Estimated Impact that Adoption of the Proposed Measure would have on California Building Inspectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building inspectors)	0	$7,600	$9,013	$10,952
Indirect Effect (Additional spending by firms supporting building inspectors)	0	$704	$1,096	$1,909
Total Economic Impacts	**0**	**$8,304**	**$10,109**	**$12,861**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

The proposed change represents a modest adjustment, which is not expected to excessively burden or competitively disadvantage California businesses, nor is it expected to lead to a competitive advantage for California businesses. Therefore, the Statewide CASE Team does not expect the proposed code changes to result in the creation of new businesses or the elimination of existing ones.

The proposed code changes would apply to all businesses operating in California, regardless of whether the business is incorporated inside or outside of the state.[2] Therefore, the Statewide CASE Team does not anticipate that the proposed changes would have an advantageous or an adverse effect on the competitiveness of California businesses.

The Statewide CASE Team derived a reasonable estimate of the change in investment by California businesses based on the estimated change in economic activity associated with the proposed measure and its expected effect on business income. The Statewide CASE Team's IMPLAN modeling resulted in an estimated $664,698 increase in California business income due to the proposed code change. The Statewide CASE Team assumed that net business investment is positively correlated with business income and that a portion of business income will be allocated to net business investment.

To estimate the portion of business income that would be allocated to net investment, the Statewide CASE Team analyzed national data on corporate profits and net capital investment by businesses that expand a firm's capital stock (referred to as net private domestic investment, or NPDI).[3] As Table 30 shows, between 2020 and 2024, NPDI as a percentage of corporate profits ranged from a low of 18 percent in 2020 due to the worldwide economic slowdowns associated with the COVID 19 pandemic to a high of 28 percent in 2022, with an average of 23 percent. While only an approximation of the proportion of business income used for net capital investment, it provides a reasonable estimate of the proportion of incremental income that business owners would reinvest into expanding their capital stock.

Table 30: Net Domestic Private Investment and Corporate Profits, U.S.

Year	Net Domestic Private Investment by Businesses, Billions of Dollars	Corporate Profits After Taxes, Billions of Dollars	Ratio of Net Private Investment to Corporate Profits (Percent)
2020	389	2,212	18
2021	545	2,888	19
2022	825	2,951	28
2023	836	3,069	27
2024	885	3,441	26
5-Year Average	**Intentionally blank**	**Intentionally blank**	**23**

Source: (Federal Reserve Economic Data (FRED) n.d.)

Given the estimated total increase in California business income and net business investment ratio described above, the Statewide CASE Team estimates the proposed code change would result in a $156,030 increase in net private investment by California businesses.

3.3.4 Economic and Fiscal Impacts

Economic and fiscal impacts for all measures are addressed in Section 6: Economic and Fiscal Impacts.

3.4 Space Conditioning Zone Controls - Cost Effectiveness

3.4.1 Cost Effectiveness Methodology

The Statewide CASE Team collaborated with CEC staff to confirm that the cost-effectiveness methodology aligns with CEC guidelines, including cost inclusion parameters. The 2028 CASE Methodology Report and Appendix A provide reproducibility details.

Per California Law (Public Resources Code 25000), a measure is considered cost effective if its BCR is 1.0 or greater, amortized over the economic life of the structure. The Statewide CASE Team calculates BCR by dividing total dollar benefits by total dollar costs over a 30-year analysis period.

Benefits are based on LSC, which assigns an hourly dollar value to energy use. LSC hourly factors weigh the long-term value of each hour differently, where times of peak demand are valued more than off-peak hours. These factors are not utility rates, forecasts, or bill estimates. The CEC develops and publishes LSC hourly conversion factors for each code cycle.

Costs include first costs and ongoing maintenance costs assessed over the 30-year period. Benefits and costs are evaluated incrementally, relative to the most recently adopted Energy Code. The analysis excludes design costs and incremental code compliance verification costs.

3.4.2 Energy and Energy Cost Savings Results

To estimate the energy and cost savings associated with this measure, the same modifications to the default CBECC hospital prototype as described in section 2.4.2 were incorporated.

Hospitals are currently exempt from the space conditioning zone controls as outlined in Section 401.2.6 *[140.4(d)]* in the 2025 California Energy Code. Because of this, the Statewide CASE Team could not use a code minimum baseline and instead had to determine common construction in hospitals and use that as a baseline scenario. Through conversations with healthcare design and engineering firms and hospital owners, the Statewide CASE Team used the following baseline.

- System type: CAV HVAC systems operating on a continuous schedule, without automatic shut-off or setback functionality during unoccupied hours.
- Control features: constant-flow fan operation at full or fixed speed
- Sequence of operation: HVAC zones remain "occupied" 8760 hours per year regardless of use

The proposed assumption is a hospital that is fully compliant with the code. Importantly, zones with minimum air change requirements outlined in Table 4A of the 2025 CMC did not reduce airflow and were assumed to be the same as the baseline.

- Ventilation/fans: Fans and outdoor air modeled to allow for unoccupied turndown.

Energy savings (electricity, natural gas, and source energy) and peak demand reductions per unit are presented in Table 31 and Table 32. For hospital prototypes, first-year per-unit electricity savings range from 7.70 to 9.33 kWh/yr-ft², natural gas savings range from 33.93 to 46.89 kBtu/yr-ft², source energy savings range from 42.83 to 53.01 kBtu/yr-ft², and peak demand reductions range from 0.82 to 0.97 W/ft², depending on climate zone.

For SNF prototypes, first-year per-unit electricity savings range from 8.96 to 12.95 kWh/yr-ft², natural gas savings range from 46.25 to 74.87 kBtu/yr-ft², source energy savings range from 54.46 to 85.49 kBtu/yr-ft², and peak demand reductions range from 0.98 to 1.25 W/ft², depending on climate zone.

Table 33 and Table 34 present a breakdown of total LSC savings from electricity and natural gas cost savings for the Hospital and SNF prototypes, respectively. Total 30-year LSC savings range from 100.75 to 116.62 2029 PV$ per square foot for hospital prototypes and from 117.60 to 176.46 2029 PV$ per square foot for SNF prototypes, depending on climate zone.

Table 31: Energy and Energy Cost Savings – Per Square Foot – New Construction and Additions– Hospital

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	7.70	0.82	46.89	53.01	105.60
2	8.45	0.91	44.73	52.37	110.63
3	8.69	0.91	44.16	52.43	112.17
4	8.71	0.91	42.42	50.85	111.02
5	8.67	0.95	43.33	51.65	111.62
6	9.24	0.94	37.97	47.79	113.01
7	9.33	0.97	41.95	51.24	116.62
8	9.33	0.95	38.88	48.62	114.48
9	9.14	0.93	40.05	49.17	113.30
10	9.29	0.96	38.83	48.52	114.02
11	8.63	0.88	42.26	50.41	109.99
12	8.68	0.86	43.72	51.74	111.44
13	8.89	0.87	42.03	50.64	112.04
14	8.58	0.91	38.33	46.81	107.54
15	8.94	0.90	35.37	45.21	107.94
16	8.12	0.91	33.93	42.83	100.75

Table 32: Energy and Energy Cost Savings – Per Square Foot – New Construction and Additions– SNF

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	9.92	0.99	69.05	75.07	141.38
2	10.28	1.07	68.77	75.64	145.38
3	11.52	1.17	74.87	83.22	161.58
4	10.18	1.02	65.43	72.65	142.26
5	11.20	1.19	72.41	80.72	157.81
6	12.95	1.24	74.75	85.49	176.46
7	12.51	1.25	74.52	84.31	172.01
8	12.10	1.16	71.91	81.31	166.82
9	11.53	1.09	71.36	79.57	160.14
10	11.45	1.11	70.12	78.52	159.09
11	10.62	1.03	68.13	75.41	148.45
12	10.82	1.03	69.95	77.46	151.34
13	10.91	1.02	69.57	77.36	152.49
14	10.22	1.02	61.91	68.97	141.41
15	11.26	1.08	66.50	75.44	154.70
16	8.96	0.98	46.25	54.46	117.60

Table 33: 2029 PV LSC Savings Over 30-Year Period of Analysis – Per Square Foot – New Construction and Additions– Hospital

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	66.61	38.99	105.60
2	73.38	37.25	110.63
3	75.31	36.86	112.17
4	75.67	35.35	111.02
5	75.44	36.18	111.62
6	80.32	32.69	113.01
7	81.11	35.51	116.62
8	81.14	33.34	114.48
9	79.24	34.06	113.30
10	80.88	33.14	114.02
11	74.60	35.39	109.99
12	74.91	36.53	111.44
13	76.82	35.23	112.04
14	75.19	32.34	107.54
15	77.34	30.60	107.94
16	72.23	28.53	100.75

Table 34: 2029 PV LSC Savings Over 30-Year Period of Analysis – Per Square Foot – New Construction and Additions– SNF

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	84.74	56.64	141.38
2	89.01	56.37	145.38
3	99.82	61.75	161.58
4	88.65	53.61	142.26
5	98.10	59.70	157.81
6	113.62	62.84	176.46
7	109.49	62.52	172.01
8	106.35	60.48	166.82
9	100.31	59.83	160.14
10	100.25	58.83	159.09
11	92.50	55.94	148.45
12	93.86	57.48	151.34
13	95.06	57.44	152.49
14	90.34	51.07	141.41
15	98.13	56.56	154.70
16	80.48	37.12	117.60

3.4.3 Incremental First Cost

The approach to deriving incremental first costs for this measure are described in 2.4.3 of this report. As described in that section, costs for the fan control measures apply equally, given the integrated nature of component upgrades. To be conservative, the incremental first cost of $4.31/ ft² was applied to each measure separately, as though they were the only measure being pursued. This means that although the savings are estimated for the individual measure, the costs are considered valid for all fan control measures, making this a conservative estimate.

3.4.4 Incremental Maintenance and Replacement Costs

Description of the incremental maintenance and replacement costs, as well as estimation of present value of maintenance and replacement costs, are provided in the 2028 CASE Methodology Report.

As described in Section 2.4.4 of this report, incremental maintenance costs are assumed to be zero for this measure.

3.4.5 Cost Effectiveness

Results of the per-unit cost-effectiveness analyses are presented in Table 35 for new construction and additions.

In the table below, all values are presented in 2026 present value dollars (2029 PV$). Benefits represent 30-year LSC savings and other savings, including incremental first-cost savings if the proposed first cost is less than the current first cost, incremental maintenance cost savings if the proposed maintenance costs are less than the current maintenance costs, and incremental residual value if proposed residual value is greater than current residual value at the end of the 30-year period of analysis. Costs represent the total incremental PV cost, including incremental equipment, replacement, and maintenance costs over the period of analysis. The analysis treats a negative incremental maintenance cost as a positive benefit. If total incremental costs are zero, the BCR is considered infinite. Costs and other savings are discounted at a real (inflation-adjusted) three percent rate. If there are no total incremental PV costs, the BCR is infinite.

Table 35: 30-Year Cost-Effectiveness Summary Per Square Foot – New Construction and Additions – Hospital and SNF Prototypes

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	119.91	7.88	15.23
2	124.53	7.88	15.81
3	131.94	7.88	16.75
4	123.51	7.88	15.68
5	130.09	7.88	16.52
6	138.39	7.88	17.57
7	138.78	7.88	17.62
8	135.42	7.88	17.19
9	132.03	7.88	16.76
10	132.05	7.88	16.77
11	125.37	7.88	15.92
12	127.40	7.88	16.18
13	128.22	7.88	16.28
14	121.09	7.88	15.37
15	126.64	7.88	16.08
16	107.49	7.88	13.65

3.5 Space Conditioning Zone Controls - Statewide Impacts

3.5.1 Statewide Energy and Energy Cost Savings

See the 2028 CASE Methodology Report for details on how statewide savings are calculated. Appendix C presents the assumptions on the percentage of the total construction forecast that the proposed measure would impact.

For more details on the methodology and context about estimating the current market share rate, as well as statewide energy and energy cost savings, see the 2028 CASE Methodology Report.

The proposed code change is expected to result in substantial statewide energy savings for newly constructed healthcare facilities and additions. As shown in Table 36, statewide first-year savings are estimated at 59.70 GWh of electricity and 3.20 million therms of natural gas, corresponding to approximately 371.88 million kBtu of source energy savings and a peak demand reduction of 5.99 MW. The proposed code change is also projected to provide approximately $787.00 million in 30-year present-valued lifecycle cost savings (2029 PV$).

Table 36: Statewide Energy and LSC Impacts – New Construction and Additions

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2029 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	32,760	0.28	0.03	0.02	2.03	$3.93
2	194,760	1.79	0.19	0.11	12.01	$24.25
3	831,780	8.17	0.84	0.47	53.85	$109.74
4	424,350	3.95	0.41	0.22	25.28	$52.41
5	89,820	0.87	0.09	0.05	5.68	$11.69
6	338,040	3.63	0.36	0.18	21.25	$46.78
7	439,560	4.66	0.48	0.24	28.34	$61.00
8	480,330	5.01	0.5	0.25	29.63	$65.05
9	892,800	9.01	0.89	0.47	54.75	$117.88
10	722,970	7.34	0.74	0.37	43.75	$95.47
11	159,030	1.5	0.15	0.08	9.61	$19.94
12	829,170	7.91	0.77	0.45	51.43	$105.64
13	318,690	3.09	0.3	0.17	19.54	$40.86
14	137,250	1.27	0.13	0.07	7.64	$16.62
15	82,170	0.81	0.08	0.04	4.71	$10.41
16	49,680	0.42	0.05	0.02	2.36	$5.34
Total	**6,023,160**	**59.7**	**5.99**	**3.2**	**371.88**	**$787.00**

3.5.2 Statewide Greenhouse Gas Emissions Reductions

Table 37 presents the estimated first-year reduction in GHG emissions resulting from the proposed code change. In this initial year, the Statewide CASE Team expects to avoid 21,865 metric tons of carbon dioxide equivalent (CO_2e) emissions. These reductions, along with their associated monetary value, were calculated using hourly GHG emissions factors published alongside the LSC hourly factors and source energy hourly factors in the research versions of CBECC, as well as data from the CEC's 2028 Metrics Report. See the [2028 CASE Methodology Report] for additional information.

Table 37: First-Year Statewide GHG Emissions Impacts

Construction Type	Reduced GHG Emissions from Electricity Savings (Metric Tons CO2e)	Reduced GHG Emissions from Natural Gas Savings (Metric Tons CO2e)	Total Reduced GHG Emissions (Metric Ton CO2e)	Total Monetary Value of Reduced GHG Emissions ($)
New Construction & Additions	5,169	16,696	21,865	3,552,198

3.5.3 Statewide Water Use Impacts

The proposed code change will not result in water use impacts.

3.5.4 Statewide Material Impacts

The proposed code change will not result in a meaningful change to materials.

3.5.5 Environmental Impacts

This measure reduces energy use and overall emissions from hospitals across California and does not result in any adverse environmental effects. Statewide emissions impacts from this change are summarized in Table 47.

3.5.6 Other Non-Energy Impacts

If the proposed enhanced space conditioning systems controls are properly implemented in healthcare facilities, it has the potential to improve occupant comfort. In a hospital environment, occupant comfort can dramatically improve the experience for the patient and improve their overall well-being.

3.6 Space Conditioning Zone Controls - Proposed Language Code

3.6.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents should be marked with dark blue underlining (new language) and strikethroughs (deletions). New to the 2028 energy code is to italicize defined terms when the terms are being used in its defined context. In-line comments that are not part of the proposed code language but are used to help describe the purpose of what is proposed are included with greyed highlight and italics.

Markups are provided to the restructured 2025 Energy Code that the CEC developed in response to feedback that aligning the structure of Title 24, Part 6 with other parts of the California Building Standards Code (Title 24) would improve readability, usability, and navigation.8 New section numbers are shown as bold followed square brackets that document the section in the 2025 Title 24, Part 6 section numbers prior to the restructuring. For example, "Section 601.1 [Section 130.0(a)] General" contains the content that is in the current Section 130.0(a).

Posting the proposed code language in this format is useful, as it helps describe how the Energy Code changes proposed for nonresidential occupancies are isolated from the requirements for residential occupancies, which are prohibited from being changed until the 2031 code cycle by Assembly Bill 130.

3.6.2 Administrative Code (Title 24, Part 1)

There are no proposed changes to Title 24, Part 1.

3.6.3 Energy Code (Title 24, Part 6)

CHAPTER 2 *[SECTION 100.1]*—DEFINITIONS

Zone, Mixed Requirement, is a group of two or more spaces within a building with sufficiently similar comfort requirements but refer to different ventilation codes or standards, i.e., CMC Table 4-A and Title 24 Part 6.

SUBCHAPTER 4 SPACE CONDITIONING AND VENTILATION

Section 401.3 *[Section 140.4]* Prescriptive requirements (Newly Constructed).

Section 401.3.6 *[140.4(d)]* **Space conditioning zone controls.**

Each *space conditioning* zone shall have controls designed in accordance with Section 401.3.6.1, Section 401.3.6.2, or Section 401.3.6.3.

Exception 1 to Section 401.3.6: Zones with special pressurization relationships or cross contamination control needs.

Exception 2 to Section 401.3.6: Zones served by *space conditioning systems* in which at least 75 percent of the energy for reheating, or providing warm air in mixing systems, is provided from a site-recovered or site-solar energy source.

Exception 3 to Section 401.3.6: Zones in which specific humidity levels are required to satisfy *non-covered process loads*. *Computer rooms* or other spaces where the only *process load* is from IT *equipment* may not use this exception.

Exception 4 to Section 401.3.6: Zones with a peak supply-air quantity of 300 cfm or less.

~~**Exception 5 to Section 401.3.6:** Systems serving healthcare facilities~~.

401.3.6.1 Reheating, recooling, simultaneous heating and cooling.

Each *space conditioning zone* shall have controls that prevent:

1. Reheating; and
2. Recooling; and
3. Simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems; or

Exception to Section 401.3.6.1: Systems serving *healthcare facilities.*

401.3.6.2 Zones served by VAV Systems.

Zones served by variable air-volume systems that are designed and controlled to reduce to a minimum, the volume of reheated, recooled, or mixed air are allowed only if the controls meet all of the following requirements:

For each zone with direct digital controls (DDC):

1. The volume of primary air that is reheated, recooled, or mixed air supply shall not exceed the larger of:

   1.1. 50 percent of the peak primary airflow; or

   1.2. The design zone outdoor airflow rate as specified by Section 120.1(c)3.

2. The volume of primary air in the deadband shall not exceed the design zone outdoor airflow rate as specified by Section 120.1(c)3.

3. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no higher than 95ºF while the airflow is maintained at the dead band flow rate.
4. The second stage of heating consists of modulating the airflow rate from the dead band flow rate up to the heating maximum flow rate.
5. Control sequences of operation for reheat zones shall be in accordance with ASHRAE Guideline 36.

For each zone without DDC

1. the volume of primary air that is reheated, re-cooled, or mixed air supply shall not exceed the larger of the following:
   1.1. 30 percent of the peak primary airflow; or
   1.2. The design zone outdoor airflow rate as specified by Section 120.1(c)3.

Exception to Section 401.3.6.2: Systems serving *healthcare facilities*.

401.3.6.3 *[New Section]* **Zone Controls in *HCAI Facilities***

Zones or *mixed requirement zones* in *HCAI facilities* served by variable air-volume systems that include a space(s) designed to California Mechanical Code Table 4-A shall be designed to meet the following requirements:

1. For each occupied zone or *mixed requirement zone*:

   1.1 the volume of primary air supplied to the space designed per CMC Table 4-A shall not exceed the minimum ventilation rates defined in CMC Table 4-A for the occupied condition unless required to meet temperature or humidity setpoints or pressure differential requirements.

   1.2 the volume of primary air supplied to the space not designed per CMC Table 4-A shall comply with the referenced design standard in such that it does not prevent the space designed per CMC Table 4-A from meeting ventilation, temperature, humidity, and pressure requirements.

2. For each unoccupied zone or *mixed requirement* zone:

   2.1 the volume of primary air supplied to the space designed per CMC Table 4-A shall not exceed the minimum ventilation rates defined in CMC Table 4-A for the unoccupied condition unless required to meet temperature or humidity setpoints or pressure differential requirements.

   2.2 the volume of primary air supplied to the space not designed per CMC Table 4-A shall comply with the referenced design standard in such that it does not prevent the space designed per CMC Table 4-A from meeting ventilation, temperature, humidity, and pressure requirements.

3. The *mixed requirement* zone ventilation rate shall be the sum of the separately calculated minimum supply air flow rates and outside air flow rates for each space from each reference standard (i.e., Title 24 Part 6 and CMC Table 4-A).

3.6.4 Reference Appendices

There are no proposed changes to the Reference Appendices.

3.6.5 Compliance Manuals

The Statewide CASE Team will provide the CEC with recommended revisions to compliance manuals after the 45-Day Language is published.

3.6.6 ACM Reference Manual

There are no proposed changes directly related to this proposed change. As discussed in Appendix F, the Statewide CASE Team recommends updates to the hospital prototype and a new SNF prototype to align with standard practices. These updates necessitate corresponding revisions to the ACM Reference Manual that are presented in the appendix.

3.6.7 Compliance Forms

As discussed in Section 2.6, the NRCC-MCH-E and NRCI-MCH-E Mechanical Systems and NRCC-CXR-E Nonresidential Building Commissioning compliance forms would be updated to reflect the proposed change. NRCC-PRF-E, supporting the performance approach, may also need to be modified. 2025-NRCA-MCH-07-A, which handles supply fan variable flow controls, may require modification. The Statewide CASE Team can support the CEC in implementing these updates if the proposed change is adopted.

4. Fan Control

4.1 Fan Control - Measure Description

4.1.1 Proposed Code Change

The proposed code change seeks to modify the overall healthcare facility exception to **Section 401.3.14 *[140.4(m)],* Fan Control**, to limit the exception to those facilities not identified as HCAI facilities (see Section 1.3). The result of this modification is that HCAI facilities would be required to comply with these fan control requirements.

This prescriptive measure requires that single and multi-zone systems be equipped with VAV and have supply fans, typically with variable speed drives, which are capable of the following:

- In single zone systems (where the fans are controlled directly by the space thermostat) they shall have a minimum of two stages of fan speed with no more than 66 percent speed when operating on stage one while drawing no more than 40 percent full fan power when running at 66 percent speed.
- In multi-zone systems, fans motor demand shall be limited to no more than 30 percent of design wattage at 50 percent design air volume.
- Systems with air-side economizers that meet section 140.4(e)1 must be equipped with a minimum of two speeds of fan control during economizer operation.

Table 38 summarizes the scope of the proposed code change.

Table 38: Scope of Proposed Code Change

A ☑ indicates the proposed code change is relevant.

Building Type(s)	Construction Type(s)	Type of Change
☐ Single Family	☑ New Construction	☐ Mandatory
☐ Multifamily	☑ Additions	☑ Prescriptive
☑ Nonresidential (Not Group R uses)	☐ Alterations	Performance

Application Climate Zones	Energy Code Sections	Compliance Forms	Sections of ACM Reference Manuals
Climate Zones 1-16	Part 6, Section 140.4(m)	NRCC-MCH-E, NRCI-MCH-E, NRCC-CXR-E, NRCC-PRF-E, 2025-NRCA-MCH-07-A	5.6 HVAC Zone Level System 5.7 HVAC Secondary System, 5.8 HVAC Primary System

Third Party Verification)	Updates to Compliance Software
☑ No changes to third party verification	☐ No updates
☐ Update existing verification requirements	☐ Update existing feature
☐ Add new verification requirements	☑ Add new feature

4.1.2 Benefits of Proposed Change

In addition to the goal of paving the way to review and potentially modify other healthcare exceptions in future code cycles, as described in section a, this proposed measure would provide significant benefits at the individual healthcare facility.

Effectively requiring VAV fans with variable speed drives in hospitals and other nonresidential healthcare facilities will yield many benefits at the building level, to the building owner and occupants, but also at the state level in terms of overall energy, cost, and emissions reductions. At the building level, this technology can reduce energy consumption, lower operating costs, improve overall system control and occupant comfort, and reduce fan operation noise. In a healthcare setting, maintaining good occupant comfort is essential and can help improve the lives of staff and patients as they may spend an extended length of time in the building.

Historically, healthcare facilities have been exempted from many requirements in Title 24, Part 6, despite this not being the case in national codes and standards, such as the IECC and ASHRAE 90.1. Modifying this measure to remove the blanket healthcare exception was proposed because it will generate large energy savings and will help pave the way to review and potentially modify other healthcare exceptions in future code cycles. Additionally, by engaging with HCAI and the CEC throughout the process, this change will bring an alignment for building energy codes in healthcare facilities.

At the state level, by extending this requirement to all new hospitals and nonresidential healthcare facilities, the cumulative impacts are considerable and presented in the energy and cost savings section of this report.

4.1.3 Background Information

Indoor fans are a major source of energy use in healthcare HVAC systems, and most systems operate at full or near-full fan speed even when the cooling load is low. Section 401.3.14 *[Section 140.4(m)]* of the 2025 California Energy Code addresses this by requiring cooling systems to reduce fan airflow and fan power during part-load conditions. Modern HVAC equipment can achieve this through variable-speed drives, electronically commutated motors, or multi-speed fans, all of which are widely available and now common. Reducing fan speed even slightly yields significant energy savings because fan power drops much faster than airflow; for example, a fan operating at roughly two-thirds of full speed typically uses less than half the power. Since buildings spend most operating hours at part load, these reductions translate into meaningful energy savings.

Variable-speed technology has matured considerably over the last decade. Equipment manufacturers now integrate fan modulation into most new systems and building automation systems routinely support variable airflow operation. California utilities have also promoted variable-speed HVAC components through incentive programs and emerging-technology studies, and previous Title 24 CASE efforts have evaluated fan-control strategies, minimum airflow limits, and system performance at part load. Similar requirements appear in national model codes such as ASHRAE 90.1 and IECC, so California's fan-control rules are consistent with industry practice and achievable with standard equipment.

Healthcare facilities are currently exempt from Section 401.3.14 *[Section 140.4(m)].* Historically, designers relied on constant-volume systems or limited airflow turndown to avoid potential issues with maintaining required air-change rates, pressure relationships, and overall air balance. However, hospital HVAC technology has advanced significantly. Modern air-handling units designed for healthcare settings commonly include variable-speed drives, pressure-control sensors, and DDC capable of maintaining minimum ventilation and pressure differentials even when fan speed is reduced. Many California hospitals have already adopted variable-speed fans as part of efficiency upgrades, demonstrating that modulation can be compatible with healthcare ventilation standards when properly designed.

Because these technologies and control strategies are now widely available, the rationale for the healthcare exception may no longer apply. Removing the exception would allow healthcare facilities to capture fan-energy savings and better support statewide grid flexibility goals, while still maintaining compliance with the mechanical code and standards that govern patient-care spaces.

4.1.4 Modifications to Energy Code Documents

This section provides descriptions of how the proposed code change will affect each Energy Code document. See Section 2.6: Shut-off and Reset Controls - Proposed Language of this report for detailed revisions to code language.

4.1.4.1 Energy Code Change Summary

The proposed energy code changes are limited to Section 401.3.14 *[Section 140.4]* – Fan Control

SECTION 401.3.14 *[SECTION 140.4(m)]* – Fan Control.

Exceptions to Section 401.3.14: The proposed change would limit the existing healthcare exception to only facilities classified as a Group R or Residential Group Occupancy, as specified in Section 310 of the 2025 California Building Code.

4.1.4.2 Reference Appendices Change Summary

The proposed changes would not impact the reference appendices, as this change is only modifying the healthcare exception and does not fundamentally change mechanical system requirements in 140.4(m).

4.1.4.3 Compliance Manuals Change Summary

Chapter 4 - Mechanical Systems of the Nonresidential Compliance Manual would be updated to reflect modifications to the healthcare exception in Section 140.4(m).

4.1.4.4 Alternative Calculation Method Reference Manual Change Summary

The Statewide CASE Team recommends that the several sections of the Nonresidential ACM Reference Manual be updated to improve modeling accuracy of the hospital prototype and account for proposed measure changes. These sections include: 5.1.3 HVAC System Map, 5.4 Space Uses, 5.6 HVAC Zone Level System, 5.7 HVAC Secondary System, and 5.8 HVAC Primary System. Specific changes being proposed are outlined in more detail in Section 2.6.6 ACM Reference Manual.

4.1.4.5 Compliance Forms Change Summary

This proposed change will require the following compliance forms to be updated to include Section 401.3.14 *[140.4(m)]* as a requirement when selecting a healthcare building type. These forms include: NRCC-MCH-E and NRCI-MCH-E Mechanical Systems.

4.1.5 Measure Context

4.1.5.1 Comparable Model Codes or Standards

ASHRAE Standard 90.1 2022

Section 6.5.3.2.1 requires supply fan airflow to be modulated as a function of load. DX and chilled-water cooling units that control the mechanical cooling capacity directly based on space temperatures shall have two stages of fan control – low speed not to exceed 66 percent of full speed and drawing no more than 40 percent of fan power at full speed. All other units shall have modulating fan control– low speed to not exceed 50 percent of full speed and draw no more than 30 percent of fan power at full speed. This section also requires systems with an air-side economizer to have a minimum of two fan speeds during economizer operation. There are no healthcare exceptions or exceptions based on airflow rate requirements.

2024 International Energy Conservation Code (IECC)

Section C403.8.6 requires fan airflow controls that vary indoor airflow as a function of load. This section has the same requirements as Title 24, Part 6 and Standard 90.1.

ASHRAE Standard 170: Ventilation of Health Care Facilities

Standard 170 provides minimum ventilation design requirements and environmental control for healthcare facilities. This standard is used throughout the industry and Tables 7-1 and 8-1are adopted directly in the California Mechanical Code as Table 4-A.

4.1.5.2 Interactions with Other Regulations

This change does not interact or conflict with any federal laws and regulations. This change does interact with certain state requirements and the California Building Code.

State laws and requirements

Title 24 Part 6 uses the definitions in the California Health and Safety Code Division 2, Chapter 2, §1250 and the California Health and Safety Code Division 2, Chapter 1, Section 1204 to define a healthcare facility. This measure is not proposing to change the existing definition.

Interactions with California Building Code

This proposed measure interacts with the 2025 CMC by referencing Table 4-A as a newly modified exception to target exceptions for specific spaces in healthcare facilities.

This measure also interacts with the 2025 CBC by referencing the Section 3 residential group classification in the modified healthcare exception. Modifying the existing healthcare exception for residential group occupancies will limit the proposed changes to commercial healthcare facilities, such as hospitals.

4.2 Fan Control - Compliance and Enforcement

4.2.1 Compliance Considerations

The Statewide Case Team does not anticipate any additional compliance considerations for this measure than what was described in Section 2.2.1.

4.2.2 Impact on Market Actors

Given that this measure focuses on space-conditioning controls, it will impact the same market actors as described in Section 2.2.2. Designers, controls contractors, commissioning providers, facility managers, and enforcement staff will interact with the measure in ways similar to those they use for other HVAC control requirements. No new market participants are introduced, and the roles and responsibilities remain consistent with standard design, construction, and commissioning workflows for nonresidential HVAC systems.

4.2.3 Compliance Software Updates

If the proposal is adopted, then CBECC will be modified based on the proposed changes to the ACM Reference Manual, as described in Section 2.6.6. This would apply to Sections 401.3.14.1 through 401.3.14.3 *[140.4(m)1,2,3]* based on the design system

401.3.14.1: Design system with staged fan mechanical cooling capacity control without economizer

401.3.14.2: All other design systems with proportional fan control without economizer

401.3.14.3: Design system with a minimum of two-speed fan and air-side economizers meeting Section 401.3.7.1 *[Section 140.4(e)1]* requirement

4.2.4 Cost of Enforcement

The Statewide CASE Team acknowledges that changes to the code will impact enforcement costs. This report is an evaluation of specific measures, and the collective impact of all proposed changes for the 2028 Title 24, Part 6 may represent an increase in training and/or workload for enforcement personnel.

The Statewide CASE Team does not anticipate the addition of this measure will increase the cost of enforcement for HCAI. Review of this measure can be easily integrated into existing plan review and field inspection processes and will not add significant review time or cost.

4.3 Fan Control - Market and Economic Analysis

4.3.1 Market Structure and Availability

4.3.1.1 Current Market Structure and Availability

The technologies and design practices required to implement variable-speed fan control in healthcare facilities are fully mature and widely available in today's nonresidential HVAC market. The key market actors who manufacture, supply, install, program, and commission these systems are the same as those identified in Section 2.2.2. This section highlights the major entities in the California market and the overall readiness of the supply chain.

The proposed measure relies on equipment and control strategies that are already standard in California's commercial buildings and increasingly common in modern hospital projects. Variable-frequency drives (VFDs), electronically commutated motors (ECMs), multi-speed fans, and pressure-independent VAV terminal units are all established products supported by multiple manufacturers and distributors.

- **Controls Vendors and Manufacturers:**
  Major BAS providers already offer native support for fan-speed modulation, duct static pressure reset, minimum ventilation control, and zone-level airflow management. These capabilities are standard features in modern BAS platforms and do not require custom software or specialized modules. Most new healthcare projects already use these systems for monitoring indoor air quality, maintaining pressure relationships, and complying with Table 4A.
- **Design Engineers and Commissioning Providers:**
  Leading California engineering and commissioning firms routinely design and verify VAV systems in nonresidential buildings. Many have already implemented VFD-driven fan arrays and airflow turndown strategies in healthcare settings as part of energy retrofits and decarbonization initiatives. Extending these design practices to all healthcare projects requires minimal, if any, additional training. (For training considerations, see Section 4.2.2)
- **Contractors and Integrators:**
  Mechanical contractors and controls integrators already install VFDs, ECMs, and pressure-independent VAV boxes as standard scope in commercial projects.
- **Equipment Manufacturers**:
  Manufacturers provide AHUs, fan arrays, and terminal units designed for continuous modulation. VFDs are now standard on most AHUs, and pressure-independent terminal units are routinely installed in laboratories, ambulatory care facilities, and other buildings that require stable ventilation control. These

products come “controls-ready,” with airflow sensors, actuators, and built-in capacity for turndown.

No significant new capital investment or specialized workforce development is necessary because the proposed requirement relies on existing BAS platform technology, widely available fan equipment, and standard control sequences. The California market already has the equipment, expertise, and supply chain capacity to support variable-speed fan control for healthcare buildings. Implementation is expected to proceed smoothly once the exemption is removed. The measure aligns with current best practice and accelerates an ongoing market trend toward modulated HVAC systems.

4.3.1.2 Market Challenges and Solutions

While the proposed measure leverages widely available technology, several market and implementation challenges could influence adoption speed and consistency across the healthcare sector. These barriers are primarily related to institutional practices, risk perception, and coordination, rather than technology availability.

Challenge - Maintaining Minimum Air Change Rates and Pressure Relationships

Healthcare stakeholders may note that patient-care spaces have strict ventilation and pressurization requirements. The primary concern is whether fan-speed reduction could compromise required minimum air changes or directional airflow.

- **Solution:** Variable-speed fan systems do not reduce airflow below space-level minimums; they modulate only during part-load conditions when airflow exceeds minimum requirements. Pressure-independent VAV boxes and modern AHU controls can maintain required minimums even under fan turndown. Many hospitals in California already use these systems in hybrid VAV/CAV designs. Commissioning requirements ensure proper operation. This challenge is therefore manageable with current equipment and standard control logic.

Challenge - Controls Complexity and Commissioning Requirements

Facility managers express concern that duct static pressure reset and fan-turndown sequences could introduce added complexity for hospital staff.

- **Solution:** BAS vendors confirmed that fan-modulation sequences (e.g., static pressure reset, minimum-flow enforcement) are standard templates. These sequences are widely used in laboratories, universities, and outpatient facilities. ASHRAE Guideline 36 also provides standardized, tested sequences that BAS vendors already implement. Commissioning agents are comfortable verifying these controls, and staff training will be minimal (see Section 4.2.2).

Challenge - Equipment Availability and Lead Times

Hospital capital planners may have concern whether necessary equipment for implementing the measure would be available from multiple suppliers given supply-chain constraints in previous years.

- **Solution:** Most major manufacturers supply VFD-compatible fans in California. None of the required components are proprietary, and no patent restrictions limit competition. These technologies are used in most nonresidential projects today, and ample supply is expected well ahead of the code's effective date.

4.3.2 Design and Construction Practices

4.3.2.1 Current Design and Construction Practices

Best practices for designing HVAC systems with variable fan control are well established in the nonresidential market and increasingly common in healthcare facilities. Most new hospital air-handling units already use variable-speed fans because they offer better energy performance, reduced noise, and smoother control of ventilation and pressurization. These systems modulate airflow continuously in response to duct static pressure or zone demand and are controlled through standard BAS/DDC platforms used in many California healthcare projects.

A central best practice is the use of pressure-independent terminal units with integrated airflow sensors. These units maintain stable zone airflow even as duct pressure fluctuates with fan turndown, which is essential for meeting the minimum air-change and pressurization requirements. Designers routinely use these terminal units in laboratories, pharmacies, isolation rooms, and many patient-care areas, and the proposed measure reinforces this approach. Modern BAS sequences such as static pressure reset, minimum-flow enforcement, and temperature- or demand-based modulation are also standard practice; most major controls platforms provide these sequences out of the box.

Airflow measurement at the AHU or system level is another best practice that aligns well with variable-speed operation. Outdoor air stations, supply- and return-air measurement devices, and zone-level airflow sensors ensure ventilation requirements are maintained during part-load operation. These devices are already widely used in healthcare facilities to support infection control, maintain code-required minimum ventilation, and provide verifiable performance for commissioning.

Fan arrays have also become increasingly common in hospital AHUs. They use multiple small ECM or VFD-driven fans arranged in a wall or cluster, providing redundancy, lower vibration, and excellent part-load efficiency. These systems inherently support the modulation required by §401.3.14 *[140.4(m)]* and often reduce the physical size of the AHU compared to a single or multiple larger fans. From a construction standpoint, integrating VFDs, ECM fan assemblies, and airflow measurement devices has minimal impact on space, electrical infrastructure, or architecture. VFDs mount within standard mechanical or electrical rooms, ECM arrays fit within conventional AHU footprints, and no special duct routing or structural modifications are required.

Occupant comfort and indoor environmental quality are generally improved by these best practices. Lower fan speeds reduce noise, and pressure-independent control keeps temperature, ventilation, and room pressurization more stable. Because these practices are already common in high-performance healthcare designs, the proposed measure does not meaningfully change design methodology.

4.3.2.2 Health and Safety Considerations

The proposed code change is not expected to introduce any adverse impacts on structural or seismic design, fire-resistance ratings, moisture management, or other health and safety factors. It does not alter any existing federal, state, or local regulations enforced by the DOSH or other authorities. All existing health and safety rules remain in effect, and compliance with the proposed measure is not anticipated to negatively impact construction, commissioning, operation, or maintenance activities.

By enabling variable-speed fan operation, it helps maintain more consistent ventilation rates and indoor air quality, including proper air-change rates and pressurization in healthcare spaces. Reduced fan speeds also lower noise and vibration, contributing to a safer and more comfortable environment for patients and staff.

4.3.2.3 Design and Construction Challenges and Solutions

Technical feasibility is well supported by modern HVAC technologies, including VFD or ECM-driven fans, pressure-independent terminal units, and advanced building automation systems. These systems can modulate airflow without compromising air-change rates or pressurization, provided proper calibration, sensor placement, and control sequences are used. The measure allows designers to maintain minimum airflow while still benefiting from part-load fan energy savings.

Installation techniques require no fundamental changes beyond standard AHU, terminal unit, and fan control integration. Multiple equipment suppliers and controls contractors in California provide compatible hardware and integration services. The widespread availability of these products ensures that multiple providers can implement the revised techniques without limiting market competition.

Regular maintenance is critical to sustaining energy savings. Fan and terminal unit calibration, sensor verification, and BAS performance checks ensure that airflow modulation continues to meet code requirements over time. Proper commissioning and ongoing operations support consistent indoor air quality, occupant comfort, and pressure control, while reducing noise and vibration.

4.3.3 Impacts on Jobs and Businesses

The Statewide CASE Team does not anticipate significant employment or financial impacts on any particular sector of the California economy. However, the proposed change may have modest impacts on employment in California. The Statewide CASE Team estimates the proposed change would affect statewide employment and economic output directly and indirectly through its impact on builders, designers, energy consultants, and building inspectors. Table 39, Table 40, and Table 41 outline the statewide implications for these job categories. For more information on the Statewide CASE Team's economic impacts methodology, see the 2028 CASE Methodology Report.

The Statewide CASE Team does not anticipate that the proposed changes would lead to the creation of new types of jobs or the elimination of existing types of jobs. In other words, the Statewide CASE Team's proposed change would not result in economic disruption to any sector of the California economy. Rather, it would lead to modest changes in the employment of existing jobs.

Table 39: Estimated Impact that Adoption of the Proposed Measure would have on the California Nonresidential Construction Sector

Type of Economic Impact	Employment (Jobs)	Labor Income (Million)	Total Value Added (Million)	Output (Million)
Direct Effects (Additional spending by Commercial Builders)	18	$1.4	$1.6	$2.8
Indirect Effect (Additional spending by firms supporting Commercial Builders)	4	$0.4	$0.6	$1.1
Total Economic Impacts	**22**	**$1.8**	**$2.2**	**$3.9**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.[11]

[11] IMPLAN® model, 2020 Data, IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

Table 40: Estimated Impact that Adoption of the Proposed Measure would have on the California Building Designers and Energy Consultant Sectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building designers and energy consultants)	0	$1,400	$1,386	$2,190
Indirect Effect (Additional spending by firms supporting building designers and energy consultants)	0	$417	$579	$932
Total Economic Impacts	**0**	**$1,816**	**$1,965**	**$3,122**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

Table 41: Estimated Impact that Adoption of the Proposed Measure would have on California Building Inspectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building inspectors)	0	$760	$901	$1,095
Indirect Effect (Additional spending by firms supporting building inspectors)	0	$70	$110	$191
Total Economic Impacts	**0**	**$830**	**$1,011**	**$1,286**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

The proposed change represents a modest adjustment, which is not expected to excessively burden or competitively disadvantage California businesses, nor is it expected to lead to a competitive advantage for California businesses. Therefore, the Statewide CASE Team does not expect the proposed code changes to result in the creation of new businesses or the elimination of existing ones.

The proposed code changes would apply to all businesses operating in California, regardless of whether the business is incorporated inside or outside of the state.[12] Therefore, the Statewide CASE Team does not anticipate that the proposed changes would have an advantageous or an adverse effect on the competitiveness of California businesses.

The Statewide CASE Team derived a reasonable estimate of the change in investment by California businesses based on the estimated change in economic activity associated with the proposed measure and its expected effect on business income. The

[12] Gov. Code, §§ 11346.3(c)(1)(C), 11346.3(a)(2); 1 CCR § 2003(a)(3) Competitive advantages or disadvantages for California businesses currently doing business in the state.

Statewide CASE Team's IMPLAN modeling resulted in an estimated $415,304 increase in California business income due to the proposed code change. The Statewide CASE Team assumed that net business investment is positively correlated with business income and that a portion of business income will be allocated to net business investment.

To estimate the portion of business income that would be allocated to net investment, the Statewide CASE Team analyzed national data on corporate profits and net capital investment by businesses that expand a firm's capital stock (referred to as net private domestic investment, or NPDI).[3] As Table 42 shows, between 2020 and 2024, NPDI as a percentage of corporate profits ranged from a low of 18 percent in 2020 due to the worldwide economic slowdowns associated with the COVID 19 pandemic to a high of 28 percent in 2022, with an average of 23 percent. While only an approximation of the proportion of business income used for net capital investment, it provides a reasonable estimate of the proportion of incremental income that business owners would reinvest into expanding their capital stock.

Table 42: Net Domestic Private Investment and Corporate Profits, U.S.

Year	Net Domestic Private Investment by Businesses, Billions of Dollars	Corporate Profits After Taxes, Billions of Dollars	Ratio of Net Private Investment to Corporate Profits (Percent)
2020	389	2,212	18
2021	545	2,888	19
2022	825	2,951	28
2023	836	3,069	27
2024	885	3,441	26
5-Year Average	Intentionally blank	Intentionally blank	23

Source: (Federal Reserve Economic Data (FRED) n.d.)

Given the estimated total increase in California business income and net business investment ratio described above, the Statewide CASE Team estimates the proposed code change would result in a $97,488 increase in net private investment by California businesses.

4.3.4 Economic and Fiscal Impacts

Economic and fiscal impacts for all measures are addressed in Section 6: Economic and Fiscal Impacts.

4.4 Fan Control - Cost Effectiveness

4.4.1 Cost Effectiveness Methodology

The Statewide CASE Team collaborated with CEC staff to confirm that the cost-effectiveness methodology aligns with CEC guidelines, including cost inclusion parameters. The 2028 CASE Methodology Report and Appendix A provide reproducibility details.

Per California Law (Public Resources Code 25000), a measure is considered cost effective if its BCR is 1.0 or greater, amortized over the economic life of the structure. The Statewide CASE Team calculates BCR by dividing total dollar benefits by total dollar costs over a 30-year analysis period.

Benefits are based on LSC, which assigns an hourly dollar value to energy use. LSC hourly factors weigh the long-term value of each hour differently, where times of peak demand are valued more than off-peak hours. These factors are not utility rates, forecasts, or bill estimates. The CEC develops and publishes LSC hourly conversion factors for each code cycle.

Costs include first costs and ongoing maintenance costs assessed over the 30-year period. Benefits and costs are evaluated incrementally, relative to the most recently adopted Energy Code. The analysis excludes design costs and incremental code compliance verification costs.

4.4.2 Energy and Energy Cost Savings Results

To estimate the energy and cost savings associated with this measure, the same modifications to the default CBECC hospital prototype as described in Section 2.4.2 were incorporated.

Hospitals are currently exempt from fan control requirements as outlined in Section 401.3.14 *[140.4(m)]* in the 2025 California Energy Code. Because of this, the Statewide CASE Team could not use a code minimum baseline and instead had to determine common construction in hospitals and use that as a baseline scenario. Through conversations with healthcare design and engineering firms and hospital owners, the Statewide CASE Team used the following baseline.

- System type: CAV HVAC systems operating on a continuous schedule, without automatic shut-off or setback functionality during unoccupied hours.
- Control features: constant-flow fan operation at full or fixed speed; no coordination between zone demand and fan power
- Sequence of operation: HVAC zones remain "occupied" 8760 hours per year regardless of use

The proposed assumption is a hospital that is fully compliant with the code.

- Ventilation/fans: Fan-power reduction consistent with §401.3.14 *[140.4(m)]* (e.g., proportional control).

Energy savings (electricity, natural gas, and source energy) and peak demand reductions per unit are presented in Table 43 and Table 44. For hospital prototypes, first-year per-unit electricity savings range from 9.08 to 11.24 kWh/yr-ft², natural gas savings range from 43.81 to 61.29 kBtu/yr-ft², source energy savings range from 53.68 to 67.51 kBtu/yr-ft², and peak electrical demand reductions range from 0.96 to 1.16 W/ft², depending on climate zone.

For SNF prototypes, first-year per-unit electricity savings range from 8.71 to 12.43 kWh/yr-ft², natural gas savings range from 41.04 to 68.87 kBtu/yr-ft², source energy savings range from 49.35 to 78.92 kBtu/yr-ft², and peak electrical demand reductions range from 0.93 to 1.17 W/ft², depending on climate zone.

Table 45 and Table 46 present total energy cost savings per unit for newly constructed buildings and additions in terms of LSC savings realized over a 30-year period, in 2029 present value dollars (2029 PV$). The LSC methodology allows peak electricity savings to be valued more than electricity savings during non-peak periods. Total 30-year LSC savings range from 122.40 to 144.61 2029 PV$ per square foot for hospital prototypes and from 110.36 to 165.41 2029 PV$ per square foot for SNF prototypes, depending on climate zone.

Table 43: Energy and Energy Cost Savings – Per Square Foot – New Construction and Additions– Hospital

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	9.08	0.96	61.29	67.51	0
2	10.03	1.08	58.87	66.90	0
3	10.34	1.08	58.26	67.12	0
4	10.36	1.08	55.87	64.89	0
5	10.33	1.12	57.44	66.32	0
6	11.11	1.12	51.43	62.14	0
7	11.24	1.16	56.02	66.08	0
8	11.23	1.12	52.35	62.92	0
9	10.98	1.10	53.34	63.23	0
10	11.14	1.13	51.94	62.45	0
11	10.32	1.04	56.08	64.80	0
12	10.38	1.02	57.89	66.47	0
13	10.67	1.04	55.67	65.03	0
14	10.31	1.08	50.34	59.64	0
15	10.83	1.06	47.85	58.62	0
16	9.65	1.08	43.81	53.68	0

Table 44: Energy and Energy Cost Savings – Per Square Foot – New Construction and Additions– SNF

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	9.74	0.96	63.07	69.45	0
2	10.06	1.03	62.47	69.64	0
3	11.22	1.12	68.87	77.23	0
4	9.90	0.97	59.35	66.69	0
5	10.94	1.14	66.47	74.89	0
6	12.43	1.17	68.54	78.92	0
7	11.94	1.17	68.26	77.57	0
8	11.58	1.09	65.74	74.80	0
9	11.07	1.03	65.18	73.21	0
10	11.01	1.05	63.95	72.17	0
11	10.24	0.97	61.71	68.99	0
12	10.48	0.97	63.72	71.24	0
13	10.48	0.96	63.16	70.83	0
14	9.88	0.96	55.85	62.97	0
15	10.68	1.01	59.85	68.49	0
16	8.71	0.93	41.04	49.35	0

Table 45: 2029 PV LSC Savings Over 30-Year Period of Analysis – Per Square Foot – New Construction and Additions– Hospital

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	78.25	50.94	129.20
2	86.71	48.98	135.69
3	89.39	48.58	137.97
4	89.67	46.50	136.16
5	89.56	47.89	137.45
6	96.22	44.08	140.31
7	97.28	47.33	144.61
8	97.18	44.74	141.93
9	94.81	45.24	140.06
10	96.55	44.20	140.74
11	88.96	46.87	135.82
12	89.27	48.31	137.58
13	91.98	46.57	138.55
14	89.98	42.41	132.39
15	93.13	41.22	134.34
16	85.62	36.78	122.40

Table 46: 2029 PV LSC Savings Over 30-Year Period of Analysis – Per Square Foot – New Construction and Additions– SNF

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	82.84	51.68	134.52
2	86.48	51.15	137.63
3	96.49	56.80	153.30
4	85.42	48.60	134.02
5	95.26	54.79	150.05
6	107.75	57.67	165.41
7	102.97	57.31	160.28
8	100.31	55.34	155.65
9	95.30	54.69	149.99
10	95.11	53.71	148.81
11	88.03	50.66	138.69
12	89.97	52.36	142.33
13	90.15	52.18	142.32
14	85.94	46.02	131.96
15	92.00	51.04	143.03
16	77.56	32.80	110.36

4.4.3 Incremental First Cost

Based on input from mechanical contractors, controls contractors, and industry stakeholders, the incremental first cost associated with this measure is expected to be negligible.

From an equipment standpoint, there is also no meaningful cost difference between VAV and CAV systems in healthcare applications. Even in CAV systems, variable frequency drives (VFDs) are commonly required for fan soft starting. At the zone level, terminal units and controllers are still required in both cases, the distinction lies only in how they are programmed and operated. In pressure-controlled healthcare spaces, both CAV and VAV systems typically require return and/or exhaust airflow control to maintain required room pressure relationships, meaning the associated return airflow control hardware is not unique to the proposed measure. For non-pressure-controlled healthcare spaces, while a CAV design may not require dedicated zone-level return dampers, a VAV design also does not necessarily require them, therefore the cost difference is minimal.

From a control perspective, the proposed measure primarily affects how airflow is modulated at the zone level, rather than introducing new control hardware. Stakeholder feedback confirmed that these differences are implemented through standard BAS programming, with the same controllers, wiring, and infrastructure used in both cases. No additional control hardware is required, only revised programming sequences.

Additionally, healthcare construction costs are inherently layered, with mechanical contractors, controls contractors, and general contractors. In practice, these layers further reduce any marginal difference in equipment or installation cost at the owner level. Based on this feedback, the Statewide CASE Team concludes that the incremental first cost for this measure is effectively zero (approaching $0/ft²).

4.4.4 Incremental Maintenance and Replacement Costs

Incremental maintenance and replacement costs for this measure are assumed to be zero. The proposed control strategies do not introduce new equipment or components beyond what is typically installed before or without this measure. Routine maintenance activities, such as BAS programming updates, sensor calibration, and terminal unit servicing, remain unchanged from what is required before this measure.

4.4.5 Cost Effectiveness

Results of the per-unit cost-effectiveness analyses are presented in Table 47 for new construction and additions.

In the table below, all values are presented in 2029 present value dollars (2029 PV$). Benefits represent 30-year LSC savings and other savings, including incremental first-cost savings if the proposed first cost is less than the current first cost, incremental maintenance cost savings if the proposed maintenance costs are less than the current maintenance costs, and incremental residual value if proposed residual value is greater than current residual value at the end of the 30-year period of analysis. Costs represent the total incremental PV cost, including incremental equipment, replacement, and maintenance costs over the period of analysis. The analysis treats a negative incremental maintenance cost as a positive benefit. If total incremental costs are zero, the BCR is considered infinite. Costs and other savings are discounted at a real (inflation-adjusted) three percent rate. If there are no total incremental PV costs, the BCR is infinite.

Table 47: 30-Year Cost-Effectiveness Summary Per Square Foot – New Construction and Additions

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	131.33	0.00	infinite
2	136.46	0.00	infinite
3	144.10	0.00	infinite
4	135.31	0.00	infinite
5	142.49	0.00	infinite
6	150.35	0.00	infinite
7	150.88	0.00	infinite
8	147.42	0.00	infinite
9	144.03	0.00	infinite
10	143.97	0.00	infinite
11	136.97	0.00	infinite
12	139.48	0.00	infinite
13	140.06	0.00	infinite
14	132.22	0.00	infinite
15	137.82	0.00	infinite
16	117.58	0.00	infinite

4.5 Fan Control - Statewide Impacts

4.5.1 Statewide Energy and Energy Cost Savings

See the 2028 CASE Methodology Report for details on how statewide energy and cost savings were calculated as well as details on estimating the current market share. Appendix C presents the assumptions on the percentage of the total construction forecast that the proposed measure would impact.

The proposed code change is expected to result in substantial statewide energy savings for newly constructed healthcare facilities and additions. As shown in Table 48, statewide first-year savings are estimated at 54.27 GWh of electricity and 2.95 million therms of natural gas, corresponding to approximately 340.35 million kBtu of source energy savings and a peak demand reduction of 5.38 MW. The proposed code change is also projected to provide approximately $715.81 million in 30-year present-valued lifecycle cost savings (2029 PV$).

Table 48: Statewide Energy and LSC Impacts – New Construction and Additions

Climate Zone	Statewide New Construction & Additions Impacted by Proposed Change in 2029 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	27,300	0.25	0.03	0.02	1.86	$3.59
2	162,300	1.63	0.17	0.1	11.04	$22.15
3	693,150	7.41	0.76	0.43	49.33	$99.88
4	353,625	3.6	0.37	0.2	23.2	$47.85
5	74,850	0.79	0.08	0.05	5.22	$10.67
6	281,700	3.28	0.32	0.16	19.39	$42.35
7	366,300	4.22	0.43	0.22	25.89	$55.27
8	400,275	4.55	0.44	0.23	27.09	$59.01
9	744,000	8.2	0.8	0.43	50.01	$107.16
10	602,475	6.68	0.66	0.34	39.97	$86.74
11	132,525	1.36	0.13	0.08	8.81	$18.15
12	690,975	7.2	0.69	0.42	47.25	$96.38
13	265,575	2.81	0.27	0.16	17.89	$37.20
14	114,375	1.16	0.12	0.06	6.97	$15.12
15	68,475	0.74	0.07	0.04	4.28	$9.44
16	41,400	0.38	0.04	0.02	2.15	$4.87
Total	**5,019,300**	**54.27**	**5.38**	**2.95**	**340.35**	**$715.81**

4.5.2 Statewide Greenhouse Gas Emissions Reductions

Note to the CEC – The Statewide CASE Team has identified inconsistent GHG emissions results and is conducting a quality assessment. Results will be added once the QA/QC is completed.

Table 49 presents the estimated first-year reduction in GHG emissions resulting from the proposed code change. In this initial year, the Statewide CASE Team expects to avoid 20,028 metric tons of carbon dioxide equivalent (CO_2e) emissions. These reductions, along with their associated monetary value, were calculated using hourly GHG emissions factors published alongside the LSC hourly factors and source energy hourly factors in the research versions of CBECC, as well as data from the CEC's 2028 Metrics Report. See the 2028 CASE Methodology Report for additional information.

Table 49: First-Year Statewide GHG Emissions Impacts

Construction Type	Reduced GHG Emissions from Electricity Savings (Metric Tons CO2e)	Reduced GHG Emissions from Natural Gas Savings (Metric Tons CO2e)	Total Reduced GHG Emissions (Metric Ton CO2e)	Total Monetary Value of Reduced GHG Emissions ($)
New Construction & Additions	4,623	15,405	20,028	3,253,697

4.5.3 Statewide Water Use Impacts

The proposed code change will not result in water use impacts.

4.5.4 Statewide Material Impacts

The proposed code change will not result in a meaningful change to materials.

4.5.5 Environmental Impacts

This measure reduces energy use and overall emissions from hospitals across California and does not result in any adverse environmental effects. Statewide emissions impacts from this change are summarized in Table 49.

4.5.6 Other Non-Energy Impacts

If the proposed enhanced space conditioning systems controls are properly implemented in healthcare facilities, it has the potential to improve occupant comfort. In a hospital environment, occupant comfort can dramatically improve the experience for the patient and improve their overall well-being.

4.6 Fan Control - Proposed Language Code

4.6.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents should be marked with dark blue underlining (new language) and ~~strikethroughs~~ (deletions). New to the 2028 energy code is to *italicize* defined terms when the terms are being used in its defined context. In-line comments that are not part of the proposed code language but are used to help describe the purpose of what is proposed are included with greyed highlight and italics.

Markups are provided to the restructured 2025 Energy Code that the CEC developed in response to feedback that aligning the structure of Title 24, Part 6 with other parts of the California Building Standards Code (Title 24) would improve readability, usability, and navigation.8 New section numbers are shown as bold followed square brackets that document the section in the 2025 Title 24, Part 6 section numbers prior to the restructuring. For example, “Section 601.1 [Section 130.0(a)] General” contains the content that is in the current Section 130.0(a).

Posting the proposed code language in this format is useful as it helps describe how the Energy Code changes proposed for nonresidential occupancies are isolated from the requirements for residential occupancies which are prohibited from being changed until the 2031 code cycle by Assembly Bill 130.

4.6.2 Administrative Code (Title 24, Part 1)

There are no proposed changes to Title 24, Part 1.

4.6.3 Energy Code (Title 24, Part 6)

SUBCHAPTER 4 SPACE CONDITIONING AND VENTILATION

SECTION 401

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES

(NEWLY CONSTRUCTED, ADDITIONS, ALTERATIONS)

Section 401.3.14 *[140.4(m)]* **Fan control.**

Each cooling system listed in Table 401.3-J *[Table 140.4-I]* shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements:

1. DX and chilled water cooling systems that control the capacity of the mechanical cooling directly based on occupied space temperature shall:

   1.1 Have a minimum of two stages of fan control with no more than 66 percent speed when operating on stage 1; and

1.2 Draw no more than 40 percent of the fan power at full fan speed, when operating at 66 percent speed.

2. All other systems, including but not limited to DX cooling systems and chilled water systems that control the space temperature by modulating the airflow to the space, shall have proportional fan control such that at 50 percent air flow the power draw is no more than 30 percent of the fan power at full fan speed.
3. Systems that include an air side economizer to meet Section 401.3.7.1 *[Section 140.4(e)1]* shall have a minimum of two speeds of fan control during economizer operation.

Exception 1 to Section 401.3.14 *[Section 140.4(m)]:* Modulating fan control is not required for chilled water systems with all fan motors < 1 HP, or for evaporative systems with all fan motors < 1 HP, if the systems are not used to provide ventilation air and all indoor fans cycle with the load.

Exception 2 to Section 140.4(m): Systems serving *healthcare facilities* other than *HCAI facilities*.

4.6.4 Reference Appendices

There are no proposed changes to the Reference Appendices.

4.6.5 Compliance Manuals

The Statewide CASE Team will provide the CEC with recommended revisions to compliance manuals after the 45-Day Language is published.

4.6.6 ACM Reference Manual

There are no proposed changes directly related to this proposed change. As discussed in Appendix F, the Statewide CASE Team recommends updates to the hospital prototype and a new SNF prototype to align with standard practices. These updates necessitate corresponding revisions to the ACM Reference Manual that are presented in the appendix.

4.6.7 Compliance Forms

As discussed in Section 2.1.4.5, the NRCC-MCH-E and NRCI-MCH-E Mechanical Systems and NRCC-CXR-E Nonresidential Building Commissioning compliance forms would be updated to reflect the proposed change. NRCC-PRF-E, supporting the performance approach, may also need to be modified. 2025-NRCA-MCH-07-A, which handles supply fan variable flow controls, may require modification. The Statewide CASE Team can support the CEC in implementing these updates if the proposed change is adopted.

5. Alterations

5.1 Alterations - Measure Description

5.1.1 Proposed Code Change

Healthcare facilities are currently exempt from nonresidential alterations sections (i.e., 301.5 for envelope, 401.5 for space conditioning and ventilation, 501.5 for plumbing, and 601.5 for electrical and lighting). This proposed measure would remove the blanket exception for nonresidential healthcare facilities and add healthcare exceptions to specific alteration provisions throughout the sections noted above. These modifications would make HCAI facilities (see Section 1.3), including hospitals, subject to certain Title 24 requirements when undergoing alterations.

The Statewide CASE Team worked with HCAI to conduct a thorough review of all requirements and exceptions in the alterations section to determine which requirements are applicable to healthcare facility alterations and which should remain exceptions this code cycle to enable time to understand unique implementation challenges for healthcare. Based on this review, the following sections were determined to be applicable and thus the Statewide CASE Team proposes subjecting HCAI facilities to these mandatory and prescriptive provisions when undergoing alterations.

Table 50: Proposed Requirements for HCAI Facility Alterations

Section	Mandatory or Prescriptive	Description
301.5.2.1.1 [141.0(b)1.A] - Roof and Ceiling Insulation	Mandatory	Minimum levels for roof insulation
401.5.2.1.1 [141.0(b)1.D] - Fan Energy Index (FEI)	Mandatory	Generally, achieving a FEI of 1.0 for constant air volume systems and 0.95 for variable air volume systems
301.5.2.1.4 [141.0(b)1.E]- Exterior Windows	Mandatory	Requires replacement windows do not exceed a maximum U-factor of 0.58
301.5.2.2.2 and 301.5.2.2.3 [141.0(b)2.B]- Altered Roof	Prescriptive	Solar reflectance and minimum insulation requirements during roof replacement
601.5.2.2.1 [141.0(b)2F] – New Lighting System	Mandatory and Prescriptive	Spaces with lighting systems installed for the first time shall meet the requirements of Sections 110.9, 130.0, 130.1, 130.2, 130.4, 140.3(c), 140.6 and 140.7.
601.5.2.2.2 [141.0(b)2G] - Daylight responsive controls	Prescriptive	Provides an exception to alterations of daylight harvesting controls when a skylight is added.
601.5.2.2.4 [141.0(b)2I] - Altered indoor lighting systems	Mandatory and Prescriptive	Replacement lighting must meet certain lighting power density requirements

With this proposed update, HCAI facilities in California undergoing alterations would be required to comply with the above provisions of the energy code, similar to healthcare facilities in other states that are subject to the IECC or ASHRAE 90.1, as well as other nonresidential building types in California. Given that other nonresidential buildings undergoing alterations have been subject to Title 24, Part 6, and have previously demonstrated cost-effectiveness, the addition of HCAI facilities under these provisions will also be cost-effective. Furthermore, if the requirements are cost-effective for buildings that are not operating 24 hours, they will likely be even more cost-effective for healthcare facilities, which tend to have longer operating hours. For example, fans in HCAI facilities will need to achieve a fan energy index (FEI) of 1.0 or 0.95 depending on the system configuration. As fans typically operate continuously in healthcare, the savings will only increase.

Importantly, existing alteration thresholds and exceptions across building systems will continue to apply, so even if healthcare facilities are subject to an alteration provision, an existing threshold or exception may exempt the requirement. For example, alterations impacting less than 2,000 square feet or 50 percent of the roof area, whichever is less, are exempted from the provisions of Section 301.5.2.2.3 *[141.0(b)2.B].* Many existing healthcare facilities, due to years of exemptions, have maintained antiquated technology that may not be fully compatible with all alteration requirements. The goal of this change is to incrementally require hospitals to upgrade to current technology as equipment fails and as modifications are made, and when it is most cost effective—while also allowing functional legacy technology to operate in parallel until it is naturally replaced.

Healthcare is unique among nonresidential building types in that building modifications and upgrades are routinely performed, so careful consideration was given to when alterations should be subject to energy code requirements to avoid undue burden on these facilities. The Statewide CASE Team proposed the following alteration requirements as outlined in Table 50. Table 51 summarizes the scope of the proposed code change.

Table 51: Scope of Proposed Code Change

A ☑ indicates the proposed code change is relevant.

Building Type(s)	Construction Type(s)	Type of Change
☐ Single Family	☐ New Construction	☑ Mandatory
☐ Multifamily	☐ Additions	☑ Prescriptive
☑ Nonresidential (Not Group R uses)	☑ Alterations	☐ Performance

Application Climate Zones	Energy Code Sections	Compliance Forms	Sections of ACM Reference Manuals
Climate Zones 1-16	• Part 6, Sections 301.5, 401.5, and 601.5 [141.0(b)]	NRCC-ENV-E, NCRI-ENV-E, NRCC-LTI-E, NRCI-LTI-E, NRCC-MCH-E, NRCI-MCH-E	Sections 5.4.2, 5.4.3, 5.4.4

Third Party Verification	Updates to Compliance Software
☑ No changes to third party verification	☐ No updates
☐ Update existing verification requirements	☐ Update existing feature
☐ Add new verification requirements	☑ Add new feature

5.1.2 Benefits of Proposed Change

Removing the blanket alteration exemption for nonresidential healthcare facilities will bring into effect several energy-efficiency requirements that have been applicable for many years in non-healthcare facilities. These requirements have already been vetted through previous code adoption cycles and have generally been demonstrated to improve building efficiency and reduce operating costs.

Examples of code sections that would apply to healthcare alterations include envelope insulation, fan power, fenestration performance, and lighting power. In general, efficiency improvements are more impactful in buildings with long operating schedules because the affected systems operate for more hours throughout the year.

Nonresidential healthcare facilities commonly operate more than 12 hours per day for outpatient facilities and 24 hours per day for inpatient facilities. As a result, applying alteration requirements to healthcare facilities can provide meaningful operational, demand, and cost benefits over the life of the equipment and building systems.

A secondary benefit of improved building efficiency is reducing electrical demand on the grid and increasing overall building resilience. Many hospitals operate with constrained heating, cooling, and ventilation infrastructure. Requiring more efficient replacement equipment and reducing unnecessary loads can help free up system capacity and improve operational flexibility. Most hospitals also maintain essential backup power systems, typically including generators with on-site fuel storage. Reducing building energy demands may allow the backup fuel supplies to last longer during utility outages or emergency events.

5.1.3 Background Information

5.1.3.1 Background Information – Proposed Code Change

The proposed change to include healthcare alterations under the purview of Title 24, Part 6, is being introduced at an opportune time to maximize impact. When Senate Bill 1953 was signed into law in California in 1994, general acute care hospitals throughout the state had to conduct seismic evaluations and bring buildings up to a Structural Performance Category (SPC) of 2 or the "Life Safety Level" by January 1, 2008, with an extension to 2013 if required changes result in a diminished capacity of community healthcare services.[13] As a result of this requirement, most older hospitals were torn down or completely retrofitted through the late 1990s and early 2000s. This means that many of these hospitals are now 20 to 30 years old and will require significant renovations to update failing or outdated systems and equipment and maintain optimal patient care in the near future. Requiring that hospitals include certain minimum efficiency measures as specified in the California Energy Code will result in significant statewide energy savings and cost-effective opportunities for hospitals across the state.

Mandatory and prescriptive requirements for alterations referenced in Sections 301.5.2, 401.5.2, 501.5.2, and 601.5.2 *[141.0(b)]* save energy in a multitude of ways; from more efficient motors, turning down flow rates, to reducing heat loss/gain through building envelopes. The proposed measures have previously gone through reviews to be adopted into the energy code and have been justified in those spaces. Nonresidential healthcare facilities are more energy intense than most building types and thus will see greater savings than most building types as the savings scale with energy use. In addition to energy savings, peak electrical and thermal demands are reduced via most of the newly activated requirements.

[13] https://hcai.ca.gov/facilities/building-safety/seismic-compliance-and-safety/program-overview/

Table 52 through Table 57 (organized by mandatory vs. prescriptive and broken out by building system) outline all provisions within Alterations, and how the removal of the healthcare exception may impact a facility when undergoing an alteration. As previously mentioned, the Statewide CASE Team is recommending a handful of these provisions to apply to healthcare alterations in the 2028 Code Cycle. In future code cycles, healthcare exceptions to additional alteration measures will be considered and may be recommended for modification. Measures where healthcare facilities would be newly subject to requirements during alterations are noted in the third column of each table.

Table 52: Mandatory Envelope Measures Impacting Alterations

Mandatory Measures	Impacts on Healthcare Facility Alterations	Impacted by Measure?
300.3.4 [110.8(d)]	Requires that insulation be added to attics, existing water heaters, or existing ducts.	No
301.5.2.1.1 [141.0(b)1.A] Roof and Ceiling Insulation	The minimum insulation levels for roofs and ceilings have been standard for several years now. Also, there are exceptions related to accounting for roof top mechanical equipment and roof drains that will be in frequent use for roof alteration projects.	Yes
301.5.2.1.2 [141.0(b)1.B] Wall Insulation	While the requirements are relatively modest for most constructions and should not present a challenge to healthcare facilities owners, design teams, or contractors, older curtain walls may have trouble achieving an R-4 performance as most existing curtain walls have an R-3 performance. High quality curtain walls typically achieve an R-5 performance. Older facilities would likely use the mass wall exception as was common in older construction methods.	No
301.5.2.1.3 [141.0(b)1.C] Floor Insulation	This would affect overhangs and crawl spaces, which are relatively uncommon in healthcare facilities. Mass floors are relatively common in older healthcare facilities, which would be exempt in this section.	No
301.5.2.1.4 [141.0(b)1.E] Exterior Windows	Requires replacement windows do not exceed a maximum U-factor of 0.58.	Yes

Table 53: Mandatory Space Conditioning Measures Impacting Alterations

Mandatory Measures	Impacts on Healthcare Facility Alterations	Impacted by Measure?
401.2.2.10 [120.2(j)] HVAC DDC	Table 120.2-A DDC Applications and Qualifications indicates that as equipment is replaced it needs to be upgraded to include direct digital controls (DDC). The control requirements are standard across all building types and should not represent a burden on healthcare systems.14 The requirements found in Table 120.2 will gradually force healthcare facilities to shift away from pneumatic systems and/or expand existing DDC systems. HVAC system controls in healthcare facilities are to be more consistent with replacement and new construction control systems in non-healthcare facilities. Greater commonality among buildings will reduce cost as the solutions are standardized in addition to saving energy. There will be a learning curve for building owners not familiar with the capabilities that the new controllers enable.	No
401.5.2.1.1 [141.0(b)1.D] Fan Energy Index (FEI)	Requires new fans to meet the requirements of section 120.10. Generally achieving a FEI of 1.0 for constant air volume systems and 0.95 for variable air volume systems is straightforward with a thoughtful design. Healthcare facilities commonly install fans in constrained spaces, where limited space may make meeting the FEI thresholds challenging due to system effects on the fan. It is possible that healthcare facilities may apply for relief on this requirement in alterations.	Yes

Table 54: Prescriptive Envelope Measures impacting Alterations

Prescriptive Section and Measure	Impacts on Healthcare Facility Alterations	Impacted by Measure?
301.5.2.2.1 *[141.0(b)2.A]*	Altered Fenestration would be required to meet new prescriptive performance requirements.	No

[14] DDC technology have been available for a long time and is included as part of the baseline systems that align with the 2013 energy code. However, many hospitals tend to keep their equipment for a long time, so pneumatic controls are very prevalent in existing health care facilities. For reference, pneumatic controls use air pressure rather than electricity to actuate controllers. That pressurized air is provided by compressors and is piped throughout the hospital. It is likely that many hospitals have been using the healthcare facility control exception for many years to avoid investing in DDC systems. Also, any pneumatic to DDC conversion needs to be carefully planned to minimize disruption and cost to the health care facility. Not all the savings capabilities may be immediately available to health care facilities during partial control conversions.

Altered Fenestration	The altered glazing performance values are less stringent than new glazing requirements.	
301.5.2.2.2 and 301.5.2.2.3 *[141.0(b)2.B]* **Altered Roof**	The altered roof performance values are less stringent than new roof requirements, lessening the cost of the upgrade when reroofing. Also, there are exceptions for size and scope of alteration (e.g., accounting for roof top mechanical equipment and roof drains that will be in frequent use for roof alteration projects).	Yes
301.5.2.2.4 *[141.0(b)2O]* **Daylighting Requirement for large enclosed spaces**	Shall meet the requirements of Section 140.3(c). Section 140.3(c) requires daylighting requirements for large, enclosed spaces, greater than 5,000 ft^2 and under a roof with a ceiling height greater than 15ft. Typical ceiling heights in hospitals are 8 to 10 ft. This is partially done to reduce ventilation flows as requirements are based on air changes per hour so as the space gets taller, the supplied air flow rate increases. Non-clinical spaces in healthcare facilities may be subject to this requirement, such as dining spaces and multi-purpose rooms.	No
301.5.2.2.5 *[141.0(b)2Q]* **Air Barrier**	Healthcare facilities are exempt from whole building air leakage tests.	No
301.5.2.2.6 *[141.0(b)2R]* **Exterior doors**	Requirement to meet the u-factor of Section 140.3(a)7, which does not have any healthcare specific requirements or constraints.	No

Table 55: Prescriptive Space Conditioning Measures Impacting Alterations

Prescriptive Section and Measure	Impacts on Healthcare Facility Alterations	Impacted by Measure?
401.5.2.2.1 *[141.0(b)2.C]* **New or Replacement Space Conditioning Systems or Components**	This section excludes duct work, which is regulated by Section 141.0(b)2.D This section references Section 140.4(b), which has 12 subsections, many of which are not applicable to healthcare facilities (e.g., Subsections 1, 3, 4, 7). Subsections 5, 6 and 8 through 12 include requirements that will not be burdensome for healthcare facilities to adopt. Section 140.4(c) increases the fan power allowance accounting for challenges in fan retrofits. Section 140.4(d) is documented above for new construction, which will be modified to include the updated CMC Table 4-A governing clinical space minimum turndown making this section feasible for healthcare facilities.	No

Prescriptive Section and Measure	Impacts on Healthcare Facility Alterations	Impacted by Measure?
	Section 140.4(e) includes Exception 2 for humidified buildings. This is heavily used for existing healthcare facilities and may be used if complying with this provision proves challenging. Typically, the energy and energy cost savings associated with the air-side economizer will exceed the energy and energy cost loss associated with wasting humidified air. However, in certain situations it may be cost prohibitive to install an air-side economizer in an existing HVAC system. Section 140.4(f) Supply air temperature reset controls is not applicable to healthcare facilities, Exception 4. Supply air temperature reset controls are applied to hospitals, however certain spaces do have strict temperature and humidity control requirements so it is best to leave this exception in place until a more sophisticated approach is developed that can require this. Section 140.4(g) Electric resistance heating is generally prohibited unless exceptions are applicable. Many healthcare facilities have existing electrical resistance heating systems. Replacing those with hydronic systems would be cost prohibitive. Section 140.4(h) Heat rejection systems requirements can be achieved in most healthcare facilities. Section 140.4(i) Minimum chiller efficiency requirements can be achieved in most healthcare facilities. Section 140.4(j) Limitation of air-cooled chillers section is not applicable to healthcare facilities, Exception 3. Healthcare facilities are required to store water on site for resilience purposes. Cooling towers often use more than half of a hospital's total water annually, resulting in significant storage costs. Section 140.4(k) Hydronic system measures section includes eight major requirements that are already typical in healthcare facilities. This includes variable flow pumping, chiller and boiler isolation, variable flow control, and other related requirements. Chilled and hot water temperature reset controls are not applicable for healthcare facilities, Exception 2 to 140.4(k)4. However, many healthcare facilities already employ resets when feasible. Section 140.4(m) fan control is already being modified for new construction and would become active for healthcare facilities when Exception 2 is removed. The minimum flow requirements by space need to be maintained per CMC Table 4-A.	

Prescriptive Section and Measure	Impacts on Healthcare Facility Alterations	Impacted by Measure?
	System alterations may not be able to make full use of the VAV fan control as downstream zones may be configured to be CAV. Though as zone level equipment is replaced this functionality will become available. Section 140.4(n) Mechanical system shut-off is not applicable to healthcare facilities, Exception 3. Section 140.4(o) Exhaust system transfer air s not applicable to healthcare facilities, Exception 5. Section 140.4(p) Dedicated outdoor air systems (DOAS) are uncommon in healthcare facilities; however, when implemented, they typically include active chilled beams (Exception 1) or sensible-only cooling terminal units (Exception 2). An all-air DOAS system is technically possible in a healthcare facility; however, the fan power limitation of 0.12 W/cfm may be difficult to meet in certain cases. Well-designed DOAS systems in healthcare facilities should be able to meet the requirements in this section. Section 140.4(q) Exhaust air heat recovery has been used in healthcare facilities for many years. Some spaces listed in CMC Table 4-A prohibit heat recovery with cross contamination potential such as exhaust from airborne infectious isolation rooms or radiology. Exception 6 note 2 references CMC for energy recovery systems with leakage potential, which sufficiently covers healthcare facilities.	
401.5.2.2.3, 401.5.2.2.4, and 401.5.2.2.5 *[141.0(b)2D]* **New or Replacement Duct Systems**	Requirements include a healthcare exception in Section ii.1. This, in turn, triggers Subsection iii, which references CMC Section 603.8.9.2, which is already in effect for healthcare facilities.	No
401.5.2.2.2 *[141.0(b)2E]* **Altered Space Conditioning Systems**	Thermostat with demand responsive controls is not applicable for healthcare facilities, Exception to 110.12	No

Table 56: Prescriptive Water Heating Measures Impacting Alterations

Prescriptive Section and Measure	Impacts on Healthcare Facility Alterations	Impacted by Measure?
501.5.2.2.1 *[141.0(b)2N]* **Service water-heating systems**	Refers to Section 140.5(a)2, which in turn refers to Sections 110.1, 110.3, 120.3 and 140.5(c). Section 110.1 Mandatory requirements for appliances do not contain anything that is healthcare facility specific. Section 110.3 Mandatory requirements for service water-heating systems and equipment include requirements that healthcare facilities already meet There is an exception in Section (a)1 that refers to Table 613.1 of the CPC for healthcare facilities There are additional healthcare facilities exceptions for controls on hot water distribution systems. Section 120.3 Requirements for pipe insulation do not include any healthcare specific exceptions or requirements Section 140.5(c) High-capacity service water-heating systems served by natural gas require 90% efficient boilers. It is common in hospitals to have large central boiler plants that distribute steam, which serve steam-to-hot water converters that supply service to hot water loops. Steam boilers will not achieve 90% efficiency because the high temperature of steam precludes condensing. Boiler efficiency ranges from 75 to 80% and may reach 86% efficiency with stack economizers.	No

Table 57: Prescriptive Lighting Measures Impacting Alterations

Prescriptive Section and Measure	Impacts on Healthcare Facility Alterations	Impacted by Measure?
601.5.2.2.1 *[141.0(b)2F]* **New Lighting System**	This will not have any healthcare specific challenges. Lighting retrofits are common in healthcare facilities.	Yes
601.5.2.2.2 *[141.0(b)2G]* **Daylight Responsive Controls**	Provides an exception to alterations of daylight harvesting controls when a skylight is added.	Yes
601.5.2.2.3 and 601.5.2.2.6 *[141.0(b)2H and 141.0(b)2M]* **New and Altered Signs**	Requirements for new internally and externally illuminated signs. Healthcare facilities are exempt from Section 130.3.	No
601.5.2.2.4 *[141.0(b)2I]* **Indoor Lighting Systems**	Altered indoor lighting systems - Lighting retrofits are common in healthcare facilities.	Yes
601.5.2.2.5 *[141.0(b)2L]* **Outdoor Lighting Systems**	Alteration to existing outdoor lighting systems - Refers to standard lighting practice, which is commonly applied in healthcare facilities.	No

5.1.3.2 Background Information – Impact of Pneumatic Control Changes

The recommended controls changes defined above will work for most existing HVAC systems in HCAI facilities; however, the exact implementation will vary on a project basis.

Many older hospitals still have pneumatic controls rather than DDC. While there is a cost of replacing control systems, maintaining pneumatic controls has become increasingly costly as fewer manufacturers and capable technicians are available to serve this shrinking market. Replacing pneumatic controls with DDC will incur costs both in installation and maintenance as two types of systems will exist for a time; it will be a long-term savings. The long-term savings come from greater control accuracy (reducing/eliminating over heating or over cooling) and generating data that could inform advanced control strategies. Operators of pneumatic control systems have limited insights into how the HVAC system operates.

Given the disruption to operations, scale, and budgets of hospitals, partial upgrades to DDC will likely be more common than complete upgrades. Electric-to-pneumatic transducers will be required to translate control signals from the DDC to the pneumatic system. This equipment is an additional cost beyond sensors and controls programming. Pneumatic controls do not necessarily have a line or low voltage connection nearby thus necessitating additional wiring.

Pneumatic controls only provide local control and do not allow for system- and/or building-wide optimization. Initially, the new DDC will only provide local control until the entire system has been updated. For example, if occupancy sensors are added to a space that allow the ventilation, heating, and/or cooling to be setback or turned off, it will only impact that zone. The HVAC system serving that space will not be able to make use of that data initially for greater optimization. However, as the pneumatic controls fail and are replaced over time, the DDC system will expand, eventually enabling full control of the HVAC system and the building.

Owners will likely accelerate the conversion to DDC once the HVAC system has achieved a threshold where it is cheaper to finish the conversion than maintaining two different control systems. In effect, certain features will be disabled or unavailable until the entire system has been upgraded. For example, variable speed drives may operate at constant speed because all the relevant control signals are not available yet.

Allowing for the phasing of control replacement and sub-optimal system performance will manage capital costs while still providing some short-term benefit, and significant long-term benefit.

5.1.4 Modifications to Energy Code Documents

This section provides descriptions of how the proposed code change will affect each Energy Code document. See Section 5.6: Alterations - Proposed Language Code of this report for detailed revisions to code language.

5.1.4.1 Energy Code Change Summary

The proposed energy code changes affect Title 24, Part 6. A brief description of these changes is provided below:

SUBCHAPTER 3 ENVELOPE

SECTION 301.5.2 *[SECTION 141.0(b)]* –Alterations

Exceptions to Section 301.5.2: The proposed change would remove the blanket healthcare exception and add healthcare exceptions to specific alteration provisions throughout Section 301.5.2. Healthcare-specific exceptions would be added to the following: 301.5.2.1.2 *[141.0(b)1B]* – Wall insulation (Mandatory), 301.5.2.1.3 *[141.0(b)1C]* – Floor insulation (Mandatory), 301.5.2.2.1 *[141.0(b)2A]* -Fenestration (Prescriptive), 301.5.2.2.4 *[Section 141.0(b)2O]* – Minimum daylighting requirement for large enclosed spaces (Prescriptive), 301.5.2.2.5 *[Section 141.0(b)2Q]* – Air barrier (Prescriptive), 301.5.2.2.6 *[Section 141.0(b)2R]* – Exterior doors (Prescriptive).

SUBCHAPTER 4 SPACE CONDITIONING AND VENTILATION

SECTION 401.5.2 *[SECTION 141.0(b)]* - Alterations

Exceptions to Section 401.5.2: The proposed change would remove the blanket healthcare exception and add healthcare exceptions to specific alteration provisions throughout Section 401.5.2. Healthcare specific exceptions would be added to the following subsections: mandatory requirements within 401.5.2.1 *[Section 141.0(b)1]* other than FEI, 401.5.2.2 *[141.0(b)2C]* – prescriptive requirements for alterations.

SUBCHAPTER 6 ELECTRICAL AND LIGHTING

SECTION 601.5.2 *[SECTION 141.0(b)]* - Alterations

Exceptions to Section 601.5.2: The proposed change would remove the blanket healthcare exception and add healthcare exceptions to specific alteration provisions throughout Section 601.5.2. Healthcare specific exceptions would be added to the following sections: 601.5.2.2.3 *[141.0(b)2H]* -New illuminated signs, 601.5.2.2.5 *[141.0(b)2L]* – Altered outdoor lighting systems, 601.5.2.2.6 *[141.0(b)2M]* – Altered illuminated signs, and 601.5.2.2.7 *[141.0(b)2P]* – Altered electrical power distribution systems.

These changes would retain a healthcare-specific exceptions for certain mandatory and prescriptive requirements related to wall and floor insulation, window glazing, space conditioning and duct systems, and outdoor lighting systems. As a result of the proposed changes, HCAI facilities undergoing alterations would then be subject to several mandatory provisions impacting roof/ceiling alterations, window u-factors, fans, and prescriptive measures related to roofs and indoor lighting systems.

5.1.4.2 Reference Appendices Change Summary

The proposed changes would not impact the reference appendices, as they only modify the healthcare exception and do not fundamentally change alteration requirements throughout the code.

5.1.4.3 Compliance Manuals Change Summary

Include additional guidance in the alterations section of chapters 3, 4, and 5 of the Nonresidential Compliance Manual explaining when energy code measures are required during healthcare alteration scenarios. For example, shutting off flow to a space will change the system pressure, which will adversely impact the flow to other spaces that cannot modulate to mitigate the change.

5.1.4.4 Alternative Calculation Method Reference Manual Change Summary

In the ACM Reference Manual key changes section, note that alterations would now comply with the energy code. There are no other proposed changes to the ACM Reference Manual.

5.1.4.5 Compliance Forms Change Summary

This proposed change will require the following compliance forms to be updated to include Sections 301.5.2, 401.5.2, and 601.5.2 *[141.0(b)]* and specific alteration measures as a requirement when selecting a healthcare building type. These forms include: NRCC-ENV-E and NCRI-ENV-E Envelope Component Approach, NRCC-LTI-E and NRCI-LTI-E Indoor Lighting, NRCC-MCH-E and NRCI-MCH-E Mechanical Systems and NRCC-CXR-E- Nonresidential Building Commissioning.

5.1.5 Measure Context

5.1.5.1 Comparable Model Codes or Standards

Unlike 2025 Title 25, Part 6, national model codes and standards, such as ASHRAE 90.1 and IECC, do not exempt healthcare facilities from efficiency requirements when implementing a building alteration or retrofit that triggers the energy code. This means that healthcare facilities in other states that have adopted one of these national standards have been subject to efficiency requirements for alterations.

The 2024 IECC outlines requirements when altering a building in Section C503: Alterations. This section covers specific requirements impacting each building system including the envelope, lighting, mechanicals, and SHW, similar to Title 24, Part 6. In addition to these base requirements, alterations that are *substantial improvements* are subject to the additional efficiency credits, which require the designers and builders to choose a number of additional measures to achieve even greater levels of efficiency.

ASHRAE 90.1 – 2022 requires alterations of existing building assemblies, systems, and equipment comply with all sections of the code, similar to the 2024 IECC and what is being proposed for Title 24, Part 6 in this measure. Section 4.2.1.3 specifically references each section covering requirements for the building envelope, HVAC, SHW, Power, Lighting, other equipment, and additional efficiency requirements.

5.1.5.2 Interactions with Other Regulations

This change does not interact or conflict with any federal laws and regulations. This change does interact with certain state requirements and the California Building Code.

The proposed measures are already present for nonresidential buildings except healthcare facilities. The healthcare facility exemption is being removed and clarifying language has been added to document how the technology is applied and limitations.

State laws and requirements

Title 24, Part 6 uses the definitions in the California Health and Safety Code Division 2, Chapter 2, §1250 and the California Health and Safety Code Division 2, Chapter 1, Section 1204 to define a healthcare facility. This measure is not proposing to change the existing definition.

Interactions with California Building Code

Title 24, Part 1: SECTION 7-118 – Building Energy Efficiency Program.

While the proposed change to Title 24, Part 6 would require healthcare facilities undergoing alterations to comply with the energy code, a similar change in scope that triggers alteration requirements would need to be incorporated in Chapter 7: Safety Standards for Health Facilities, Title 24, Part 1. Section 7-118 currently only requires newly constructed or an addition to healthcare facilities to comply with Title 24, Part 6, and does not account for alterations. To maintain consistency between Title 24, Part 1, and Part 6, and reduce confusion among industry and the enforcement community, this section should be updated to reflect energy code compliance for healthcare alterations.

5.2 Alterations - Compliance and Enforcement

5.2.1 Compliance Considerations

Many healthcare facilities impacted by this measure are regulated and enforced by the HCAI OSHPD, who enforce all Title 24 codes, including Part 6. (HCAI 2024) This means that HCAI staff and Inspectors or Record (IORs)—plans examiners and field inspectors—are responsible for verifying compliance with this measure for healthcare facilities outlined in Section 2.1.3. HCAI uses a similar plan review and permitting process to local jurisdictions but with a few important distinctions. Once a set of drawings is reviewed and approved by HCAI reviewers, the healthcare facility owner hires OSHPD certified Inspectors of Record (IORs) to monitor construction progress and note discrepancies between approved plans and field installation. IOR's perform continuous inspection during construction activities and are essential to quality control during construction. In addition to IORs, HCAI field inspectors periodically visit the site to verify compliance with the building code (HCAI 2024).

Considering that alterations have been previously exempt for healthcare facilities, this will present a significant change for HCAI and its plan reviewers and inspectors. Plan reviewers and inspectors will need considerable training on when specific alterations trigger an energy code requirement and how to ensure its verified and complied with on plans and in the field. Specific impact on HCAI inspectors is as follows:

While this measure will increase the enforcement burden on HCAI inspectors, this change will streamline the alterations section and reduce confusion among other market actors by requiring healthcare facilities to comply with specific alteration requirements as required in other nonresidential building types. For specific healthcare facilities enforced by local building departments, there will be limited impact on their enforcement processes, as plan review and inspectors in those departments currently enforce this measure for other nonresidential building types.

5.2.2 Impact on Market Actors

This proposed measure will require healthcare facilities to be subject to certain energy code provisions when altering a healthcare facility in which other nonresidential construction building types are already subject to. Many of the same market actors that work on healthcare facilities also support other nonresidential buildings, so added efficiency requirements for alteration scopes will not require a change in their approach.

Table 58 summarizes impacts on market actors and suggests outreach and education that might be helpful to support market actors as they prepare for the effective date of the requirements.

Table 58: Impacts on Market Actors and Suggested Training and Education Opportunities

Market Actor	Impact(s)	Suggested Outreach and Education
Builders [a]	This change aligns healthcare facilities more closely with other nonresidential buildings.	This is already common practice for most building types, no additional training needed.
Design Professionals [b]	Design professionals who specialize in healthcare are likely familiar with alteration requirements but may not have applied them in healthcare projects. This change will require some rethinking.	The newly active requirements are already standard for non-healthcare facilities, but it makes sense to have some training with examples for design professionals that specialize in healthcare facility design.
Construction Team [c]	Likely this will simplify their work as the approaches used on other building types will align more with healthcare facilities.	This is already common practice in construction, no additional training needed.
HCAI Inspectors [d]	Requiring efficiency improvements for alterations will be entirely new for HCAI and IOR inspectors. HCAI plan reviewers and inspectors will need to apply energy code requirements to alteration projects. Aside from	Substantial training and education will need to be provided to HCAI inspectors to improve understanding of energy code alteration requirements and thresholds for when measures need to comply. A

Market Actor	Impact(s)	Suggested Outreach and Education
	specific threshold triggers, HCAI and IOR inspectors should be familiar with referenced sections of the code, as all these requirements apply for new construction and additions.	training program, and additional resources, should be developed and administered through HCAI's standard training programs.
Verification Testers [e]	Commissioning agents and inspectors should have an easier time validating functional compliance with the additional data available through more controls and operational flexibility.	This is already common practice for most building types; no additional training is needed other than general outreach that this is now also a health care requirement and that the exception has been repealed.
Building Owners, Managers, and Occupants	Reduced energy bills. Modified preventative maintenance routines. More data to diagnose operational issues. Nonresidential healthcare facilities with antiquated controls may see significant challenges as their previous approaches to maintaining controls will no longer be permissible.	Hospitals should be notified via the California chapter of the American Society for Health Care Engineering as the primary conduit for reaching owners, operators, engineers, and manufacturers affected by this code change. The California Society for Healthcare Engineering would likely develop any necessary educational content for its membership.
Manufacturers and Distributors	The few remaining pneumatic control manufacturers may no longer be able to justify producing spare parts if the demand continues to decrease. Like many technologies supplanted by a superior solution, this is inevitable. However, this code change could accelerate the decline of this market. Given the timeline of the code change adoption, manufacturers should have ample time to modify production rates to not lose money. DDC equipment manufacturers and technicians will see increased demand for their services offsetting any impact on economic activity.	Most if not all controls contractors do this work on most building types. General notification of this change will be sufficient.

a. Builders include builders and developers.

b. Design professionals include architects, interior designers, engineers (mechanical, electrical, plumbing, structural), specification writers, cost estimators, commissioning agents, lighting designers, and energy consultants.

c. Construction team includes general contractors, design-build contractors, installation contractors (e.g., HVAC, plumbing, electrical), commissioning agents, and tradespeople.

d. Building departments include plans reviewers, building inspectors, specialty inspectors, permit counter technicians, and sustainability department staff.
e. Verification testers include commissioning agents, ECC Raters, and Acceptance Test Technicians.

The 2028 CASE Methodology Report presents a quantitative assessment of how changes to the California building code impact builders, building designers and energy consultants, and building owners and occupants. The analysis in the methodology report is not specific to the changes presented in this report. The following provides a qualitative description of how this specific code change affects various market actors and additional quantitative analyses of its potential impacts on building industry subsectors.

Builders. The proposed change would likely affect residential and/or commercial builders; however, it would likely not impact firms focused on the construction or retrofitting of industrial buildings, utility systems, public infrastructure, or other heavy construction. The proposed change would not affect all firms and workers in the residential and commercial building industries equally; instead, it would primarily affect specific subsectors within the industry.

With the alterations section impacting all other sections of the code, this change has the potential to impact a broad swath of construction subsectors. Any commercial building trade that works on the building envelope, lighting, HVAC, or SHW may be impacted, depending on the type of alteration and whether the size of change is greater than the system specific compliance thresholds specified in Sections 301.5.2, 401.5.2, or 601.5.2 *[141.0(b)].* Table 59 shows the commercial building subsectors that the Statewide CASE Team expects to be impacted by the changes proposed in this report.

Table 59: Specific Subsectors of the California Commercial Building Industry Impacted by Proposed Change to Code/Standard by Subsector in 2025 (Estimated)

Construction Subsector	Establishments	Employment	Annual Payroll (Billions $)
Commercial Building Construction	4,919	83,028	9.0
Nonresidential Structural Steel Contractors	363	13,110	1.1
Nonresidential Framing Contractors	133	3,406	0.3
Nonresidential Masonry Contractors	229	4,246	0.3
Nonresidential Glass and Glazing Contractors	283	6,133	0.6
Nonresidential Roofing Contractors	354	10,382	0.9
Nonresidential Siding Contractors	26	668	0.0
Other Nonresidential Exterior Contractors	277	3,006	0.2
Nonresidential Electrical Contractors	3,137	74,277	7.0
Nonresidential Plumbing & HVAC Contractors	2,346	55,572	5.5
Other Nonresidential Equipment Contractors	556	9,594	1.0
All Other Nonresidential Trade Contractors	940	18,027	1.6

Source: (State of California Employment Development Department n.d.)

Building occupants (owners and tenants). For California healthcare building owners and tenants, the proposed code changes would result in lower energy bills and the potential for improved occupant comfort. The Statewide CASE Team estimates that, on average, the proposed change to Title 24, Part 6 would increase construction costs by about $2.20 per sq. ft. of healthcare space. However, the measure would also result in savings of $3.52 per sq. ft. in energy and maintenance cost savings over 30 years.

5.2.3 Compliance Software Updates

If the proposal is adopted, then CBECC will be modified based on the proposed changes to the ACM as described in Section 2.6.6.

5.2.4 Cost of Enforcement

This proposed change will require certain healthcare alterations must comply with Title 24, Part 6. With healthcare facilities having been previously exempted from these requirements, this change will increase the number of healthcare projects seeking energy code review and additional work for HCAI and IOR inspectors.

5.3 Alterations - Market and Economic Analysis

5.3.1 Market Structure and Availability

5.3.1.1 Current Market Structure and Availability

The proposed code change is already applicable to new healthcare facilities as well as alterations for non-healthcare facilities, so many products, services, technologies, designers, installers, and owners are familiar with implementing these requirements.

Nonresidential healthcare facility owners undergoing a major alteration will likely need to learn about requirements that are now applicable to their facility as well as new technologies that may support its implementation. Individual owners may not be familiar with these new products to achieve code compliance if they have not altered their hospital in a while or are not progressing ahead of the energy code.

5.3.1.2 Market Challenges and Solutions

This proposed change would likely impact healthcare facility owners most significantly, as requiring alterations now comply with Title 24, Part 6 would represent a learning curve for them and their staff. Training materials and case studies should allay most concerns as the requirements being implemented have been in use for many years in California.

Product vendors that have not previously served the healthcare sector may find onerous requirements regarding certifications and paperwork that they are not used to in other less regulated building types. The regulatory process will likely seem opaque to them. Training materials and consultants working through the adoption process will eventually overcome any of these challenges.

See Section 5.2.2 for a description of workforce training that may be needed to ensure effective design, installation, and commissioning.

5.3.2 Design and Construction Practices

5.3.2.1 Current Design and Construction Practices

The proposed change activates previously adopted sections of the energy code for nonresidential healthcare facilities. The design and construction practices are already in place, with most having already been adopted in some progressive healthcare facility projects.

5.3.2.2 Health and Safety Considerations

The proposed code change assures certain sections of the alterations code, Sections 301.5.2, 401.5.2, and 601.5.2 *[Section 141.0],* are active for nonresidential healthcare facilities. All of the requirements have already been vetted for non-healthcare facility types. A team of experts reviewed all the newly active sections for impacts on infection prevention, delivery of care, or onerous burdens to facilities management/maintenance staff. New exceptions for healthcare facilities were suggested where appropriate.

5.3.2.3 Design and Construction Challenges and Solutions

The most significant design challenge was solved as part of the 2025 update to the CMC, which adopted ASHRAE 170 ventilation requirements into Table 4-A. Table 4-A clearly defines which spaces can implement air flow setbacks and under what conditions. This set the stage for the next step of requiring air flow setbacks in the energy code as the health and safety aspects were already addressed in the CMC. Owners and design professionals that specialize in healthcare facilities will require training to understand these new requirements.

The other sections related to equipment and component performance requirements (fans, lighting, envelope insulation, etc.) are already in standard practice in many progressive healthcare facilities. Certain products that have not been used in healthcare before may encounter regulatory hurdles to provide the necessary paperwork to meet requirements and therefore may have slow adoption.

See Table 58 in Section 5.2.2 for a description of workforce training that could support effective design, installation, and commissioning.

5.3.3 Impacts on Jobs and Businesses

The Statewide CASE Team does not anticipate significant employment or financial impacts on any particular sector of the California economy. However, the proposed change may have modest impacts on employment in California. The Statewide CASE Team estimates the proposed change would affect statewide employment and economic output directly and indirectly through its impact on builders, designers, energy consultants, and building inspectors. Table 60, Table 61, and Table 62 (envelope), Table 63, Table 64, and Table 65 (mechanical), and Table 66, Table 67, and Table 68 (lighting) outline the statewide implications for these job categories. For more information on the Statewide CASE Team’s economic impacts methodology, see the 2028 CASE Methodology Report.

The Statewide CASE Team does not anticipate that the proposed changes would lead to the creation of new types of jobs or the elimination of existing types of jobs. In other words, the Statewide CASE Team’s proposed change would not result in economic disruption to any sector of the California economy. Rather, it would lead to modest changes in the employment of existing jobs.

Table 60: Estimated Impact that Adoption of the Proposed Envelope Measure would have on the California Nonresidential Construction Sector

Type of Economic Impact	Employment (Jobs)	Labor Income (Million)	Total Value Added (Million)	Output (Million)
Direct Effects (Additional spending by Commercial Builders)	16	$1	$2	$4
Indirect Effect (Additional spending by firms supporting Commercial Builders)	9	$1	$1	$2
Total Economic Impacts	**25**	**$2**	**$3**	**$6**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.[15]

Table 61: Estimated Impact that Adoption of the Proposed Envelope Measure would have on the California Building Designers and Energy Consultant Sectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building designers and energy consultants)	0	$14,421	$14,277	$22,565
Indirect Effect (Additional spending by firms supporting building designers and energy consultants)	0	$4,294	$5,968	$9,607
Total Economic Impacts	**0**	**$18,715**	**$20,244**	**$32,172**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

Table 62: Estimated Impact that Adoption of the Proposed Envelope Measure would have on California Building Inspectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building inspectors)	0	$7,831	$9,286	$11,284
Indirect Effect (Additional spending by firms supporting building inspectors)	0	$725	$1,129	$1,967
Total Economic Impacts	**0**	**$8,556**	**$10,416**	**$13,252**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

[15] IMPLAN® model, 2020 Data, IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

Table 63: Estimated Impact that Adoption of the Proposed Mechanical Measure would have on the California Nonresidential Construction Sector

Type of Economic Impact	Employment (Jobs)	Labor Income (Million)	Total Value Added (Million)	Output (Million)
Direct Effects (Additional spending by Commercial Builders)	25	$2.0	$3.0	$6.4
Indirect Effect (Additional spending by firms supporting Commercial Builders)	15	$1.1	$2.0	$3.4
Total Economic Impacts	**39**	**$3.1**	**$4.9**	**$9.9**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.[16]

Table 64: Estimated Impact that Adoption of the Proposed Mechanical Measure would have on the California Building Designers and Energy Consultant Sectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building designers and energy consultants)	0	$14,421	$14,277	$22,565
Indirect Effect (Additional spending by firms supporting building designers and energy consultants)	0	$4,294	$5,968	$9,607
Total Economic Impacts	**0**	**$18,715**	**$20,244**	**$32,172**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

Table 65: Estimated Impact that Adoption of the Proposed Mechanical Measure would have on California Building Inspectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building inspectors)	0	$7,831	$9,286	$11,284
Indirect Effect (Additional spending by firms supporting building inspectors)	0	$725	$1,129	$1,967
Total Economic Impacts	**0**	**$8,556**	**$10,416**	**$13,252**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

[16] IMPLAN® model, 2020 Data, IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

Table 66: Estimated Impact that Adoption of the Proposed Lighting Measure would have on the California Nonresidential Construction Sector

Type of Economic Impact	Employment (Jobs)	Labor Income (Million)	Total Value Added (Million)	Output (Million)
Direct Effects (Additional spending by Commercial Builders)	17	$1.4	$2.1	$4.5
Indirect Effect (Additional spending by firms supporting Commercial Builders)	10	$0.8	$1.4	$2.4
Total Economic Impacts	**27**	**$2.2**	**$3.5**	**$6.9**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.[17]

Table 67: Estimated Impact that Adoption of the Proposed Lighting Measure would have on the California Building Designers and Energy Consultant Sectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building designers and energy consultants)	0.4	$48,070	$47,588	$75,218
Indirect Effect (Additional spending by firms supporting building designers and energy consultants)	0.2	$14,313	$19,892	$32,022
Total Economic Impacts	**0.6**	**$62,382**	**$67,480**	**$107,240**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

Table 68: Estimated Impact that Adoption of the Proposed Lighting Measure would have on California Building Inspectors

Type of Economic Impact	Employment (Jobs)	Labor Income	Total Value Added	Output
Direct Effects (Additional spending by building inspectors)	0	$26,102	$30,953	$37,615
Indirect Effect (Additional spending by firms supporting building inspectors)	0	$2,417	$3,765	$6,557
Total Economic Impacts	**0**	**$28,519**	**$34,718**	**$44,172**

Source: Statewide CASE Team analysis of data from the IMPLAN modeling software.

The proposed change represents a modest adjustment that is not expected to excessively burden or competitively disadvantage California businesses, nor is it

[17] IMPLAN® model, 2020 Data, IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

expected to lead to a competitive advantage for California businesses. Therefore, the Statewide CASE Team does not expect the proposed code changes to result in the creation of new businesses or the elimination of existing ones.

The proposed code changes would apply to all businesses operating in California, regardless of whether the business is incorporated inside or outside of the state.[18] Therefore, the Statewide CASE Team does not anticipate that the proposed changes would have an advantageous or an adverse effect on the competitiveness of California businesses.

The Statewide CASE Team derived a reasonable estimate of the change in investment by California businesses based on the estimated change in economic activity associated with the proposed measure and its expected effect on business income. The Statewide CASE Team's IMPLAN modeling resulted in an estimated increases of $429,686 (envelope), $683,945 (mechanical), and $486,066 (lighting) increase in California business income due to the proposed code change. The Statewide CASE Team assumed that net business investment is positively correlated with business income and that a portion of business income will be allocated to net business investment.

See Section 2.3.3 and Table 18 for an explanation of how the Statewide CASE Team estimated the portion of business income that would be allocated to net investment. Given the estimated total increase in California business income and the net business investment ratio described above, the Statewide CASE Team estimates that the proposed code change would result in the net private investment increase of $100,864 (envelope), $160,549 (mechanical), and $114,099 (lighting) for California businesses.

5.3.4 Economic and Fiscal Impacts

Economic and fiscal impacts for all measures are addressed in Section 6: Economic and Fiscal Impacts.

5.4 Alterations - Cost Effectiveness

5.4.1 Cost Effectiveness Methodology

The Statewide CASE Team collaborated with the CEC staff to confirm that the cost-effectiveness methodology aligns with the CEC guidelines, including cost inclusion parameters. The 2028 CASE Methodology Report and Appendix A provide reproducibility details.

[18] Gov. Code, §§ 11346.3(c)(1)(C), 11346.3(a)(2); 1 CCR § 2003(a)(3) Competitive advantages or disadvantages for California businesses currently doing business in the state.

Per California Law (Public Resources Code 25000), a measure is considered cost effective if its BCR is 1.0 or greater, amortized over the economic life of the structure. The Statewide CASE Team calculates BCR by dividing total dollar benefits by total dollar costs over a 30-year analysis period.

Benefits are based on LSC, which assigns an hourly dollar value to energy use. LSC hourly factors weigh the long-term value of each hour differently, where times of peak demand are valued more than off-peak hours. These factors are not utility rates, forecasts, or bill estimates. The CEC develops and publishes LSC hourly conversion factors for each code cycle.

Costs include first costs and ongoing maintenance costs assessed over the 30-year period. Benefits and costs are evaluated incrementally, relative to the most recently adopted Energy Code. The analysis excludes design costs and incremental code compliance verification costs.

5.4.2 Energy and Energy Cost Savings Results

The Statewide CASE Team simulated energy, LSC cost, and emissions impacts using the newly developed hospital and SNF prototypes. As described in Appendix F, the Statewide CASE Team and the CEC worked together to develop the SNF prototype and enhance the hospital prototype, so it represented current practices more accurately. The Statewide CASE Team used CBECC 2025 2.0 and EnergyPlus 25.1 and new 2028 metric files (weather, emission, source energy factor, and LSC cost) are used for analysis.

5.4.2.1 Measure Specific Baseline versus Proposed Designs

Existing healthcare facilities across California are constructed to a wide array of design standards and practices, largely based on building vintage. To establish a single baseline, the Statewide CASE Team used a hospital constructed to the 2019 Title 24, Part 6 standard. This is a conservative, yet appropriate, baseline as this is when healthcare facilities were initially added to the California Energy Code, creating a better comparison point when factoring in current healthcare exceptions, and ensures savings estimates remain conservative.

The proposed design is an existing hospital that is fully compliant with the minimum alteration requirements in the 2025 Title 24, Part 6 code.

As specified in Sections 301.5.2, 401.5.2, and 601.5.2 *[141.0(b)]* – Alterations, the type of building systems and the level of alteration being performed dictate whether the work is subject to energy code requirements. A detailed description of energy code requirements by building system (e.g., envelope, lighting, mechanical, and SHW) is provided in Section 5.1.3 and indicates which existing healthcare exceptions will apply based on the proposed change. As described in that section, certain alterations to envelope, lighting, and fans would be subject to certain energy code requirements, while other measures such as SHW and space conditioning system modifications would be exempt based on existing and modified healthcare exceptions.

As such, the Statewide CASE Team modeled envelope (roof and windows), lighting (LPD), and fan (FEI) improvements to hospitals separately based on alteration requirements in the 2019 Title 24, Part 6 baseline and 2025 Title 24, Part 6 proposed model. Baseline and proposed designs are provided in Table 69.

Table 69: Hospital Alterations Baseline and Proposed Model Assumptions

Building System	Building Component	Baseline Design (2019 Title 24)	Proposed Design (2025 Title 24)
Envelope	Roof insulation [h·ft²·°F/Btu]	CZ01, CZ03–CZ09: R-8; CZ02, CZ10–CZ16: R-14	CZ06–CZ08: R-20.5; CZ01–CZ05, CZ09–CZ16: R-34.9
Envelope	Window U-factor [Btu/h·ft²·°F]	U-factor: 0.86	U-factor: 0.54
Lighting	LPD	App5-4A_SpaceBySpace-T24N_2019	App5-4A_SpaceBySpace-T24N_2025
HVAC	Fan Energy Index (FEI)	Multiple: varies based on fan name and Climate Zone	Multiple: varies based on fan name and Climate Zone

5.4.2.2 Results

Energy savings (electricity, natural gas, and source energy) and peak demand reductions per unit are presented for each building system (envelope, lighting, fans) in Table 70 through Table 77.

5.4.2.3 Envelope Alterations

Energy savings (electricity, natural gas, and source energy) and peak demand reductions per unit are presented in Table 70 and Table 71.

For hospital prototypes, first-year electricity impacts range from a savings of 0.04 kWh/yr-ft² to an increase of 0.08 kWh/yr-ft², depending on climate zone. Natural gas savings range from 0.12 to 3.45 kBtu/yr-ft², while source energy savings range from 0.06 to 2.88 kBtu/yr-ft². Peak demand impacts are small, ranging from a 0.01 W/ft² increase to no measurable change. For SNF prototypes, first-year electricity savings range from 0.05 to 0.16 kWh/yr-ft², natural gas savings range from an increase of 0.16 kBtu/yr-ft² to a savings of 4.80 kBtu/yr-ft², source energy savings range from an increase of 0.08 kBtu/yr-ft² to a savings of 4.27 kBtu/yr-ft², and peak demand reductions range from 0.00 to 0.03 W/ft², depending on climate zone.

The envelope alteration measure primarily reduces heating energy use, resulting in positive natural gas savings and source energy savings across most climate zones. Small increases in electricity use occur in several hospital climate zones but are offset by reductions in heating energy consumption.

Table 70 and Table 71 present total per-unit energy cost savings for envelope alterations in terms of lifecycle cost savings (LSC) realized over a 30-year period, in 2029 present-value dollars (2029 PV$). The LSC methodology allows peak electricity savings to be valued more than electricity savings during non-peak periods. Table 72 presents a breakdown of total LSC savings from electricity and natural gas cost savings. Total 30-year LSC savings range from 0.72 to 3.31 2029 PV$/ft², depending on climate zone.

Table 70: Energy and Energy Cost Savings – Per Square Foot – Alterations– Hospital Envelope

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	-0.07	0.00	3.45	2.88	2.43
2	-0.04	0.00	2.11	1.73	1.51
3	-0.08	-0.01	2.42	1.94	1.39
4	0.01	0.00	2.50	2.11	2.23
5	-0.06	-0.01	2.54	2.05	1.58
6	-0.06	0.00	1.23	0.94	0.59
7	-0.06	-0.01	0.99	0.70	0.33
8	-0.02	0.00	1.08	0.82	0.74
9	-0.03	0.00	1.39	1.08	1.03
10	-0.03	0.00	0.95	0.72	0.59
11	-0.01	0.00	1.77	1.48	1.56
12	-0.03	0.00	1.79	1.46	1.34
13	-0.02	0.00	1.08	0.86	0.81
14	-0.01	0.00	1.76	1.48	1.57
15	0.04	0.00	0.12	0.06	0.51
16	-0.02	0.00	3.12	2.64	2.66

Table 71: Energy and Energy Cost Savings – Per Square Foot – Alterations– SNF Envelope

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	0.05	0.01	4.80	4.27	4.63
2	0.05	0.01	1.76	1.59	1.95
3	0.05	0.01	3.31	2.94	3.36
4	0.16	0.03	2.93	2.70	3.92
5	0.07	0.01	3.29	2.94	3.42
6	0.06	0.00	1.48	1.30	1.79
7	0.07	0.00	1.10	0.97	1.51
8	0.12	0.01	1.30	1.16	1.97
9	0.14	0.01	2.13	1.91	2.94
10	0.08	0.01	0.94	0.84	1.37
11	0.07	0.01	1.33	1.22	1.81
12	0.06	0.01	1.47	1.34	1.84
13	0.08	0.01	0.73	0.70	1.39
14	0.08	0.01	1.26	1.17	1.79
15	0.14	0.01	-0.16	-0.08	1.03
16	0.06	0.01	2.77	2.48	2.96

Table 72: 2029 PV LSC Savings Over 30-Year Period of Analysis – Alterations – Hospital + SNF Envelope

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	-0.12	3.43	3.31
2	-0.05	1.74	1.68
3	-0.25	2.43	2.18
4	0.51	2.39	2.91
5	-0.15	2.46	2.32
6	-0.16	1.23	1.07
7	-0.17	0.97	0.80
8	0.12	1.11	1.23
9	0.20	1.59	1.79
10	0.01	0.89	0.90
11	0.18	1.48	1.66
12	0.04	1.50	1.54
13	0.12	0.92	1.04
14	0.17	1.49	1.66
15	0.55	0.17	0.72
16	0.10	2.68	2.78

5.4.2.4 Lighting Alterations

The proposed lighting alteration requirements were evaluated using the hospital prototype only. The affected lighting power densities occur primarily in space types that are well represented in the hospital prototype, while the SNF prototype contains relatively limited floor area subject to the proposed lighting changes. As a result, the hospital prototype was considered a reasonable representation of per-unit lighting savings for the affected healthcare facilities.

Per-unit savings for lighting alterations for the first year are expected to range from 0.44 to 0.45 kWh/yr-ft², depending on climate zone. Peak demand reductions are expected to be approximately 0.05 W/ft² across all climate zones. Small increases in natural gas use, ranging from 1.19 to 1.43 kBtu/yr-ft², are observed due to reduced internal heat gains from more efficient lighting systems. As a result, source energy impacts range from -0.43 to -0.24 kBtu/yr-ft², depending on climate zone.

Table 73 presents total per-unit energy cost savings for lighting alterations in terms of LSC savings realized over a 30-year period, in 2029 present value dollars (2029 PV$). The LSC methodology allows peak electricity savings to be valued more than electricity savings during non-peak periods.

Table 75 presents a breakdown of total LSC savings from electricity and natural gas cost savings for the prototypical building. Total 30-year LSC savings range from 2.75 to 2.85 2029 PV$ per square foot, depending on climate zone.

Table 73: Energy and Energy Cost Savings – Per Square Foot – Alterations– Hospital Lighting

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	0.44	0.05	-1.28	-0.32	2.83
2	0.44	0.05	-1.33	-0.37	2.81
3	0.45	0.05	-1.39	-0.41	2.80
4	0.44	0.05	-1.33	-0.37	2.80
5	0.45	0.05	-1.38	-0.40	2.78
6	0.45	0.05	-1.42	-0.43	2.80
7	0.45	0.05	-1.43	-0.43	2.78
8	0.45	0.05	-1.36	-0.39	2.77
9	0.45	0.05	-1.34	-0.36	2.80
10	0.45	0.05	-1.33	-0.36	2.80
11	0.44	0.05	-1.32	-0.35	2.83
12	0.45	0.05	-1.35	-0.38	2.79
13	0.44	0.05	-1.33	-0.37	2.80
14	0.45	0.05	-1.30	-0.33	2.85
15	0.44	0.05	-1.40	-0.42	2.75
16	0.44	0.05	-1.19	-0.24	2.85

Table 74: Energy and Energy Cost Savings – Per Square Foot – Alterations–Hospital Lighting

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	3.89	-1.06	2.83
2	3.92	-1.11	2.81
3	3.96	-1.15	2.80
4	3.90	-1.10	2.80
5	3.93	-1.15	2.78
6	3.99	-1.19	2.80
7	3.97	-1.19	2.78
8	3.91	-1.14	2.77
9	3.92	-1.12	2.80
10	3.91	-1.11	2.80
11	3.92	-1.09	2.83
12	3.91	-1.12	2.79
13	3.90	-1.10	2.80
14	3.95	-1.09	2.85
15	3.92	-1.17	2.75
16	3.85	-1.00	2.85

5.4.2.5 Fan Alterations

Energy savings (electricity, natural gas, and source energy) and peak demand reductions per unit are presented in Table 75 and Table 76. For hospital prototypes, first-year per-unit electricity savings range from 0.19 to 0.21 kWh/yr-ft², natural gas impacts range from -0.12 to -0.04 kBtu/yr-ft², source energy savings range from 0.24 to 0.31 kBtu/yr-ft², and peak demand reductions are approximately 0.02 W/ft², depending on climate zone.

For SNF prototypes, first-year per-unit electricity savings range from 0.06 to 0.07 kWh/yr-ft², natural gas impacts range from -0.11 to -0.01 kBtu/yr-ft², source energy savings range from 0.01 to 0.10 kBtu/yr-ft², and peak demand reductions are approximately 0.01 W/ft², depending on climate zone.

Table 77 presents a breakdown of total LSC savings from electricity and natural gas cost savings for the prototypical building. Total 30-year LSC savings range from 1.14 to 1.31 2029 PV$ per square foot, depending on climate zone.

Table 75: Energy and Energy Cost Savings – Per Square Foot – Alterations– Hospital Fans

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	0.21	0.02	-0.04	0.31	1.75
2	0.20	0.02	-0.06	0.28	1.70
3	0.21	0.02	-0.09	0.27	1.72
4	0.20	0.02	-0.08	0.26	1.69
5	0.21	0.02	-0.06	0.29	1.74
6	0.21	0.02	-0.12	0.24	1.72
7	0.21	0.02	-0.09	0.28	1.80
8	0.21	0.02	-0.12	0.24	1.70
9	0.21	0.02	-0.10	0.26	1.72
10	0.21	0.02	-0.10	0.25	1.71
11	0.20	0.02	-0.05	0.29	1.74
12	0.20	0.02	-0.05	0.29	1.72
13	0.21	0.02	-0.04	0.30	1.75
14	0.20	0.02	-0.05	0.28	1.69
15	0.21	0.02	-0.08	0.28	1.77
16	0.19	0.02	-0.08	0.25	1.61

Table 76: Energy and Energy Cost Savings – Per Square Foot – Alterations– SNF Fans

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	0.06	0.01	-0.08	0.03	0.44
2	0.06	0.01	-0.07	0.04	0.47
3	0.06	0.01	-0.04	0.07	0.51
4	0.07	0.01	-0.07	0.04	0.50
5	0.06	0.01	-0.05	0.06	0.50
6	0.07	0.01	-0.01	0.10	0.58
7	0.07	0.01	-0.02	0.10	0.59
8	0.07	0.01	-0.03	0.08	0.58
9	0.07	0.01	-0.03	0.08	0.56
10	0.07	0.01	-0.04	0.07	0.55
11	0.06	0.01	-0.06	0.05	0.49
12	0.06	0.01	-0.06	0.05	0.51
13	0.07	0.01	-0.05	0.06	0.54
14	0.07	0.01	-0.06	0.05	0.50
15	0.07	0.01	-0.03	0.08	0.59
16	0.06	0.01	-0.11	0.01	0.44

Table 77: 2029 PV LSC Savings Over 30-Year Period of Analysis – Alterations – Hospital + SNF Fans

Climate Zone	30-Year LSC Electricity Savings (2029 PV$)	30-Year LSC Natural Gas Savings (2029 PV$)	Total 30-Year LSC Savings (2029 PV$)
1	1.28	-0.05	1.23
2	1.26	-0.06	1.21
3	1.29	-0.06	1.24
4	1.28	-0.07	1.21
5	1.29	-0.05	1.24
6	1.33	-0.06	1.27
7	1.36	-0.05	1.31
8	1.32	-0.07	1.25
9	1.31	-0.06	1.26
10	1.31	-0.06	1.25
11	1.29	-0.05	1.24
12	1.29	-0.05	1.24
13	1.30	-0.04	1.26
14	1.27	-0.05	1.22
15	1.34	-0.05	1.30
16	1.23	-0.09	1.14

5.4.2.6 Combined Alterations

Energy savings (electricity, natural gas, and source energy) and peak demand reductions per unit for the combined alteration measures are presented in Table 75 and Table 76. The combined hospital results include envelope, lighting, and fan alterations, while the combined SNF results include envelope and fan alterations.

For hospital prototypes, first-year per-unit electricity savings range from 0.58 to 0.69 kWh/yr-ft² and peak demand reductions range from 0.06 to 0.07 W/ft², depending on climate zone. Natural gas impacts range from an increase of 1.36 kBtu/yr-ft² to a savings of 2.13 kBtu/yr-ft². Despite small increases in natural gas consumption in several climate zones due primarily to reduced internal heat gains from lighting retrofits, source energy impacts remain positive in nearly all climate zones, ranging from -0.08 to 2.87 kBtu/yr-ft². Total 30-year LSC savings range from 4.91 to 7.12 2029 PV$ per square foot.

For SNF prototypes, first-year per-unit electricity savings range from 0.11 to 0.23 kWh/yr-ft² and peak demand reductions range from 0.01 to 0.04 W/ft², depending on climate zone. Natural gas impacts range from an increase of 0.19 kBtu/yr-ft² to a savings of 4.72 kBtu/yr-ft², while source energy impacts range from 0.00 to 4.30 kBtu/yr-ft². Total 30-year LSC savings range from 1.62 to 5.07 2029 PV$ per square foot.

Overall, the combined alteration package provides positive lifecycle cost savings across all climate zones for both hospital and SNF prototypes, with the largest benefits generally occurring in colder climate zones where envelope improvements provide additional heating-energy savings.

Table 78: Energy and Energy Cost Savings – Per Square Foot – Combined Alterations– Hospitals

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	0.58	0.07	2.13	2.87	7.01
2	0.6	0.07	0.72	1.64	6.02
3	0.58	0.06	0.94	1.8	5.91
4	0.65	0.07	1.09	2	6.72
5	0.6	0.06	1.1	1.94	6.1
6	0.6	0.07	-0.31	0.75	5.11
7	0.6	0.06	-0.53	0.55	4.91
8	0.64	0.07	-0.4	0.67	5.21
9	0.63	0.07	-0.05	0.98	5.55
10	0.63	0.07	-0.48	0.61	5.1
11	0.63	0.07	0.4	1.42	6.13
12	0.62	0.07	0.39	1.37	5.85
13	0.63	0.07	-0.29	0.79	5.36
14	0.64	0.07	0.41	1.43	6.11
15	0.69	0.07	-1.36	-0.08	5.03
16	0.61	0.07	1.85	2.65	7.12

Table 79: Energy and Energy Cost Savings – Per Square Foot – Combined Alterations– SNF

Climate Zone	First Year Electricity Savings (kWh)	First Year Peak Demand Reduction (Watts)	First Year Natural Gas Savings (kBtu)	First Year Source Energy Savings (kBtu)	Total 30-Year LSC Savings (2029 PV$)
1	0.11	0.02	4.72	4.3	5.07
2	0.11	0.02	1.69	1.63	2.42
3	0.11	0.02	3.27	3.01	3.87
4	0.23	0.04	2.86	2.74	4.42
5	0.13	0.02	3.24	3	3.92
6	0.13	0.01	1.47	1.4	2.37
7	0.14	0.01	1.08	1.07	2.1
8	0.19	0.02	1.27	1.24	2.55
9	0.21	0.02	2.1	1.99	3.5
10	0.15	0.02	0.9	0.91	1.92
11	0.13	0.02	1.27	1.27	2.3
12	0.12	0.02	1.41	1.39	2.35
13	0.15	0.02	0.68	0.76	1.93
14	0.15	0.02	1.2	1.22	2.29
15	0.21	0.02	-0.19	0	1.62
16	0.12	0.02	2.66	2.49	3.4

5.4.3 Incremental First Cost

Incremental costs associated with healthcare alterations will vary depending on the type and extent of the alteration being performed. By removing the healthcare exception for alterations in the code, healthcare facilities would be subject to code requirements for alterations impacting envelope, lighting, and fans, when accounting for other healthcare exceptions. Specific code provisions that healthcare building alterations would be newly subject to are outlined in Section 5.1.3.

Given the complexity of analyzing costs associated with alterations, the Statewide CASE Team has collected additional stakeholder input from market actors specializing in healthcare buildings. These market actors include design and engineering firms, general contractors, HVAC and controls contractors, manufacturers and others closely involved in building alteration work.

For fenestration, the Statewide CASE Team assumes that performance improvements will result in negligible incremental costs when compared to a less efficient window, as installation and material use is the same, and difference in u-factor values are minor.

Wall and floor insulation is not being analyzed as a new healthcare exemption has been proposed given it is one of the least likely alterations to be implemented.

For lighting, costs will be established for improved LPD, which is assumed to be negligible given the reduced costs of LED technologies. Lighting controls are not analyzed as part of this report and thus costs will not be considered, as healthcare facilities are currently exempt.

For fan alterations, the analysis factors in alterations that trigger improvements in FEI, so costs for those improvements will be collected.

It should be noted that all measures are already required for alterations in other nonresidential building types and previously have been proven cost-effective. As such, changes to healthcare facilities that operate 24/7 will be shown to be cost-effective since upfront costs remain static, but ongoing energy savings increase relative to standard buildings.

The Statewide CASE Team established the break-even cost point for what incremental costs will show cost-effectiveness based on the projected energy cost savings. These maximum costs per system are outlined in Table 80. As a reference point, when the FEI measure was added to Title 24 Part 6 for non-healthcare buildings in the 2022 code cycle in the Air Distribution CASE Report, the team analyzing that measure found an incremental cost of $0.026/sf, demonstrating that the value used in this analysis is extremely conservative.

Regarding the envelope incremental cost, the Statewide CASE Team referenced the Roof Alterations Measure in the 2022 NR High Performance Envelope CASE report. The per unit cost for all buildings ranged from $0.01/sf to $0.11/sf. The Statewide CASE Team referenced the High-Performance Windows Measure in the 2025 NR Envelope CASE report, where the average cost for hospital is $0.03/sf. This demonstrates that the $0.80/sf incremental cost used for this analysis is very conservative.

Finally, regarding the lighting power density incremental cost, the Statewide CASE Team referenced the 2022 Indoor Lighting CASE Report. Table 53 of that report displayed a list of space types and estimated incremental cost for lighting upgrades. On average, the incremental cost per square foot was *negative* $1.11, meaning that the LED measure case was less expensive than the base case. This provides strong evidence that the positive $0.25/sf is a very conservative incremental cost in this report.

Table 80: Incremental Cost Break-even Point across Altered Systems

System	Description	Minimum Costs ($/sf)
Envelope	Roof and fenestration improvements	$0.80
Lighting	LPD reduction	$0.25
Fans	Fan Energy Index	$0.44

5.4.4 Incremental Maintenance and Replacement Costs

Description of the incremental maintenance and replacement costs, as well as estimation of present value of maintenance and replacement costs, are provided in the 2028 CASE Methodology Report.

Incremental maintenance and replacement costs will differ by building system being impacted. For example, building envelope measures like roof insulation and window fenestration general require little maintenance impacted by the proposed code change and have long measure lifetimes, so measure replacement is rare. Windows are typically only replaced when broken and roof insulation can be replaced during a roof membrane replacement. Given the long lifetimes of these measures, this 30-year analysis does not assume any replacement costs. While there is maintenance costs associated with roof care, these are needed regardless of whether the roof is insulated or not.

By using the 2019 code as a baseline, the Statewide CASE Team is comparing like-for-like LED fixtures. LEDs have long lifetimes and will likely be replaced for cosmetic improvements before they need to be replaced due to failure. As such, maintenance cost effects are negligible and are not included.

The analysis models fan alterations that improve FEI. As described in section 2.4.4, maintenance and replacement costs are outweighed by cost savings through improved system awareness and early fault detection.

5.4.5 Cost Effectiveness

Results of the per-unit cost-effectiveness analyses are presented in Table 81 through Table 83 for alterations based on covered systems.

In the tables below, all values are presented in 2029 present value dollars (2029 PV$). Benefits represent 30-year LSC savings and other savings, including incremental first-cost savings if the proposed first cost is less than the current first cost, incremental maintenance cost savings if the proposed maintenance costs are less than the current maintenance costs, and incremental residual value if proposed residual value is greater than current residual value at the end of the 30-year period of analysis. Costs represent the total incremental PV cost, including incremental equipment, replacement, and maintenance costs over the period of analysis. The analysis treats a negative incremental maintenance cost as a positive benefit. If total incremental costs are zero, the BCR is considered infinite. Costs and other savings are discounted at a real (inflation-adjusted) three percent rate. If there are no total incremental PV costs, the BCR is infinite.

Table 81: 30-Year Cost-Effectiveness Summary Per Square Foot – Alterations – Hospital + SNF Envelope

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	3.31	0.50	6.61
2	1.68	0.50	3.37
3	2.18	0.50	4.35
4	2.91	0.50	5.81
5	2.32	0.50	4.63
6	1.07	0.50	2.13
7	0.80	0.50	1.61
8	1.23	0.50	2.46
9	1.79	0.50	3.59
10	0.90	0.50	1.81
11	1.66	0.50	3.32
12	1.54	0.50	3.08
13	1.04	0.50	2.08
14	1.66	0.50	3.32
15	0.72	0.50	1.44
16	2.78	0.50	5.56

Table 82: 30-Year Cost-Effectiveness Summary Per Square Foot – Alterations – Hospital Lighting

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	2.83	2.76	1.03
2	2.81	2.76	1.02
3	2.80	2.76	1.02
4	2.80	2.76	1.02
5	2.78	2.76	1.01
6	2.80	2.76	1.01
7	2.78	2.76	1.01
8	2.77	2.76	1.00
9	2.80	2.76	1.02
10	2.80	2.76	1.01
11	2.83	2.76	1.02
12	2.79	2.76	1.01
13	2.80	2.76	1.02
14	2.85	2.76	1.03
15	2.75	2.76	1.00
16	2.85	2.76	1.03

Table 83: 30-Year Cost-Effectiveness Summary Per Square Foot – Alterations – Hospital + SNF Fans

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	1.23	0.44	2.82
2	1.21	0.44	2.77
3	1.24	0.44	2.85
4	1.21	0.44	2.79
5	1.24	0.44	2.86
6	1.27	0.44	2.91
7	1.31	0.44	3.02
8	1.25	0.44	2.88
9	1.26	0.44	2.89
10	1.25	0.44	2.87
11	1.24	0.44	2.85
12	1.24	0.44	2.84
13	1.26	0.44	2.90
14	1.22	0.44	2.80
15	1.30	0.44	2.98
16	1.14	0.44	2.62

Table 88 and Table 89 present the combined cost-effectiveness results for the alteration measures. For hospital prototypes, total benefits range from 4.77 to 7.37 2029 PV$/ft^2, resulting in benefit-to-cost ratios ranging from 1.29 to 1.99 across climate zones. For SNF prototypes, total benefits range from 1.62 to 5.07 2029 PV$/ft^2, resulting in benefit-to-cost ratios ranging from 1.72 to 5.39 across climate zones. The combined alteration package is cost-effective in all climate zones for both hospital and SNF prototypes.

Table 84: 30-Year Cost-Effectiveness Summary Per Square Foot – Combined Alterations – Hospital

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	7.37	3.7	1.99
2	5.7	3.7	1.54
3	6.22	3.7	1.68
4	6.92	3.7	1.87
5	6.34	3.7	1.71
6	5.14	3.7	1.39
7	4.89	3.7	1.32
8	5.25	3.7	1.42
9	5.85	3.7	1.58
10	4.95	3.7	1.34
11	5.73	3.7	1.55
12	5.57	3.7	1.51
13	5.1	3.7	1.38
14	5.73	3.7	1.55
15	4.77	3.7	1.29
16	6.77	3.7	1.83

Table 85: 30-Year Cost-Effectiveness Summary Per Square Foot – Combined Alterations - SNF

Climate Zone	Benefits LSC Savings + Other PV Savings (2029 PV$)	Costs Total Incremental PV Costs (2029 PV$)	Benefit-to-Cost Ratio
1	5.07	0.94	5.39
2	2.42	0.94	2.57
3	3.87	0.94	4.12
4	4.42	0.94	4.7
5	3.92	0.94	4.17
6	2.37	0.94	2.52
7	2.1	0.94	2.23
8	2.55	0.94	2.71
9	3.5	0.94	3.72
10	1.92	0.94	2.04
11	2.3	0.94	2.45
12	2.35	0.94	2.5
13	1.93	0.94	2.05
14	2.29	0.94	2.44
15	1.62	0.94	1.72
16	3.4	0.94	3.62

5.5 Alterations - Statewide Impacts

5.5.1 Statewide Energy and Energy Cost Savings

See the 2028 CASE Methodology Report for details on how statewide savings are calculated (Statewide CASE Team 2026). Appendix C presents the assumptions on the percentage of the total construction forecast that the proposed measure would impact.

For more details on the methodology and context about estimating the current market share rate, as well as statewide energy and energy cost savings, see the 2028 CASE Methodology Report.

Table 91 presents the combined statewide impacts of the alteration measures. While lighting alterations result in a small increase in heating energy due to reduced internal heat gains, the combined alteration package provides positive statewide electricity savings, source energy savings, and lifecycle cost savings. Statewide first-year electricity savings are estimated at 8.30 GWh, with peak electrical demand reductions of

0.95 MW, source energy savings of 18.81 million kBtu, and 30-year present-valued-lifecycle cost savings of approximately &78.54 million (2029 PV$).

The impacted square footage is not summed in Table 91 because the same building area may be affected by multiple alteration measures. Energy, demand, source energy, and LSC savings are summed across Table 86 and Table 88 by climate zone.

Table 86 through Table 88 present the statewide impacts of the proposed alteration requirements for envelope, lighting, and fan systems. Statewide first-year electricity savings are estimated at 0.18 GWh for envelope alterations, 4.27 GWh for lighting alterations, and 3.85 GWh for fan alterations. Combined, the three measures are projected to provide approximately $78.54 million in 30-year present-valued lifecycle cost savings (2029 PV$).

Table 91 presents the combined statewide impacts of the alteration measures. While lighting alterations result in a small increase in heating energy due to reduced internal heat gains, the combined alteration package provides positive statewide electricity savings, source energy savings, and lifecycle cost savings. Statewide first-year electricity savings are estimated at 8.30 GWh, with peak electrical demand reductions of 0.95 MW, source energy savings of 18.81 million kBtu, and 30-year present-valued lifecycle cost savings of approximately $78.54 million (2029 PV$).

The impacted square footage is not summed in Table 91 because the same building area may be affected by multiple alteration measures. Energy, demand, source energy, and LSC savings are summed across Table 86 and Table 88 by climate zone.

Table 86: Statewide Energy and LSC Impacts – Alterations – Hospital + SNF Envelope

Climate Zone	Statewide Alterations Impacted by Proposed Change in 2029 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	59,940	0	0	0	0.21	$0.20
2	356,100	0	0	0.01	0.6	$0.60
3	1,528,500	0.04	0	0.04	3.57	$3.33
4	778,500	0.05	0.01	0.02	1.83	$2.26
5	164,940	0	0	0	0.4	$0.38
6	925,500	-0.01	0	0.01	1	$0.99
7	884,100	-0.01	0	0.01	0.72	$0.71
8	1,336,200	0.05	0	0.02	1.27	$1.64
9	2,186,700	0.08	0.01	0.04	3.08	$3.92
10	1,254,300	0.02	0	0.01	0.97	$1.13
11	345,900	0.01	0	0.01	0.48	$0.57
12	1,674,300	0.01	0.01	0.03	2.37	$2.58
13	729,600	0.01	0	0.01	0.58	$0.76
14	278,580	0.01	0	0	0.38	$0.46
15	145,050	0.01	0	0	0	$0.10
16	102,030	0	0	0	0.26	$0.28
Total	**12,750,240**	**0.18**	**0.04**	**0.21**	**17.71**	**$19.93**

Table 87: Statewide Energy and LSC Impacts – Alterations – Hospital Lighting

Climate Zone	Statewide Alterations Impacted by Proposed Change in 2029 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	44,955	0.02	0	0	-0.01	$0.13
2	267,075	0.12	0.01	0	-0.1	$0.75
3	1,146,375	0.51	0.06	-0.02	-0.47	$3.21
4	583,875	0.26	0.03	-0.01	-0.22	$1.64
5	123,705	0.06	0.01	0	-0.05	$0.34
6	694,125	0.31	0.04	-0.01	-0.3	$1.94
7	663,075	0.3	0.03	-0.01	-0.29	$1.84
8	1,002,150	0.45	0.05	-0.01	-0.39	$2.77
9	1,640,025	0.74	0.08	-0.02	-0.59	$4.60
10	940,725	0.42	0.05	-0.01	-0.34	$2.63
11	259,425	0.12	0.01	0	-0.09	$0.73
12	1,255,725	0.56	0.06	-0.02	-0.48	$3.51
13	547,200	0.24	0.03	-0.01	-0.2	$1.53
14	208,935	0.09	0.01	0	-0.07	$0.60
15	108,788	0.05	0.01	0	-0.05	$0.30
16	76,523	0.03	0	0	-0.02	$0.22
Total	**9,562,680**	**4.27**	**0.49**	**-0.13**	**-3.66**	**$26.75**

Table 88: Statewide Energy and LSC Impacts – Alterations – Hospital + SNF Fans

Climate Zone	Statewide Alterations Impacted by Proposed Change in 2029 (Square Feet)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	119,880	0.02	0	0	0.02	$0.15
2	712,200	0.1	0.01	0	0.13	$0.86
3	3,057,000	0.46	0.05	0	0.58	$3.78
4	1,557,000	0.23	0.03	0	0.27	$1.89
5	329,880	0.05	0.01	0	0.06	$0.41
6	1,851,000	0.28	0.03	0	0.34	$2.34
7	1,768,200	0.28	0.03	0	0.36	$2.32
8	2,672,400	0.41	0.04	0	0.47	$3.35
9	4,373,400	0.66	0.07	0	0.81	$5.50
10	2,508,600	0.38	0.04	0	0.45	$3.13
11	691,800	0.1	0.01	0	0.13	$0.86
12	3,348,600	0.5	0.05	0	0.65	$4.14
13	1,459,200	0.22	0.02	0	0.3	$1.84
14	557,160	0.08	0.01	0	0.1	$0.68
15	290,100	0.05	0	0	0.06	$0.38
16	204,060	0.03	0	0	0.03	$0.23
Total	**25,500,480**	**3.85**	**0.42**	**-0.02**	**4.76**	**$31.86**

Table 89: Statewide Energy and LSC Impacts – Combined Alterations – Hospital + SNF

Climate Zone	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction	First-Year Natural Gas Savings (Million Therms)	First-Year Source Energy Savings (Million kBtu)	30-Year Present Valued LSC Savings (Million 2029 PV$)
1	0.04	0	0	0.22	$0.48
2	0.22	0.02	0.01	0.63	$2.21
3	0.93	0.11	0.02	3.68	$10.32
4	0.54	0.07	0.01	1.88	$5.79
5	0.11	0.02	0	0.41	$1.13
6	0.58	0.07	0	1.04	$5.27
7	0.57	0.06	0	0.79	$4.87
8	0.91	0.09	0.01	1.35	$7.76
9	1.48	0.16	0.02	3.3	$14.02
10	0.82	0.09	0	1.08	$6.89
11	0.23	0.02	0.01	0.52	$2.16
12	1.07	0.12	0.01	2.54	$10.23
13	0.47	0.05	0	0.68	$4.13
14	0.18	0.02	0	0.41	$1.74
15	0.11	0.01	0	0.01	$0.78
16	0.06	0	0	0.27	$0.73
Total	**8.3**	**0.95**	**0.06**	**18.81**	**$78.54**

5.5.2 Statewide Greenhouse Gas Emissions Reductions

Table 90 presents the estimated first-year reduction in GHG emissions resulting from the proposed code change. In this initial year, the Statewide CASE Team expects to avoid approximately 1,038 metric tons of carbon dioxide equivalent (CO_2e) emissions. These reductions, along with their associated monetary value, were calculated using hourly GHG emissions factors published alongside the LSC hourly factors and source energy hourly factors in the research versions of CBECC, as well as data from the CEC's 2028 Metrics Report. See the 2028 CASE Methodology Report for additional information.

Table 90: First-Year Statewide GHG Emissions Impacts – Alterations Submeasures (Hospital + SNF combined)

Construction Type	Reduced GHG Emissions from Electricity Savings (Metric Tons CO2e)	Reduced GHG Emissions from Natural Gas Savings (Metric Tons CO2e)	Total Reduced GHG Emissions (Metric Ton CO2e)	Total Monetary Value of Reduced GHG Emissions ($)
Envelope	-19	1,100	1,081	175,578
Lighting	395	-678	-283	-45,955
Fans	330	-89	240	39,037
Total	**706**	**333**	**1,038**	**168,660**

5.5.3 Statewide Water Use Impacts

The proposed code change will not result in water use impacts.

5.5.4 Statewide Material Impacts

As previously described, healthcare building systems subject to alteration requirements include modifications envelope, lighting, and mechanical systems. Some of these modifications will result in greater material use, while other changes, such as reductions in lighting power density (LPD), will result in fewer materials. To derive material impacts for each building system resulting from this proposed code change when moving from a 2019 baseline to 2025 Title 24, Part 6 requirements, the Statewide CASE Team used material impact analyses from recent CASE Reports.

Lighting

As specified in Section 601.5.2 *[141.0(b)],* alterations of indoor lighting systems that affect more than 10 percent of luminaires serving an enclosed space are subject to new LPD requirements. The *2022 Nonresidential Indoor Lighting CASE Report* proposed new LPD values for LEDs from a 2019 code baseline. LPD values have not changed since the 2022 update, so the Statewide CASE Team will use these results to demonstrate material impacts. As noted in that report, reduced LPD values also result in a reduction in material use (Lerner, et al. 2020).

Table 91: First-Year Statewide Impacts on Material Use - Lighting

Material	Impact	Per-Unit Impacts (Pounds per Unit)
Antimony	D	3.3 x 10-4
Barium	D	9.6 x 10-4
Cerium	D	2.0 x 10-5
Chromium	D	3.2 x 10-4
Copper	D	8.3 x 10-2
Gallium	D	2.8 x 10-4
Iron	D	3.2 x 10-2
Lead	D	4.5 x 10-5
Nickel	D	4.0 x 10-4
Phosphorus	D	3.4 x 10-4
Silver	D	4.2 x 10-4
Zinc	D	1.2 x 10-2
TOTAL	**N/A**	**N/A**

Envelope

While certain modifications to envelope components will trigger energy code requirements in Title 24, not all changes will impact materials. Updates to fenestration will result in improved u-factor requirements, but this will not result in any additional materials given the window materials and installation are the same.

For opaque assemblies, roof alterations are the most common opaque assembly that is altered given the need to replace or recover roofing materials several times over the life of a building. Moving from the roof insulation as specified in Table 141.0-C in the 2019 code to 2025 levels will increase overall insulation materials, which may be foam, mineral wool, or other materials. To determine statewide material impacts from increased roof insulation, the Statewide CASE Team:

1. Determined the average weight of a typical 4x8' sheet of insulation meeting 2019 and 2025 insulation levels, as shown in Table 69, averaged across all climate zones.
2. Subtracted the relative material weight from 2019 levels to determine the per-unit impact.
3. Multiplied the per-unit impact by the total roof area of existing hospitals likely to replace a roof in any given year.

Table 92: First-Year Statewide Impacts on Material Use – Roof Insulation

Material	Impact	Per-Unit Impacts (Pounds per Unit)	First-Year Statewide Impacts (Pounds)	Embodied GHG Emissions Saved (Metric Tons CO2e)
Insulation	I	0.439	892,259	-990

Aside from increased insulation materials, no additional materials would likely be impacted. An increase in wall or floor insulation is not modeled given a new healthcare exemption would be added.

Fans

Updating FEI is not expected to result in material impacts.

For more information on the Statewide CASE Team's methodology and assumptions used to calculate embodied GHG emissions, see the 2028 CASE Methodology Report.

5.5.5 Environmental Impacts

This measure reduces energy use and overall emissions from hospitals across California and does not result in any adverse environmental effects. Statewide emissions impacts from this change are summarized in Table 90.

5.5.6 Other Non-Energy Impacts

Healthcare alterations that implement efficiency measures, such as increased levels of insulation, more efficient space conditioning systems and enhanced controls, or lighting retrofits have the potential to improve occupant comfort. In a hospital environment, occupant comfort can dramatically improve the experience for the patient and improve their overall well-being.

5.6 Alterations - Proposed Language Code

5.6.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents should be marked with dark blue underlining (new language) and ~~strikethroughs~~ (deletions). New to the 2028 energy code is to italicize defined terms when the terms are being used in its defined context. In-line comments that are not part of the proposed code language but are used to help describe the purpose of what is proposed are included with greyed highlight and italics.

Markups are provided to the restructured 2025 Energy Code that the CEC developed in response to feedback that aligning the structure of Title 24, Part 6 with other parts of the California Building Standards Code (Title 24) would improve readability, usability, and navigation.8 New section numbers are shown as bold followed square brackets that document the section in the 2025 Title 24, Part 6 section numbers prior to the restructuring. For example, "Section 601.1 [Section 130.0(a)] General" contains the content that is in the current Section 130.0(a).

Posting the proposed code language in this format is useful as it helps describe how the Energy Code changes proposed for nonresidential occupancies are isolated from the requirements for residential occupancies which are prohibited from being changed until the 2031 code cycle by Assembly Bill 130.

5.6.2 Administrative Code (Title 24, Part 1)

There are no proposed changes to Title 24, Part 1.

5.6.3 Energy Code (Title 24, Part 6)

SUBCHAPTER 3 ENVELOPE

SECTION 301.5.2 *[SECTION 141.0]* – Alterations

Alterations to components of existing *nonresidential* (including *HCAI Facilities*), *hotel/motel*, or *relocatable public school buildings*, including *alterations* made in conjunction with a change in *building occupancy* to a *nonresidential,* or *hotel/motel occupancy* shall meet mandatory requirements of Section 301.5.2.1, and either prescriptive requirements of Section 301.5.2.2 or performance requirements of Section 301.5.2.3.

~~**Exception to Section 301.5.2:** *Alterations* to *healthcare facilities* are not required to comply with this Section.~~

301.5.2.1. *[141.0(b)1]* **Mandatory Requirements (Alterations)**.

Altered components in a *nonresidential*, or *hotel/motel building* shall meet the requirements specified in the sections listed below that are applicable to the *building* project and the minimum requirements in Sections 301.5.2.1.1 through 301.5.2.1.4.

Covered process requirements for *alterations*, and *repairs* to existing *nonresidential*, and *hotel/motel buildings* are specified in Subchapter 9 *[Section 141.1]*.

101 *[Section 100.0 (h), 110.0, 110.1, 110.5]* Systems and Equipment

300.1, 300.2, 300.3, 301.1, 301.2 *[Section 110.6, 110.7, 110.8, 120.0, 120.7]* Mandatory Requirements for Envelopes.5.6.4

301.5.2.1.1 *[141.0(b)1A].* **Roof/Ceiling Insulation.** The opaque portions of the *roof*/ceiling that separate *conditioned spaces* from *unconditioned spaces* or ambient air shall meet the requirements of Section 301.5.2.2.3 *[141.0(b)2Bii].*

Exception to Section 301.5.2.1.1: Alterations to *healthcare facilities* other than *HCAI facilities.*

301.5.2.1.2 *[141.0(b)1B].* **Wall Insulation.** For the altered opaque portion of walls separating *conditioned spaces* from *unconditioned spaces* or ambient air shall meet the applicable requirements of Items 1 through 4 below:

1. **Metal Building.** A minimum of R-13 insulation between framing members, or the area-weighted average *U-factor* of the wall assembly shall not exceed U-0.113.

2. **Metal Framed.** A minimum of R-13 insulation between framing members, or the area-weighted average *U-factor* of the wall assembly shall not exceed U-0.217.

3. **Wood Framed and Others.** A minimum of R-11 insulation between framing members, or the area-weighted average *U-factor* of the wall assembly shall not exceed U-0.110.

4. **Spandrel Panels and Glass Curtain Walls.** A minimum of R-4, or the area-weighted average *U-factor* of the wall assembly shall not exceed U-0.280.

Exception 1 to Section 301.5.2.1.2: Light and heavy mass walls.

Exception 2 to Section 301.5.2.1.2: Alterations to *healthcare facilities*.

301.5.2.1.3 *[141.0(b)1C].* **Floor Insulation.** For the altered portion of *raised floors* that separate *conditioned spaces* from *unconditioned spaces* or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. **Raised Framed Floors.** A minimum of R-11 insulation between framing members, or the area-weighted average *U-factor* of the floor assembly shall not exceed the *U-factor* of U-0.071.

2. **Raised Mass Floors in Hotel/Motel Guest Rooms.** A minimum of R-6 insulation, or the area-weighted average *U-factor* of the floor assembly shall not exceed the *U-factor* of U-0.111.

3. **Raised Mass Floors in Other Occupancies.** No minimum *U-factor* requirement.

Exception to Section 301.5.2.1.3: Alterations to *healthcare facilities*.

301.5.2.1.4 *[Section 141.0(b)1E]* **Exterior windows.**

Fenestration alterations other than *repairs* shall meet the following requirements:

1. **Vertical fenestration alterations**. Where over 150 square feet of the entire building's vertical fenestration is replaced, the maximum U-factor of the replaced units shall not exceed U-0.58.

2. **Added vertical fenestration**. Where over 50 square feet of vertical fenestration is added, it shall meet the requirements of Section 301.2.4 [Section 120.7(d)]. Where 50 square feet or less of vertical fenestration is added, this requirement shall not apply.

Exception to Section 301.5.2.1.4: Alterations to *healthcare facilities* other than *HCAI facilities.*

301.5.2.2 *[Section 141.0(b)2]* **Prescriptive requirements (Alterations).**

301.5.2.2.1 *[Section 141.0(b)2A]* **Fenestration.**
Fenestration alterations other than *repair* shall meet the requirements below:

Exception to Section 301.2.2.1: Alterations to healthcare facilities.

…

301.5.2.2.2 *[Section 141.0(b)2Bi]* **Roofing products.**

Existing *roofs* of a *nonresidential* or *hotel/motel building* being replaced, recovered or recoated, as defined in Section 201 *[Section 100.1(b)]* and Title 24, Part 2, Chapter 2, shall meet the requirements of Section 300.3.7 *[Section 110.8(i)]*. When a *roof* with more than 50 percent of the *roof* area or more than 2,000 square feet of *roof*, whichever is less, is being altered, *roofing products* shall comply with requirements in Sections 301.3.1.1 and 301.3.1.2 *[Section 140.3(a)1A]*.

Exception 1 to Section 301.5.2.2.2: An aged solar reflectance less than 0.63 is allowed for *low-sloped roofs* provided the maximum *roof*/ceiling *U-factor* in Table 301.5-B *[TABLE 141.0-B]* is not exceeded.

Exception 2 to Section 301.5.2.2.2: *Roof* area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not required to meet the minimum requirements for solar reflectance, thermal emittance, or *SRI*.

Exception 3 to Section 301.5.2.2.2: *Roof* constructions with a weight of at least 25 lb/ft² are not required to meet the minimum requirements for solar reflectance, thermal emittance, or *SRI*.

Exception 4 to Section 301.5.2.2.2: Existing *roofs* being replaced, recovered or recoated on *healthcare facilities* other than *HCAI facilities.*

…

301.5.2.2.3 *[Section 141.0(b)2Bii]* **Roof/ceiling insulation.**

When a *low-sloped roof* with more than 50 percent of the *roof* area or more than 2,000 square feet of *roof*, whichever is less, is being altered, the area of the *roof recover* or *roof replacement* shall be insulated to the level specified in Table 301.5-C *[Table 141.0-C]*.

Exception 1 to Section 301.5.2.2.3: *Roof recovers* with new R-10 insulation added above deck do not need to be insulated to the level specified in **Table 301.5-C** *[Table 141.0-C]*.

Exception 2 to Section 301.5.2.2.3: When existing mechanical *equipment* located on the *roof* will not be disconnected and lifted, insulation added is the greater of R-10 or the maximum installed thickness that will allow the distance between the height of the *roof* membrane surface to the top of the base flashing to remain in accordance with the manufacturer's instructions.

Exception 3 to Section 301.5.2.2.3: At the drains and other low points, tapered insulation with a *thermal resistance* less than that prescribed in Table 301.5-C *[Table 141.0-C]* may be used, provided that insulation thickness is increased at the high points of the *roof* so that the average *thermal resistance* equals or exceeds the value specified in Table 301.5-C *[Table 141.0-C]*.

Exception 4 to Section 301.5.2.2.3: The area of the *roof* recoat is not required to be insulated.

Exception 5 to Section 301.5.2.2.3: *Roof* alterations on *healthcare facilities* other than *HCAI facilities*.

…

301.5.2.2.4 *[Section 141.0(b)2O]* **Minimum daylighting requirement for large enclosed spaces.**

A *building* shell for which interior walls or ceilings are installed for the first time shall meet the requirements of Section 301.3.10 *[Section 140.3(c)]*.

Exception to Section 301.5.2.2.4: Alterations to *Healthcare facilities*.

301.5.2.2.5 *[Section 141.0(b)2Q]* **Air barrier.**

Existing *building envelope* wall where at least 25% or more of the wall area is being altered must comply with Section 301.3.7 *[Section 140.3(a)9]*. Where the *building* is tested in accordance with the procedures for whole *building* air leakage in NA5.1 and the tested leakage rate exceeds 0.4 cfm/ft^2 of *building* shell at 75 pa. A Visual Inspection and Diagnostic Evaluation shall be done in accordance with NA5.7 and all observed leaks shall be sealed where such sealing can be made without destruction of existing *building* components.

Exception to Section 301.5.2.2.5: Alterations to *Healthcare facilities*.

301.5.2.2.6 *[Section 141.0(b)2R]* **Exterior doors.**

Alterations that add exterior *door area* shall meet the *U-factor* requirements of Section 301.3.6 *[Section 140.3(a)7]*.

Exception to Section 301.5.2.2.6: Alterations to *Healthcare facilities*.

SUBCHAPTER 4 SPACE CONDITIONING AND VENTILATION

SECTION 401.5.2 *[SECTION 141.0(b)]* **- Alterations**

Alterations to components of existing *nonresidential*, *hotel/motel*, or *relocatable public school buildings*, including *alterations* made in conjunction with a change in *building occupancy* to a *nonresidential, high-rise residential*, or *hotel/motel occupancy* shall meet mandatory requirements of Section 401.5.2.1, and either prescriptive requirements of Section 401.5.2.2 or performance requirements of Section 401.5.2.3.

~~**Exception 1 to Section 401.5.2:** *Alterations* to *healthcare facilities* are not required to comply with this Section.~~

401.5.2.1 *[Section 141.0(b)1]* **Mandatory requirements (Alterations).**

401.5.2.1.1 *Altered components* in a *nonresidential*, or *hotel/motel building* shall meet the requirements specified in the sections listed below that are applicable to the *building* project and the minimum requirements in Section 401.5.2.1.1.

Covered process requirements for *alterations*, and *repairs* to existing *nonresidential*, and *hotel/motel buildings* are specified in Subchapter 9 *[Section 141.1]*.

101 *[Section 100.0(h), 110.0, 110.1, 110.5]* Systems and Equipment
400.2, 400.3, 400.4.4, 400.5, 401.1, 401.2 *[Section 110.2, 110.5, 110.8(d)3, 120.0 through 120.5, 120.9, 120.10]* Mandatory Requirements for HVAC Systems
400.6 *[Section 110.12]* Mandatory Requirements for Demand Management

Exception 1 to Section 401.5.2.1.1: The requirements of Section 401.2.2.9 *[Section 120.2(i)]* shall not apply to *alterations* of *space-conditioning systems* or components.

Exception 2 to Section 401.5.2.1.1: Alterations to *Healthcare facilities*.

401.5.2.1.~~1~~2 *[Section 141.0(b)1D]* **Fan Energy Index.**
New *fan systems* serving an existing *building* shall meet the requirements of Section 401.2.6 *[Section 120.10]*.

Exception to Section 401.5.2.1.2: Alterations to *Healthcare facilities* other than *HCAI facilities*.

401.5.2.2 *[141.0(b)2]*. Prescriptive requirements (Alterations).

…

Exception to Section 401.5.2.2*:* Alterations to *Healthcare facilities.*

…

SUBCHAPTER 6 ELECTRICAL AND LIGHTING

SECTION 601.5.2 *[SECTION 141.0(b)]* **- Alterations**

601.5.2 *[Section 141.0(b)]* **Alterations.**

Alterations to components of existing *nonresidential*, *hotel/motel*, or *relocatable public school buildings*, including *alterations* made in conjunction with a change in *building occupancy* to a *nonresidential, high-rise residential*, or *hotel/motel occupancy* shall meet mandatory requirements of Section 601.5.2.1, and either prescriptive requirements of Section 601.5.2.2 or performance requirements of Section 601.5.2.3.

~~***Exception to Section 601.5.2:*** *Alterations to healthcare facilities are not required to comply with this Section.*~~

601.5.2.1 *[Section 141.0(b)1]* **Mandatory requirements (Alterations).**

Altered components in a *nonresidential*, or *hotel/motel building* shall meet the requirements specified in the sections *listed* below that are applicable to the *building* project.

Covered process requirements for *alterations*, and *repairs* to existing *nonresidential*, and *hotel/motel buildings* are specified in Subchapter 9 *[Section 141.1]*.

101.1, 101.2, 101.3 *[Section 100.0(h), 110.0, 110.1]* Systems and Equipment

600.2, 601.2 *[Section 110.9, 130.0 through 130.5]* Mandatory Requirements for Electrical and Lighting Systems

Exception to Section 601.5.2.1: Alterations to *Healthcare facilities* other than *HCAI facilities* that are triggered by Section 601.5.2.2.1 or Section 601.5.2.2.4.

601.5.2.2 *[Section 141.0(b)2]* **Prescriptive requirements (Alterations).**

601.5.2.2.1 *[Section 141.0(b)2F]* **Spaces with lighting systems installed for the first time.**

Spaces with *lighting* systems installed for the first time shall meet the requirements of Sections 600.2.1 *[Section 110.9]*, 601.1.1 through 601.2.3 *[Sections 130.0, 130.1, 130.2]*, 601.2.5 *[Section 130.4]*, 301.3.10 *[Section 140.3(c)]*, 601.3.1 *[Section 140.6]* and 601.3.2 *[Section 140.7]*.

Exception to Section 601.5.2.2.1: Alterations to *Healthcare facilities* other than *HCAI facilities*.

601.5.2.2.2 *[Section 141.0(b)2G]* **Addition of skylights to an existing building.**

When the requirements of Section 601.2.2.4 *[Section 130.1(d)]* are triggered by the addition of *skylights* to an existing *building* and the *lighting* system is not recircuited, the daylighting control need not meet the multilevel requirements in Section 601.2.2.4 *[Section 130.1(d)]*.

Exception to Section 601.5.2.2.2: Alterations to *Healthcare facilities* other than *HCAI facilities*.

601.5.2.2.3 *[Section 141.0(b)2H]* **New illuminated signs.**

New *internally and externally illuminated signs* shall meet the requirements of Sections 600.2.1 *[Section 110.9]*, 601.2.4 *[Section 130.3]* and 601.3.3 *[Section 140.8]*.

Exception to Section 601.5.2.2.3: Alterations to *Healthcare facilities*.

601.5.2.2.4 *[Section 141.0(b)2I]* **Altered indoor lighting systems.**

Alterations to indoor *lighting* systems that include 10% or more of the *luminaires* serving an *enclosed space* shall meet the requirements of 1, 2, or 3 below:

1. **Comply with Section 601.3.1 and Table 601.5-A.** The *alteration* shall comply with the indoor lighting power requirements specified in Section 601.3.1 *[Section 140.6]* and the *lighting* control requirements specified in Table 601.5-A *[Table 141.0-F]*;
2. **80% of power requirements and Table 601.5-A.** The *alteration* shall not exceed 80% of the indoor lighting power requirements specified in Section 601.3.1 *[Section 140.6]*, and shall comply with the lighting control requirements specified in Table 601.5-A *[Table 141.0-F]*; or

3. **One-for-one luminaire alteration.** The *alteration* shall be a one-for-one *luminaire alteration* within a *building* or *tenant space* of 5,000 square feet or less, the total wattage of the altered *luminaires* shall be at least 40% lower compared to their total pre-alteration wattage, and the *alteration* shall comply with the lighting control requirements specified in Table 601.5-A *[Table 141.0-F]*.

Alterations to indoor *lighting* systems shall not prevent the operation of existing, unaltered controls, and shall not alter controls to remove functions specified in Section 601.2.2 *[Section 130.1]*.

Alterations to *lighting* wiring are considered *alterations* to the *lighting* system. *Alterations* to indoor *lighting* systems are not required to separate existing general, floor, wall, display, or *decorative lighting* on shared circuits or controls. New or completely replaced lighting circuits shall comply with the control separation requirements of Section 601.2.2.1.3 *[Section 130.1(a)3]*.

Exception 1 to Section 601.5.2.2.4: *Alteration* of portable *luminaires*, *luminaires* affixed to moveable partitions, or *lighting* excluded as specified in Section 601.3.1.1.3 *[Section 140.6(a)3]*.

Exception 2 to Section 601.5.2.2.4: Any *enclosed space* with only one *luminaire*.

Exception 3 to Section 601.5.2.2.4: Any *alteration* that would directly cause the disturbance of asbestos unless the *alteration* is made in conjunction with asbestos abatement.

Exception 4 to Section 601.5.2.2.4: Acceptance testing requirements of Section 601.2.5 *[Section 130.4]* are not required for *alterations* where lighting controls are added to control 20 or fewer *luminaires*.

Exception 5 to Section 601.5.2.2.4: Any *alteration* limited to adding lighting controls or replacing *lamps*, ballasts, or *drivers*.

Exception 6 to Section 601.5.2.2.4: One-for-one *luminaire alteration* of up to 50 *luminaires* either per complete floor of the *building* or per complete *tenant space*, per annum.

Exception 7 to Section 601.5.2.2.4: Alterations to *Healthcare facilities* other than *HCAI facilities*.

TABLE 601.5-A [Table 141.0-F] – CONTROL REQUIREMENTS FOR INDOOR LIGHTING SYSTEM ALTERATIONS

Control Specifications	Coded Section	Projects complying with Section 601.5.2.2.4 item 1	Projects complying with 601.5.2.2.4. item 2 or 3
Manual Area Controls	601.2.2.1.1 *[130.1(a)1]*	Required	Required
Manual Area Controls	601.2.2.1.2 *[130.1(a)2]*	Required	Required
Manual Area Controls	601.2.2.1.3 *[130.1(a)3]*	Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multilevel Controls	601.2.2.2 *[130.1(b)]*	Required[1]	Not Required[1]
Automatic Shut-Off Controls	601.2.2.3.1 *[130.1(c)1]*	Required[1]	Required[1]
Automatic Shut-Off Controls	601.2.2.3.2 *[130.1(c)2]*	Required[1]	Required[1]
Automatic Shut-Off Controls	601.2.2.3.3 *[130.1(c)3]*	Required[1]	Required[1]
Automatic Shut-Off Controls	601.2.2.3.4 *[130.1(c)4]*	Required[1]	Required[1]
Automatic Shut-Off Controls	601.2.2.3.5 *[130.1(c)5]*	Required[1]	Required[1]
Automatic Shut-Off Controls	601.2.2.3.6 *[130.1(c)6]*	Required[1]	Required; except for 601.2.2.3.6.4 *[130.1(c)6D]*[1]
Automatic Shut-Off Controls	601.2.2.3.7 *[130.1(c)8]*	Required[1]	Required[1]
Daylight Responsive Controls	601.2.2.4 *[130.1(d)]*	Required	Not Required
Demand Responsive Controls	600.4.1 *[110.12(a)]* and 600.4.2 *[110.12(c)]*	Required[1]	Not Required[1]

Footnote to Table 601.5-A:

1. Not required for projects in *HCAI facilities*.

…

601.5.2.2.5 *[Section 141.0(b)2L]* **Altered outdoor lighting systems.**

Alterations to existing *outdoor lighting* systems in a *lighting* application listed in Table 601.3-D or Table 601.3-E *[TABLE 140.7-A or 140.7-B]* shall meet the applicable requirements of Section 601.1, Section 601.2.1 and 601.2.2 *[Section 130.0]*, Section 601.2.3.1 *[Section 130.2(b)]*, and Section 601.2.5 *[130.4]*.

Exception 1 to Section 601.5.2.2.5: Acceptance testing requirements of Section 601.2.5 *[130.4]* **are not required for *alterations* where controls are added to 20 or fewer *luminaires*.**

Exception 2 to Section 601.5.2.2.5: Alterations to *Healthcare facilities*.

…

601.5.2.2.6 *[Section 141.0(b)2M]* **Altered illuminated signs.**

Alterations to existing *internally and externally illuminated signs* that increase the connected lighting load, replace and rewire more than 50 percent of the ballasts, or relocate the *sign* to a different location on the same site or on a different site shall meet the requirements of Section 601.3.3 *[Section 140.8]*.

Exception 1 to Section 601.5.2.2.6: Replacement of parts of an existing *sign*, including replacing *lamps*, the *sign* face or ballasts, that do not require rewiring or that are done at a time other than when the *sign* is relocated, is not an *alteration* subject to the requirements of Section 601.5.2.2.6 *[Section 141.0(b)2M]*.

Exception 2 to Section 601.5.2.2.6: Alterations to *Healthcare facilities*.

601.5.2.2.7 *[Section 141.0(b)2P]* **Altered electrical power distribution systems.**

Alterations to *electrical power distribution systems* shall meet the applicable requirements of Section 601.2.6 *[Section 130.5]* as follows:

Exception to Section 601.5.2.2.7: Alterations to *Healthcare facilities*.

…

5.6.4 Reference Appendices

There are no proposed changes to the Reference Appendices.

5.6.5 Compliance Manuals

The Statewide CASE Team will provide the CEC with recommended revisions to compliance manuals after the 45-Day Language is published.

5.6.6 ACM Reference Manual

By removing exceptions from alterations sections to the energy code, the need for a robust performance pathway for healthcare facilities would be elevated. As discussed in Appendix F, the Statewide CASE Team recommends updates to the hospital prototype and a new SNF prototype to align with standard practices. These updates necessitate corresponding revisions to the ACM Reference Manual that are presented in the appendix.

5.6.7 Compliance Forms

As discussed in Section, the NRCC-ENV-E and NRCI- ENV-E Envelope Component Approach, NRCC-LTI-E and NRCI-LTI-E Indoor Lighting, NRCC-MCH-E and NRCI-MCH-E Mechanical Systems compliance forms would be updated to reflect the proposed change. The Statewide CASE Team can support the CEC in implementing these updates if the proposed change is adopted.

6. Economic and Fiscal Impacts

The Statewide CASE Team does not anticipate that the economic impacts associated with the proposed measure would lead to a significant change (increase or decrease) in investment, directly or indirectly, in any affected sectors of California's economy. The proposed change would not result in economic disruption to any sector of the California economy. For more information on the Statewide CASE Team's economic and fiscal impacts methodology, see the 2028 CASE Methodology Report.

Adoption of this code change proposal would result in relatively modest economic impacts through the additional direct spending by those in the commercial building industry, architects, energy consultants, and building inspectors. The Statewide CASE Team does not anticipate that money saved by commercial building owners or other organizations affected by the proposed 2028 code cycle regulations would result in additional spending by those businesses.

6.1 Effects on the State General Fund, State Special Funds, and Local Governments

The Statewide CASE Team does not expect the proposed code changes to have a measurable impact on California's General Fund, any state special funds, or local government funds.

Cost to State: The state government already has a budget for code development, education, and compliance enforcement. While the state government would be allocating resources to update the Title 24, Part 6 Standards, including updating education and compliance materials and responding to questions about the revised requirements, these activities are already covered by existing state budgets. The costs for the state government are small when compared to the overall cost savings and policy benefits associated with the code change proposals. The proposal will impact healthcare facilities owned and operated by the state, resulting in cost savings over the 30-year period of analysis.

There is no expected effect on the state General Fund or state specific funds related to the University of California (UC) system. The UC system includes six major academic health centers, encompassing at least 12 hospitals and thousands of healthcare clinics that own or operate as a self-supporting enterprise that generates its own revenue to fund facility maintenance and expansions.

Cost to Local Governments: All proposed code changes to Title 24, Part 6 would result in changes to compliance determinations. Local governments would need to train building department staff on the revised Title 24, Part 6 Standards. While this retraining is an expense to local governments, it is not a new cost associated with the 2025 code change cycle. The building code is updated on a triennial basis, and local governments plan and budget for retraining every time the code is updated. There are numerous resources available to local governments to support compliance training that can help mitigate the cost of retraining, including tools, training, and resources provided by the IOU Codes and Standards program (such as Energy Code Ace). As noted in Sections 2.2.2, 3.2.2, 4.2.2, and 5.2.2, the Statewide CASE Team considered how the proposed code change might impact various market actors involved in the compliance and enforcement process and aimed to minimize negative impacts on local governments.

6.2 Mandates on Local Agencies or School Districts

Counties, cities, and health care districts fund and operate healthcare facilities. Locally owned and operated hospitals and clinics often serve low-income and uninsured patients. The proposed code changes would impact locally owned and operated healthcare facilities. The proposed code changes are not expected to impact school districts.

6.3 Costs to Local Agencies or School Districts

The proposed changes will impact locally owned and/or operated healthcare facilities. The requirements are cost effective over the 30-year period of analysis, meaning local agencies will realize cost savings of the evaluation period. The cost-effectiveness analysis, including incremental first costs, incremental maintenance and replacement costs, and energy cost savings, is presented in Section 2.4, 3.4, 4.4, and 5.4.

6.4 Costs or Savings to Any State Agency

HCAI is responsible for verifying all healthcare facilities in the state comply with all requirements, including Title 24, Part 6 requirements. As discussed in Section 2.2.2, 3.2.2, 4.2.2, 5.2.2, and 2.2.3,3.2.4, 4.2.4, and 5.2.4, the proposed changes would modify what HCAI reviews during plans checks and inspections, but the revisions are not expected to add significant review time or cost associated with verifying compliance.

The proposed requirements would apply to the five hospitals that the California Department of State Hospitals (DSH) operates. The proposed are cost effective over the 30-year period of analysis, meaning the state will realize cost savings during the evaluation period. The cost-effectiveness analyses, including incremental first costs, incremental maintenance and replacement costs, and energy cost savings, are presented in Section 2.4, 3.4, 4.4, and 5.4.

6.5 Other Non-Discretionary Cost or Savings Imposed on Local Agencies

It is expected that state and local healthcare facilities that comply with the proposed requirements will be required to cover the incremental costs, but would also benefit from reduced energy costs. As mentioned, the proposed changes are cost effective over the 30-year period of analysis, so it is expected that there is an overall cost savings over that timeframe.

6.6 Costs or Savings in Federal Funding to the State

There are no expected costs or savings to federal funding to the state.

7. Energy Equity and Environmental Justice

The Statewide CASE Team recognizes, acknowledges, and accounts for a history of prejudice and inequality in environmental and social justice (ESJ) communities.[19] These issues persist today. To minimize the risk of perpetuating inequity, code change proposals are being developed with intentional consideration of the unintended consequences on ESJ communities.

When analyzing impacts for nonresidential buildings, the Statewide CASE Team reviewed each nonresidential building type through the lens of the four criteria: cost, health, resiliency, and comfort. The Statewide CASE Team examined which building types are used by ESJ communities most frequently and evaluated the allocation of impacts related to the following areas among all populations. Some building types have unique environmental justice concerns due to their common uses, location, or other factors. The proposed changes are unlikely to have significant impacts on ESJ outside of any impacts mentioned in the 2028 CASE Methodology Report, therefore reducing the impacts of disparities on ESJ communities.

As outlined in Sections 2.4.5, 3.4.5, 4.4.5, and 5.4.5, the proposals are cost effective and will reduce overall operating costs for healthcare facilities. The proposals are cost effective, but there are increased incremental first costs for some measures, which could potentially lead to disproportionate impacts to healthcare facilities, especially smaller, skilled nursing facilities with fewer resources to put toward energy efficiency during retrofits, and may therefore experience more burden funding the increased first costs.[20] The Statewide CASE Team is aware of this challenge and was intentional in how they modified the healthcare alteration language, by limiting changes to mandatory provisions and components that have greatest ROI (e.g., Lighting LPD). Measures with little to no incremental first costs will typically have very fast paybacks associated with them. As noted, a few measures have no or negligible incremental first costs. Further, reducing operating costs of healthcare facilities may make those facilities more

[19] The CPUC refers to ESJ communities as “low-income or communities of color that have been underrepresented in the policy setting or decision-making process, are subject to a disproportionate impact from one or more environmental hazards, and likely to experience disparate implementation of environmental regulations and socio-economic investments in their communities” (CPUC 2022). ESJ communities also include the CPUC definition for Disadvantaged Communities, which comprises “(1) Census tracts receiving the highest 25 percent of overall scores in CalEnviroScreen 4.0 (1,984 tracts); (2) Census tracts lacking overall scores in CalEnviroScreen 4.0 due to data gaps, but receiving the highest 5 percent of CalEnviroScreen 4.0 cumulative pollution burden scores (19 tracts); (3) Census tracts identified in the 2017 DAC designation as disadvantaged, regardless of their scores in CalEnviroScreen 4.0 (307 tracts); and (4) Lands under the control of federally recognized Tribes (OEHHA 2022).

[20] The fan control, alterations: fenestration, and alterations: lighting measures have no or negligible incremental first costs.

economically resilient and enable them to put more resources toward patient care. Measures with Keeping healthcare facilities open and operational is especially critical when serving ESJ communities where residents may not have other options for care.

The proposed enhanced space conditioning systems have the potential to improve occupant comfort. In a hospital environment, occupant comfort can improve the experience for the patient and improve their overall well-being.

The proposal is expected to increase building resilience and allow the fuel supply to last longer during a potential utility outage. The Statewide CASE Team does not expect impacts on the disaster preparedness of ESJ communities.

There are no anticipated adverse impacts to health or safety. The mechanical proposals are all consistent with ASHRAE 170 and the 2025 CMC, which consider health and safety with respect to airflow, ventilation, and other related attributes. The alterations proposals are already required for other nonresidential buildings and were reviewed for their applicability to healthcare facilities and determined not to increase health or safety risks.

The Statewide CASE Team will continue to build relationships with CBOs and other stakeholders to improve the identification of potential impacts for future code cycles and is open to additional resources that can contribute to this effort.

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Appendix A: Assumptions for Cost-effectiveness Analysis

A.1 Shut-off and Reset Controls

A.1.1 Key Assumptions for Energy Savings Analysis

- The Statewide CASE Team simulated the energy impacts in every climate zone and applied the climate-zone-specific LSC hourly factors when calculating energy and energy cost impacts.
- To model the energy savings for reset controls, the Statewide CASE Team used and modified the default CBECC hospital prototype to represent hospital characteristics and energy use profile more accurately.
- While the proposed change applies to all nonresidential healthcare facilities, including skilled nursing facilities, hospitals were modeled to represent a reasonable proxy for per-unit savings across other healthcare facilities. A prototype is being developed to represent skilled nursing facilities, and an analysis of that building type reflecting impacts of proposed measures will be included in the final report.
- The proposed design includes reduced minimum-airflow operation and thermostat heating setback/cooling setup sequences for eligible spaces. Modified terminal units were modeled using a scheduled minimum-airflow fraction that maintained 100 percent of design airflow during occupied periods and 25 percent of design airflow during unoccupied or standby periods.

A.1.2 Energy Savings Methodology per Prototypical Building

The 2028 CASE Methodology Report provides details on estimating energy savings per prototypical building and unit. The CEC directed the Statewide CASE Team to model energy impacts using specific prototypical building models that represent typical building geometries for different building types. Table 93 presents the prototype buildings used in the analysis.

Table 93: Prototype Buildings Used for Energy, Demand, Cost, and Environmental Impacts Analysis

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
Hospital	5	241,501	The prototype contains Title 24, Part 6, minimally compliant envelope features and lighting. For HVAC systems, the AIA guidelines recommended using VAV systems wherever possible. 8 Patient Room zones, 8 Office zones, 1 Kitchen zone, 7 HspSurgOutptLab zones, 2 Dining zones.
Skilled Nursing Facility	1	64,010	Single story 80-bed facility with different occupancies (I2, A2, B). Source: CBC 1225 and CAHF Database. 75% for I-2 occupancy, 15% for B occupancy, 10% for A2 occupancy, double-sided corridors for patient wing.

There are no existing Title 24, Part 6 requirements that address the building system in question. The Statewide CASE Team modified the Standard Design to calculate energy impacts of the most common current or industry-standard practices. The baseline design assumed the following:

- System type: VAV HVAC systems that operate on a continuous schedule, without automatic shut-off or setback functionality during unoccupied hours.
- Control features: No occupancy sensing; no heating-setback or cooling-setup logic

The Proposed Design was identical to the Standard Design in all ways except for the revisions that represent the proposed changes to the code. Table 94 presents the parameters modified and the values used in the Standard Design and Proposed Design. Specifically, the proposed conditions assume:

- Eligible spaces were assumed to be equipped with occupancy-sensing controls communicating with the building automation system (BAS).
- Automatic heating-setback/cooling-setup sequences per Title 24 §401.2.2.5 *[120.2(e)].*
- Occupancy-based control functionality was represented through reduced minimum-airflow terminal-unit settings and thermostat setback/setup schedules applied to eligible spaces.

Table 94: Modifications Made to Standard Design in Each Prototype to Simulate Proposed Code Change

Prototype ID	Climate Zone	Objects Modified	Parameter Name	Standard Design Parameter Value	Proposed Design Parameter Value
Hospital, SNF	All	VAV Terminal Units	Zone Minimum Air Flow Input Method	Fixed Flow Rate	Scheduled
Hospital, SNF	All	VAV Terminal Units	Fixed Minimum Air Flow Rate	Defined (zone-specific)	Blank
Hospital, SNF	All	VAV Terminal Units	Constant Minimum Air Flow Fraction	Existing configuration (zone-specific)	Blank
Hospital, SNF	All	VAV Terminal Units	Minimum Air Flow Fraction Schedule Name	None	Occupancy-Based Airflow Turndown Schedule
Hospital, SNF	All	Zone Thermostats	Heating Setpoint Schedule	Occupied Schedule	Heating Setback Schedule (65°F unoccupied)
Hospital, SNF	All	Zone Thermostats	Cooling Setpoint Schedule	Occupied Schedule	Cooling Setup Schedule (80°F unoccupied)

The energy impacts of the proposed code change do vary by climate zone. The Statewide CASE Team simulated the energy impacts in every climate zone and applied the climate-zone-specific LSC hourly factors when calculating energy and LSC impacts.

A.1.3 Detailed Modeling Implementation – Hospital Prototype

The proposed measure was implemented through reduced minimum-airflow terminal-unit controls and thermostat setback/setup sequences applied to eligible hospital spaces. Eligible spaces included patient rooms, operating rooms, laboratory spaces, radiology spaces, and physical therapy spaces. Intensive care unit (ICU) spaces, emergency department spaces, nurse stations, corridors, offices, kitchens, dining spaces, and other support spaces were excluded from the analysis due to ventilation, occupancy, or operational requirements.

The following hospital space types were modified in the prototype model to represent reduced minimum-airflow operation and thermostat setback/setup controls.

Table 95: Modified Hospital Space Types in Prototype Model

Reporting Zone Group	Conditioned Floor Area (ft^2)
Patient Room	20,402.68
Operating Room	6,600.65
Laboratory	5,700.56
Physical Therapy	5,250.51
Radiology	5,250.51
Total Impacted Area	43,204.91

Table 96: Prototype Coverage of Modified Zones

Metric	Value
Total conditioned floor area (prototype)	241,524 ft²
Impacted conditioned floor area	43,205 ft²
Percent of prototype floor area impacted	17.9%
Included space types	Patient rooms, operating rooms, laboratories, physical therapy, radiology
Excluded space types	ICU, emergency department, nurse stations, corridors, offices, kitchens, dining, support spaces

The modified spaces represent approximately 17.9 percent of the total conditioned floor area of the hospital prototype. Eligible space types include patient rooms, operating rooms, laboratories, radiology spaces, and physical therapy spaces. ICU spaces, emergency department spaces, nurse stations, corridors, offices, kitchens, dining spaces, and support spaces were excluded from the analysis. The selected space types were chosen to represent areas where airflow turndown is permitted under CMC Table 4-A and where occupancy-based control strategies are considered feasible based on the proposed code language.

For these zones, the following terminal unit control changes were implemented.

Table 97: Terminal Unit Control Logic Modifications

Field	Baseline	Proposed
Zone Minimum Air Flow Input Method	Fixed Flow Rate	Scheduled
Fixed Minimum Air Flow Rate	Defined (zone-specific)	Blank
Constant Minimum Air Flow Fraction	Existing configuration	Blank
Minimum Air Flow Fraction Schedule Name	None	Occupancy-Based Airflow Turndown Schedule
Heating Setpoint Schedule	Occupied Schedule	Heating Setback Schedule (65°F unoccupied)
Cooling Setpoint Schedule	Occupied Schedule	Cooling Setup Schedule (80°F unoccupied)

Airflow reduction in eligible hospital spaces was implemented by converting terminal units from a fixed minimum-airflow-rate control method to a scheduled minimum-airflow-fraction control method. The proposed airflow schedule shown in Table 98 maintains terminal airflow at 100 percent of design airflow during occupied periods and reduces airflow to 25 percent of design airflow during unoccupied or standby periods.

Table 98: Occupancy-Based Airflow Turndown Schedule

Time Period	Minimum Airflow Fraction	Operating Mode
00:00 – 06:00	25%	Unoccupied/Standby
06:00 – 12:00	100%	Occupied
12:00 – 18:00	25%	Unoccupied/Standby
18:00 – 24:00	100%	Occupied

This schedule represents a simplified approximation of occupancy-based airflow turndown, with terminal airflow maintained at 100 percent during occupied periods and reduced to 25 percent during unoccupied or standby periods. Heating setback and cooling setup schedules were also applied to eligible zones to represent the temperature-reset functionality required by Section 401.2.2.5 [120.2(e)]. ICU patient rooms and other excluded healthcare support spaces were not modified due to ventilation, pressurization, occupancy, and operational requirements that differ from the eligible spaces modeled for this measure.

A.2 Space conditioning zone controls

A.2.1 Key Assumptions for Energy Savings Analysis

- The Statewide CASE Team simulated the energy impacts in every climate zone and applied the climate-zone-specific LSC hourly factors when calculating energy and energy cost impacts.
- To model the energy savings for space conditioning zone controls, the Statewide CASE Team used and modified the default CBECC hospital prototype to represent hospital characteristics and energy use profile more accurately.
- While the proposed change applies to all nonresidential healthcare facilities, including skilled nursing facilities, hospitals were modeled to represent a reasonable proxy for per-unit savings across other healthcare facilities.

A.2.2 Energy Savings Methodology per Prototypical Building

The 2028 CASE Methodology Report provides details on estimating energy savings per prototypical building and unit. The CEC directed the Statewide CASE Team to model energy impacts using specific prototypical building models that represent typical building geometries for different building types. Table 99 presents the prototype buildings used in the analysis.

Table 99: Prototype Buildings Used for Energy, Demand, Cost, and Environmental Impacts Analysis

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
Hospital	5	241,501	The prototype contains Title 24, Part 6, minimally compliant envelope features and lighting. For HVAC systems, the AIA guidelines recommended using VAV systems wherever possible. 8 Patient Room zones, 8 Office zones, 1 Kitchen zone, 7 HspSurgOutptLab zones, 2 Dining zones.
Skilled Nursing Facility	1	64,010	Single story 80-bed facility with different occupancies (I2, A2, B). Source: CBC 1225 and CAHF Database. 75% for I-2 occupancy, 15% for B occupancy, 10% for A2 occupancy, double-sided corridors for patient wing.

There are no existing Title 24, Part 6 requirements that cover the building system in question. The Statewide CASE Team modified the Standard Design to calculate the energy impacts of the most common current or industry-standard practices. The baseline design assumed the following:

- System type: VAV HVAC systems that operate on a continuous schedule, without automatic shut-off or setback functionality during unoccupied hours
- Control features: Terminal units were modeled as effective constant-volume systems by setting minimum airflow equal to design airflow, with no occupancy-based airflow reset.
- Sequence of operation: HVAC zones remain “occupied” 8760 hours per year regardless of use

The Proposed Design was identical to the Standard Design in all ways except for the revisions that represent the proposed changes to the code. Table 100 presents the control parameters modified in the prototype model to represent occupancy-based airflow reset operation. The modifications convert terminal-unit minimum airflow control from fixed minimum airflow settings to schedule-based control linked to zone occupancy. Specifically, the proposed conditions assume:

- Ventilation/fans: Occupancy-based airflow reset controls were implemented. Terminal-unit minimum airflow rates were reset to healthcare ventilation minimums when occupancy fell below 25 percent of design occupancy.

Table 100: Modifications Made to Standard Design in Each Prototype to Simulate Proposed Code Change

Prototype ID	Climate Zone	Objects Modified	Parameter Name	Standard Design Parameter Value	Proposed Design Parameter Value
Hospital, SNF	All	VAV Terminal Unit Controls	Zone Minimum Air Flow Input Method	Fixed Flow Rate	Scheduled
Hospital, SNF	All	VAV Terminal Unit Controls	Fixed Minimum Air Flow Rate	Existing VAV minimum airflow	Blank
Hospital, SNF	All	VAV Terminal Unit Controls	Minimum Air Flow Fraction Schedule Name	None	Occupancy-Based Airflow Reset Schedule
Hospital, SNF	All	Occupancy-Based Airflow Reset Logic	Occupancy Threshold	Not Used	<25% Design Occupancy

Table 101 summarizes the occupancy-based airflow reset control sequence applied in the Proposed Design.

Table 101: Occupancy-Based Airflow Reset Control Sequence

Prototype ID	Climate Zone	Occupancy Condition	Terminal Minimum Airflow
Hospital, SNF	All	Occupancy ≥ 25% of design occupancy	Existing VAV minimum airflow
Hospital, SNF	All	Occupancy < 25% of design occupancy	Code-required minimum ventilation airflow

Occupancy was determined using the People schedule associated with each thermal zone. A low-occupancy condition was defined as occupancy below 25 percent of the design occupancy level. When occupancy fell below 25 percent of design occupancy, terminal-unit minimum airflow was reset to the code-required healthcare minimum ventilation airflow applicable to that zone. When occupancy exceeded this threshold, terminal units operated at their baseline design airflow settings.

A.3 Fan Control

A.3.1 Key Assumptions for Energy Savings Analysis

- The Statewide CASE Team simulated the energy impacts in every climate zone and applied the climate-zone-specific LSC hourly factors when calculating energy and energy cost impacts.
- To model the energy savings for fan control, the Statewide CASE Team used and modified the default CBECC hospital prototype to represent hospital characteristics and energy use profile more accurately.
- While the proposed change applies to all nonresidential healthcare facilities, including skilled nursing facilities, hospitals were modeled to represent a reasonable proxy for per-unit savings across other healthcare facilities.

A.3.2 Energy Savings Methodology per Prototypical Building

The 2028 CASE Methodology Report provides details on estimating energy savings per prototypical building and unit. The CEC directed the Statewide CASE Team to model energy impacts using specific prototypical building models that represent typical building geometries for different building types. Table 102 presents the prototype buildings used in the analysis.

Table 102: Prototype Buildings Used for Energy, Demand, Cost, and Environmental Impacts Analysis

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
Hospital	5	241,501	The prototype contains Title 24, Part 6, minimally compliant envelope features and lighting. For HVAC systems, the AIA guidelines recommended using VAV systems wherever possible. 8 Patient Room zones, 8 Office zones, 1 Kitchen zone, 7 HspSurgOutptLab zones, 2 Dining zones.
Skilled Nursing Facility	1	64,010	Single story 80-bed facility with different occupancies (I2, A2, B). Source: CBC 1225 and CAHF Database. 75% for I-2 occupancy, 15% for B occupancy, 10% for A2 occupancy, double-sided corridors for patient wing.

There are no existing Title 24, Part 6 requirements that address the building system in question. The Statewide CASE Team modified the Standard Design to calculate energy impacts based on the most common current or industry-standard practices. The baseline design assumed the following:

- System type: VAV HVAC systems modified to represent effective constant-volume operation for the baseline.
- Control features: Fan power was modeled as constant with no modulation in response to airflow reduction; terminal units were modeled as effective constant-volume where maximum airflow values were available.
- Sequence of operation: HVAC zones remain “occupied” 8,760 hours per year regardless of use.

The Proposed Design was identical to the Standard Design in all ways except for the revisions that represent the proposed changes to the code. Table 103 presents the parameters modified and the values used in the Standard Design and Proposed Design. Specifically, the proposed conditions assume:

- Ventilation/fans: Proposed systems retain variable-volume fan performance using the existing fan power curves and VAV terminal-unit control logic consistent with §401.3.14 [140.4(m)]. (e.g., proportional control).

Table 103: Modifications Made to Standard Design in Each Prototype to Simulate Proposed Code Change

Prototype ID	Climate Zone	Objects Modified	Parameter Name	Standard Design Parameter Value	Proposed Design Parameter Value
Hospital, SNF	All	Supply and Return Fan Controls	Fan Power Curve	Constant fan power curve	Variable-volume fan power curve
Hospital, SNF	All	VAV Terminal Unit Controls	Minimum Airflow Control Method	Fixed Flow Rate	Existing VAV minimum-airflow control
Hospital, SNF	All	VAV Terminal Unit Controls	Fixed Minimum Airflow Rate	Maximum airflow rate	Existing VAV minimum airflow setting

In the baseline design, fan power curves were modified to represent constant fan power operation and terminal-unit minimum airflow rates were set equal to maximum airflow rates where available, creating an effective constant-volume system representation. The proposed design retained the original VAV fan and terminal-unit control strategies, allowing fan power and airflow to vary in response to system demand.

A.4 Alterations

A.4.1 Key Assumptions for Energy Savings Analysis

- The Statewide CASE Team simulated the energy impacts in every climate zone and applied the climate-zone-specific LSC hourly factors when calculating energy and energy cost impacts.
- To model the energy savings associated with the proposed alteration requirements, the Statewide CASE Team used and modified the default CBECC hospital prototype to represent hospital characteristics and energy use profile more accurately.
- While the proposed change applies to all nonresidential healthcare facilities, including skilled nursing facilities, hospitals were modeled to represent a reasonable proxy for per-unit savings across other healthcare facilities.

A.4.2 Energy Savings Methodology per Prototypical Building

The 2028 CASE Methodology Report provides details on estimating energy savings per prototypical building and unit. The CEC directed the Statewide CASE Team to model energy impacts using specific prototypical building models that represent typical building geometries for different building types. Table 104 presents the prototype buildings used in the analysis.

Table 104: Prototype Buildings Used for Energy, Demand, Cost, and Environmental Impacts Analysis

Prototype Name	Number of Stories	Floor Area (Square Feet)	Description
Hospital	5	241,501	The prototype contains Title 24, Part 6, minimally compliant envelope features and lighting. For HVAC systems, the AIA guidelines recommended using VAV systems wherever possible. 8 Patient Room zones, 8 Office zones, 1 Kitchen zone, 7 HspSurgOutptLab zones, 2 Dining zones.
Skilled Nursing Facility	1	64,010	Single story 80-bed facility with different occupancies (I2, A2, B). Source: CBC 1225 and CAHF Database. 75% for I-2 occupancy, 15% for B occupancy, 10% for A2 occupancy, double-sided corridors for patient wing.

There are no existing Title 24, Part 6 requirements that address alteration requirements in nonresidential healthcare facilities. The Statewide CASE Team modified the Standard Design to calculate energy impacts of the most common current or industry-standard practices. The baseline design assumed the following:

- Existing healthcare facilities across California are constructed to a wide array of design standards and practices, largely based on building vintage. To establish a single baseline and ensure savings estimates remain conservative, the Statewide CASE Team used a 2019 Title 24, Part 6-compliant hospital prototype as the baseline design for the alteration analysis.

The Proposed Design was identical to the Standard Design in all ways except for the revisions that represent the proposed changes to the code. Table 105 through Table 107 presents the parameters modified and the values used in the Standard Design and Proposed Design. The Proposed Design assumes alterations are performed in accordance with the proposed 2028 Title 24, Part 6 healthcare alteration requirements. Envelope, lighting, and mechanical systems affected by the alteration scope were modified to reflect the applicable prescriptive requirements.

Table 105: Modifications Made to Standard Design in Each Prototype to Simulate Proposed Code Change – Envelope

Prototype ID	Climate Zone	Objects Modified	Parameter Name	Standard Design Parameter Value	Proposed Design Parameter Value
Hospital, SNF	All	Exterior Window Assemblies	Window U-Factor [Btu/h·ft²·°F]	U-0.86	CZ01–CZ08, CZ10, CZ16: U-0.36 CZ09, CZ11–CZ15: U-0.34
Hospital, SNF	All	Roof Assemblies	Roof Insulation [h·ft²·°F/Btu]	CZ01, CZ03–CZ09: R-8 CZ02, CZ10-CZ16: R-14	CZ06–CZ08: R-20.5 CZ01–CZ05, CZ09–CZ16: R-34.9

Table 106: Modifications Made to Standard Design in Each Prototype to Simulate Proposed Code Change – Lighting

Prototype ID	Climate Zone	Objects Modified	Parameter Name	Standard Design Parameter Value	Proposed Design Parameter Value
Hospital, SNF	All	Interior Lighting Power Density	Lighting Power Density (W/ft²)	Varies based on Space type (T24 2019 Section 140.6)	Varies based on Space type (T24 2025 Section 140.6)

Table 107: Modifications Made to Standard Design in Each Prototype to Simulate Proposed Code Change – Mechanical

Prototype ID	Climate Zone	Objects Modified	Parameter Name	Standard Design Parameter Value	Proposed Design Parameter Value
Hospital, SNF	All	Supply and Return Variable-Volume Fan Systems	Fan Pressure Rise	Fan pressure rise increased by 1/0.965 (3.63%) to represent pre-FEI baseline performance	Original prototype fan pressure-rise values representing compliance with proposed FEI requirements

Envelope alterations were modeled through updates to exterior window thermal performance and roof insulation levels. Lighting alterations were modeled by updating lighting power densities to the applicable 2025 Title 24 requirements for each space type. Mechanical alterations were modeled through adjustments to supply- and return-fan pressure rise to represent compliance with the proposed Fan Energy Index (FEI) alteration requirements. Baseline fan pressure-rise values were increased to represent pre-FEI fan-system performance, while the Proposed Design retained the original prototype fan pressure-rise values. Airflow rates, HVAC system configurations, and operating schedules were unchanged between the Standard Design and Proposed Design. The reduction in fan pressure rise decreases fan energy consumption while maintaining equivalent airflow delivery and system operation. A combined alteration analysis was also completed that combined envelope, lighting, and mechanical modifications together.

Appendix B: Purpose and Necessity of Proposed Code Changes

B.1 Introduction

The sections below provide the purpose and necessity of proposed changes to Title 24, Part 1; Title 24, Part 6; and the reference appendices. This section intends to provide the CEC with the information needed for the Initial Statement of Reasons.

See Section 2.6 of this report for marked-up code language.

B.2 Definition affecting all measures

Purpose and Necessity of Changes to Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

Purpose and Necessity of Changes to Title 24, Part 6

Section: Section 201 *[Section 100.1]*

Purpose: The purpose of this change is to introduce a new definition to Title 24 Part 6 that distinguishes the subset of healthcare facilities that are directly overseen by HCAI.

Necessity: This change is necessary to ensure that only appropriate space types are impacted by the measures in this proposal. Additionally, it is necessary to ensure that remaining exceptions are preserved between the 2025 and 2028 editions of Title 24 Part 6.

B.3 Shut-off and Reset Controls

Purpose and Necessity of Changes to Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

Purpose and Necessity of Changes to Title 24, Part 6

Section: Section 401.2.2.5 *[Section 120.2(e)]*

Purpose: The purpose of this change is to modify the current exception for shut-off and reset controls for nonresidential healthcare facilities to only be applicable to subsection 1 and establish a more targeted approach through a new subsection to require system level airflow turndown in spaces that allow it per California Mechanical Code Table 4-A.

Necessity: This change is necessary to align minimum energy code requirements for nonresidential healthcare facilities with standard design and construction practice in California. Direct Digital Control (DDC) and Building Automation Systems (BAS) are standard in nearly all new California healthcare projects so this code change will ensure controls are programmed in spaces where it is safe to do so, and healthcare operators experience operational energy and cost savings. Additionally, this change demonstrates that other healthcare exceptions in Title 24, Part 6 should be evaluated and potentially modified.

Purpose and Necessity of Changes to the Reference Appendices

There are no proposed changes to reference appendices.

B.4 Space conditioning zone controls

Purpose and Necessity of Changes to Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

Purpose and Necessity of Changes to Title 24, Part 6

Section: Section 401.3.6 *[Section 140.4(d)]*

Purpose: The purpose of this change is to add a new healthcare specific subsection that requires occupied and unoccupied zones or mixed zones served by VAV systems to reduce the volume of air to the zone shall to the minimum ventilation rates defined by Table 4-A of the CMC or the referenced design standard applicable to the space, while accounting for ventilation, temperature, humidity and pressure requirements. This will reduce the amount of air that is reheated, recooled, or simultaneously heated or cooled, while ensuring minimum level of airflow still serves the space.

Necessity: This change is necessary to align minimum energy code requirements for nonresidential healthcare facilities with standard design and construction practice in California. Direct Digital Control (DDC) and Building Automation Systems (BAS) are standard in nearly all new California healthcare projects so this code change will ensure controls are programmed in spaces where it is safe to do so, and healthcare operators experience operational energy and cost savings. Additionally, this change demonstrates that other healthcare exceptions in Title 24, Part 6 should be evaluated and potentially modified.

Purpose and Necessity of Changes to the Reference Appendices

There are no proposed changes to reference appendices.

B.5 Fan Control

Purpose and Necessity of Changes to Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

Purpose and Necessity of Changes to Title 24, Part 6

Section: Section 401.3.14 *[Section 140.4(m)]*

Purpose: The purpose of this change is to require that nonresidential healthcare spaces be equipped with VAV capable of modulating fan speed as a function of load.

Necessity: This change is necessary to align minimum energy code requirements for nonresidential healthcare facilities with standard design and construction practice in California. VAV is standard in new California healthcare projects so this code change will ensure Title 24, Part 6 reflects this as a minimum standard for healthcare facilities. Additionally, this change demonstrates that other healthcare exceptions in Title 24, Part 6 should be evaluated and potentially modified.

Purpose and Necessity of Changes to the Reference Appendices

There are no proposed changes to reference appendices.

B.6 Alterations

Purpose and Necessity of Changes to Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

Purpose and Necessity of Changes to Title 24, Part 6

Section: Sections 301.5.2, 401.5.2, and 601.5.2 *[Section 141.0]*

Purpose: The purpose of this change is to eliminate the blanket exception for nonresidential healthcare facilities undergoing building alterations and incorporate more targeted exceptions for specific altered building systems. Altered building systems will be subject to the alteration requirements as specified in Section 301.5.2.2, 401.5.2.2, and 601.5.2.2 [Section141.0(b)], unless a new healthcare exception was established or an existing exception already exists.

Necessity: This change is necessary to align alteration requirements across healthcare and other nonresidential buildings in California, as well as healthcare facilities in other states. With frequent modifications to healthcare facilities, and their 24/7 operation, the proposed code change will result in significant energy and cost savings that persist year over year.

Purpose and Necessity of Changes to the Reference Appendices

There are no proposed changes to reference appendices.

Appendix C: Assumptions for Statewide Savings Estimates

The Statewide CASE Team estimated statewide impacts for the first year by multiplying per-unit savings estimates by the statewide CEC's construction forecasts for healthcare facilities. The CEC healthcare construction forecast includes new construction and alterations estimates for hospitals (OSHPD 1) and skilled nursing facilities (OSHPD 2). As previously noted, the Statewide CASE Team used the enhanced hospital prototype to determine the potential per-unit impact of the proposed code change and extrapolated those savings across the CEC healthcare construction projections. In this final report, the Statewide CASE Team separately assessed savings impacts on skilled nursing facilities by developing a separate prototype. The 2028 CASE Methodology Report includes additional information about the methodology and assumptions used to calculate statewide energy impacts.

Throughout the analysis, the Statewide CASE Team assumed a 60 percent/40 percent breakout between Hospital and SNF prototypes, shown in Table 108. This was applied to the overall impacted floor area for the "Hospital" building type that CEC provided. For example, for every 100 square feet of Hospital floor area that CEC estimated, the Statewide CASE Team treated 40 square feet of that as SNF and the remaining 60 square feet as a Hospital building.

Table 108: Assumed Breakout between Hospital and SNF Prototypes Used in Impacts Analysis

Building Type	Assumed Percentage of Floor Area
Hospital	60%
SNF	40%

C.1 Measures Affecting New Construction

The statewide savings and cost estimates take the current market share rate into account. The Statewide CASE Team estimated that the current market share is 10 percent for Shut-off and Reset Controls and Space Conditioning Zone controls measures and 25 percent for the Fan control measure. The current market share rate is estimated based on the Statewide CASE Team's professional judgment and data from the evaluation of past Title 24 code cycles.

Table 109 (Shut-off and Reset Controls and Space Conditioning Zone Controls) and Table 110 (Fan Control) present the projected nonresidential new construction that the proposed code change will impact in 2026. Shut-off and Reset Controls and Space Conditioning Zone Controls are grouped together because the impacted floor area is the same across the two measures. The Statewide CASE Team developed these estimates using the methods described in this section.

The Statewide CASE Team estimated the percentage of newly constructed floorspace that the proposed code change would impact. Table 111 shows the assumed percentage of affected floorspace by building type. If a proposed code change does not apply to a specific building type, the Statewide CASE Team assumes that zero percent of the floorspace would be impacted. If the assumed percentage is non-zero, but less than 100 percent, the proposal is expected to affect some—but not all—buildings. Table 112 presents the assumed percentage of affected floorspace by climate zone.

The Statewide CASE Team adjusted the overall floor space impact of this measure based on the percentage of spaces affected. To account for spaces exempted under turndown specifications outlined in Table 4-A, the Statewide CASE Team assumed that 70 percent of hospital space is affected across the three measures.

Table 109: Estimated New Nonresidential Construction Impacted by Proposed Code Change in 2029, by Climate Zone and Building Type (Million Square Feet) (Shut-off and Reset Controls and Space Conditioning Zone Controls Measures)

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Hospital	0.02	0.12	0.50	0.25	0.05	0.20	0.26	0.29	0.54	0.43	0.10	0.50	0.19	0.08	0.05	0.03	3.61
SNF	0.01	0.08	0.33	0.17	0.04	0.14	0.18	0.19	0.36	0.29	0.06	0.33	0.13	0.05	0.03	0.02	2.41
TOTAL	**0.03**	**0.2**	**0.83**	**0.42**	**0.09**	**0.34**	**0.44**	**0.48**	**0.9**	**0.72**	**0.16**	**0.83**	**0.32**	**0.13**	**0.08**	**0.05**	**6.02**

Table 110: Estimated New Nonresidential Construction Impacted by Proposed Code Change in 2029, by Climate Zone and Building Type (Million Square Feet) (Fan Control Measure)

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Hospital	0.02	0.10	0.42	0.21	0.04	0.17	0.22	0.24	0.45	0.36	0.08	0.41	0.16	0.07	0.04	0.02	3.01
SNF	0.01	0.06	0.28	0.14	0.03	0.11	0.15	0.16	0.30	0.24	0.05	0.28	0.11	0.05	0.03	0.02	2.01
TOTAL	**0.0**	**0.2**	**0.7**	**0.4**	**0.1**	**0.3**	**0.4**	**0.4**	**0.7**	**0.6**	**0.1**	**0.7**	**0.3**	**0.1**	**0.1**	**0.0**	**5.0**

Table 111: Percentage of Nonresidential Floorspace Impacted by Proposed Code Change in 2029, by Building Type

Building Type	Shut-off and Reset Controls / Space Conditioning Zone Controls Impacted (Percent Square Footage)	Fan Control Impacted (Percent Square Footage)
Hospital	90%	75%
SNF	90%	75%

Table 112: Percentage of New Construction Nonresidential Floorspace Impacted by Proposed Measures, by Climate Zone

Climate Zone	Shut-off and Reset Controls / Space Conditioning Zone Controls Impacted (Percent Square Footage)	Fan Control Stock (NC) Impacted (Percent Square Footage)
1	5%	5%
2	4%	3%
3	4%	4%
4	3%	2%
5	2%	1%
6	2%	2%
7	3%	2%
8	2%	1%
9	2%	2%
10	3%	2%
11	1%	1%
12	3%	2%
13	2%	2%
14	1%	1%
15	1%	0%
16	0%	0%

C.2 Submeasures Affecting Alterations

A similar approach was taken for the three Alterations submeasures. In this case, the existing building stock was used as the basis for impacts instead of new construction. The Statewide CASE Team estimated a 10 percent market share for FEI, a 0 percent market share for roof/windows, and a 75 percent market share for lighting submeasures. This input, combined with the estimated measure life for each submeasure (15 years for FEI, 30 years for roof/window, and 6.7 years for lighting), resulted in the estimated annual impacted floor area by submeasure. This information is shown in Table 113, Table 114, and Table 115. SNF was not analyzed for the lighting measure due to small savings and limited existing LPD requirements for relevant spaces within the prototype.

The amount of floor area impacted for each prototype is related to the market share for each given measure. These estimated figures are shown in Table 116 by submeasure. These values were developed by the Statewide CASE Team's professional judgment. In the case of lighting, the Statewide CASE Team performed research on existing healthcare building incentive programs and found a number of examples of lighting retrofits.

The fraction of floor area by climate zone and submeasure impacted annually is shown in Table 117. This value varies across climate zones because it relates to the overall amount of nonresidential floor area in each climate zone.

Table 113: FEI Impacted Floor Area

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Hospital	0.07	0.43	1.83	0.93	0.20	1.11	1.06	1.60	2.62	1.51	0.42	2.01	0.88	0.33	0.17	0.12	15.30
SNF	0.05	0.28	1.22	0.62	0.13	0.74	0.71	1.07	1.75	1.00	0.28	1.34	0.58	0.22	0.12	0.08	10.20
TOTAL	0.12	0.71	3.06	1.56	0.33	1.85	1.77	2.67	4.37	2.51	0.69	3.35	1.46	0.56	0.29	0.20	25.50

Table 114: Roof/Window Alterations Impacted Floor Area

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Hospital	0.04	0.21	0.92	0.47	0.10	0.56	0.53	0.80	1.31	0.75	0.21	1.00	0.44	0.17	0.09	0.06	7.65
SNF	0.02	0.14	0.61	0.31	0.07	0.37	0.35	0.53	0.87	0.50	0.14	0.67	0.29	0.11	0.06	0.04	5.10
TOTAL	0.06	0.36	1.53	0.78	0.16	0.93	0.88	1.34	2.19	1.25	0.35	1.67	0.73	0.28	0.15	0.10	12.75

Table 115: Lighting Alterations Impacted Floor Area

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16	All
Hospital	0.04	0.27	1.15	0.58	0.12	0.69	0.66	1.00	1.64	0.94	0.26	1.26	0.55	0.21	0.11	0.08	9.56
SNF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.04**	**0.27**	**1.15**	**0.58**	**0.12**	**0.69**	**0.66**	**1.00**	**1.64**	**0.94**	**0.26**	**1.26**	**0.55**	**0.21**	**0.11**	**0.08**	**9.56**

Table 116: Impacted Floor Area Fraction by Prototype of Alterations Submeasures

Building Type	FEI Impacted (Percent Square Footage)	Roof/Window Impacted (Percent Square Footage)	Lighting Impacted (Percent Square Footage)
Hospital	90%	100%	25%
SNF	90%	100%	0%

Table 117: Impacted Annual Floor Area by Climate Zone of Alterations Submeasures

Climate Zone	FEI Impacted (Percent Square Footage)	Roof/Window Impacted (Percent Square Footage)	Lighting Impacted (Percent Square Footage)
1	0.35%	0.17%	0.13%
2	0.35%	0.17%	0.13%
3	0.32%	0.16%	0.12%
4	0.28%	0.14%	0.11%
5	0.35%	0.17%	0.13%
6	0.23%	0.12%	0.09%
7	0.32%	0.16%	0.12%
8	0.22%	0.11%	0.08%
9	0.25%	0.12%	0.09%
10	0.24%	0.12%	0.09%
11	0.36%	0.18%	0.13%
12	0.34%	0.17%	0.13%
13	0.38%	0.19%	0.14%
14	0.23%	0.12%	0.09%
15	0.21%	0.10%	0.08%
16	0.25%	0.13%	0.09%

Appendix D: Environmental Analysis

D.1 Potential Significant Environmental Effect of Proposal

The Statewide CASE Team has considered the environmental benefits and adverse impacts of all proposals described in this report, including—but not limited to—an evaluation of factors contained in the California Code of Regulations, Title 14, section 15064, and has determined that the proposal will not result in a significant effect on the environment.

D.2 Direct Environmental Impacts

D.2.1 Direct Environmental Benefits

This measure is expected to result in energy savings and GHG emissions reductions by requiring shut-off and reset controls installed and programmed in nonresidential healthcare facilities. The estimated impact of these benefits has been quantified in this report.

D.2.2 Direct Adverse Environmental Impacts

This measure is not expected to result in any direct adverse environmental impacts.

D.3 Indirect Environmental Impacts

D.3.1 Indirect Environmental Benefits

This measure is not expected to result in any indirect environmental benefits.

D.3.2 Indirect Adverse Environmental Impacts

This measure is not expected to result in any indirect adverse environmental impacts.

D.4 Mitigation Measures

The Statewide CASE Team has considered opportunities to minimize the environmental impact of the proposal, including an evaluation of "specific economic, environmental, legal, social, and technological factors" (Cal. Code Regs., tit. 14, § 15021). The Statewide CASE Team determined this measure would not result in significant direct or indirect adverse environmental impacts, so mitigation measures were not considered or developed.

Reasonable Alternatives to Proposal

The Statewide CASE Team has considered alternatives to the proposal and determined that no alternative would achieve its purpose with less environmental effect.

Water Use and Water Quality Impacts Methodology

There are no impacts on water quality or water use.

Appendix E: Summary of Stakeholder Engagement

Introduction to Stakeholder Engagement

Collaborating with stakeholders who may be affected by proposed code changes is a core component of the Statewide CASE Team's process. The Statewide CASE Team engages interested parties to identify and address issues related to the proposals, with the goal of submitting recommendations to the CEC in this Final CASE Report that reflect broad support. Public stakeholders provide valuable feedback on draft analyses and help identify and address adoption challenges, including cost effectiveness, market and technical barriers, compliance and enforcement, and potential impacts on human health or the environment. Some stakeholders also provide data that the Statewide CASE Team uses to support analyses.

This appendix summarizes the stakeholder engagement conducted by the Statewide CASE Team during the development and refinement of the report's recommendations.

All Measures

Utility-Sponsored Stakeholder Meetings

Utility-sponsored stakeholder meetings provide an opportunity to learn about the Statewide CASE Team's role in the advocacy effort and to hear about specific code change proposals that the Statewide CASE Team is pursuing for the 2028 code cycle. The goal of these meetings is to solicit input on proposals from stakeholders early enough to ensure the proposals and the supporting analyses are vetted and have as few outstanding issues as possible. To promote transparency in the development of code change proposals, the Statewide CASE Team uses stakeholder meetings to solicit feedback on:

- Proposed code changes
- Draft code language
- Draft assumptions and results of analyses
- Data to support assumptions
- Compliance and enforcement
- Technical and market feasibility

The Statewide CASE Team hosted two stakeholder meetings for the proposed healthcare measures via webinar, as described in Table 118. The Statewide CASE Team hosted a third stakeholder meeting on proposed Healthcare Prototype Enhancements to gather feedback for this report. Please see below for dates and links to event pages on Title24Stakeholders.com. Materials from each meeting, such as slide presentations, proposal summaries with code language, and meeting notes, are included in the bibliography section of this report.

Table 118: Utility-Sponsored Stakeholder Meetings

Meeting Name and Link to Materials	Meeting Date	Summary of Items Discussed
2028 Title 24 Energy Code Update: Nonresidential Topics	January 8, 2025	• Welcome and Introduction to the 2028 code cycle from the California Energy Commission and discussion of the Statewide CASE Team role including measure ideas.
First Round of Nonresidential HVAC, Covered Processes Utility-Sponsored Stakeholder Meeting	Tuesday, September 23, 2025	• Proposed code change measures impacting new construction and alterations • Market and technical barriers • Compliance changes and challenges • Energy modeling and hospital prototype changes
Second Round of Nonresidential HVAC, Covered Processes Utility-Sponsored Stakeholder Meeting	Tuesday, March 17, 2026	• Presented updated evolution of code measures under consideration • Focus on incremental changes to the analysis since First Round Stakeholder Meeting • Energy cost and benefit analysis, including upfront first costs
Second Round of Nonresidential HVAC, Covered Processes Utility-Sponsored Stakeholder Meeting	Monday, April 20, 2026	• Proposed changes to the Healthcare Prototype Enhancements (hospital and SNF prototypes)

During the January 8, 2025, 2028 Title 24 Energy Code Update Meeting: Nonresidential Topics, the Statewide CASE Team introduced the proposals described in this CASE Report, including Healthcare Exceptions.

The first round of utility-sponsored stakeholder meetings began in September 2025 and served as an early forum to promote transparency and gather stakeholder feedback on measures under consideration by the Statewide CASE Team.

The objectives of the first round of stakeholder meetings were to solicit input on the scope of the code cycle proposals; request data and feedback on the specific approaches, assumptions, and methodologies for the energy impacts and cost-effectiveness analyses; and understand potential technical and market barriers. The Statewide CASE Team also presented the initial draft code language for stakeholders to review.

The Statewide CASE Team received the following feedback from stakeholders during this meeting.

- Stakeholders provided guidance on other healthcare exceptions that could be eliminated. These included load reduction and controls, simultaneous heating and cooling, and commissioning and acceptance testing requirements.
- Stakeholders resoundingly agreed that changes to the hospital prototype modeling baseline are needed, and performance credit should be provided in the performance path.
- In response to this feedback, the Statewide CASE Team:
    - Modified the hospital prototype in this report to appropriately reflect a hospital design and operation.
    - Proposes to allow performance credit for the proposed mechanical equipment changes in this CASE Report.

The second round of utility-sponsored stakeholder meetings occurred March through April 2026 to provide updated details on proposed code changes and engage additional stakeholders impacted by the proposed measures. The Healthcare Exceptions CASE topic as a whole was presented on March 17, 2026. In this meeting, the scope of the measures was presented to stakeholders as well as measure cost effectiveness information. The presentation included introduction to results of energy, cost effectiveness, and incremental cost analyses, and solicited additional feedback on refined draft code language. Due to the magnitude of adjustments needed to the prototypes to support the analysis, a standalone prototype-specific stakeholder meeting was held. The Healthcare Prototype stakeholder meeting took place on April 20, 2026, where detailed information regarding the proposed updates to the hospital prototype as well as information to support a brand new skilled nursing facility SNF) prototype was presented to the public.

Utility-sponsored stakeholder meetings are open to the public. For each stakeholder meeting, two promotional emails were distributed from info@title24stakeholders.com. A number of emails were sent to the full Title 24 stakeholders' listserv, which includes over 3,000 individuals. Other emails were sent to targeted, specific recipients based on their subscription preferences.

The Title 24 Stakeholders listserv is an opt-in service comprising participants from a diverse industries and trades, such as manufacturers, advocacy groups, local government, and building and energy professionals. Each meeting was announced on the Title 24 Stakeholders LinkedIn page and cross-promoted on individual LinkedIn pages in advance to engage individuals, organizations, and broader channels outside beyond the listserv.

The Statewide CASE Team also conducted extensive personal outreach to stakeholders. Exported webinar meeting data captured attendance numbers, individual comments, and results from live attendee polls to help evaluate stakeholder participation and support.

Statewide CASE Team Communications

The Statewide CASE Team held personal communications over email and phone with numerous stakeholders when developing this report. The organizations listed in Table 119 provided input on the proposed measures and content in the report. In addition to those stakeholders, the Statewide CASE Team engaged market actors who manage hospitals, design and engineering firms, and national experts involved in healthcare projects across the country.

Table 119: Engaged Stakeholders

Organization/Individual Name	Market Role	Mentioned in CASE Report Sections
California Energy Commission (CEC)	State Regulator	No
California Department of Healthcare Access and Information (HCAI)	State Regulator	Throughout report
Kaiser Permanente	Healthcare Owner and Operator	Market Structure and Availability
American Hospital Association (AHA)	Trade Association	Cost Effectiveness
American Society for Health Care Engineering (ASHE)	Trade Association	Cost Effectiveness
Taylor Engineers	Engineering Firm	No
Flad Architects	Design Firm	No
ASHRAE Technical Committee 9.6 Committee	Standards Development	No
ASHRAE SSPC Committee 170	Standards Development	No

Appendix F: Prototype Specification and Proposed ACM Reference Manual Markups

F.1 Background

The Statewide CASE Team gathered input from industry and stakeholders to update the current CBECC Hospital prototype and to develop a new skilled nursing facility prototype that reflects healthcare-sector building and operational characteristics in California. These updates are intended to help determine realistic energy savings of proposed health care measures.

Hospital EUI alignment: The Statewide CASE Team compared the modeled hospital energy use (EUI) to the reported annual energy use of California hospitals based on data collected through the CEC's Building Energy Benchmarking Program[21]. After analyzing the data, which requires hospitals over 50,000 square feet to submit annual energy-use data, the Statewide CASE Team determined that hospitals report an average weather-normalized EUI of 200 to 250 kBtu/sf (235 kBtu/sf for 2024). The average EUI from the CEC's dataset is approximately two to two and a half times larger than the EUI of a hospital modeled per the CBECC prototype.[22] There are many reasons for this inconsistency, including, but not limited to, spaces (e.g., data center), additional plug and process loads, and increased ventilation not fully accounted for in the model. To align the hospital baseline model more closely with actual hospital energy usage, the Statewide CASE Team has modified the baseline hospital prototype.

In addition, the following factors drove the decision to undertake large-scale prototype development efforts in conjunction with this CASE study:

- Discussions with subject-matter experts confirmed that the existing hospital prototype is not representative of a typical California hospital in terms of design or energy use characteristics.
- Some of the modeling inputs and assumptions for the existing hospital prototype are not consistent with other California Building Code requirements.
- The current exceptions in Title 24, Part 6 apply to both hospitals and SNFs. Healthcare facilities exceptions currently apply to all Hospitals and SNFs.
- The construction ratio of hospitals and SNFs is approximately 3:2 by floor area; however, no prototype available for SNFs.

[21] California Building Energy Benchmarking Program - Property: Hospital (General Medical and Surgical) Year: 2018-2024

[22] This finding was also consistent with data derived from the American Society for Health Care Engineering (ASHE) and based on Mazzetti and Kaiser Permanente's experience.

- The CEC construction forecast includes hospital and SNF buildings as a single building type.

The Statewide CASE Team presented prototype enhancements during a utility-sponsored stakeholder meeting on April 20, 2026.

F.2 Hospital Prototype Enhancements

The Statewide CASE Team modified the following characteristics of the existing hospital prototype model representative of typical healthcare hospital facilities in California:

1. **Building Geometry**: Modified envelope geometry to represent WWR of 30 percent
2. **Occupancy and Operational Schedules**: Added new space functions and space types to align with California Mechanical Code (CMC) Table-4A and updated occupancy schedules for all spaces by space function
3. **Lighting Power Density and Schedules**: Updated lighting power densities for the existing and newly added space functions
4. **Equipment Power Density and Schedules:** Updated plug and receptacle loads and schedules of existing and newly added space functions.
5. **HVAC System Type:** Modified VAV to CAV system for critical spaces (e.g., operating rooms)
6. **HVAC Controls and Ventilation Rates**: Updated set points for supply air temperature reset and ventilation rates for each space function to reflect 2025 CMC requirements[23]

Details of model updates for each of the above characteristics is summarized below.

1. Building Geometry

The current CBECC prototype features an envelope geometry with an average WWR of 16 percent, ranging from 12 percent on the north façade to 24 percent on the west façade. This is significantly lower than typical average WWR of 30 percent found in California hospital buildings. In the updated prototype, the higher WWR is distributed proportionally across each façade, maintaining consistency with the existing prototype. This update accounts for some of the EUI difference observed between the current prototype and typical hospital buildings.

2. Occupancy and Operational Schedules

[23] Hospitals are subject to ventilation requirements in the CMC, which is consistent with the 2021 ASHRAE 170 ventilation rates

Current CBECC hospital prototype uses three schedules - HealthOccupancy, HealthLights, HealthReceptacle - for all clinical and support spaces. These three schedules are based on typical office occupancy fractions and schedules. The updated prototype defines seven new schedule types for eighteen new space functions listed in Table 120, each with independent occupancy, lighting and plug load schedules representative of typical hospital facility occupancy and operation.

Table 120: Hospital Space Functions, Schedule Types and Occupancy Fractions

Space Function Name(s)	Occupancy Schedule Type	Wkday 6A–12P Occ.	Wkday 12P–6P Occ.	Wkday 6P–10P Occ.	Wkday 10P–6A Occ.	Wknd Peak Occ.	Wknd Night Occ.
Patient Room – Inpatient	Patient_Room	0.85	0.90	0.80	0.80	0.85	0.80
Patient Room (ICU)	Patient_Room	0.85	0.90	0.80	0.80	0.85	0.80
ICU Nurse Station / Lobby	Patient_Room	0.85	0.90	0.80	0.80	0.85	0.80
Operating / Procedure Room	Operating_Room	0.80	0.80	0.60	0.20	0.50	0.20
Operating Room – Nurse Station/Lobby	24x7	1.00	1.00	1.00	1.00	1.00	1.00
Emergency Room - Nurse Station/Lobby	24x7	1.00	1.00	1.00	1.00	1.00	1.00
Inpatient Floor -	24x7	1.00	1.00	1.00	1.00	1.00	1.00
Nurse Station	24x7	1.00	1.00	1.00	1.00	1.00	1.00
Emergency Room – Exam/Triage	24x7	1.00	1.00	1.00	1.00	1.00	1.00
Lobby/Records/Waiting	24x7	1.00	1.00	1.00	1.00	1.00	1.00
Corridor – Clinical	24x7	1.00	1.00	1.00	1.00	1.00	1.00
Imaging / Radiology Room;	Clinical_Area	0.90	0.95	0.70	0.10	0.60	0.10
Laboratory (Clinical);	Clinical_Area	0.90	0.95	0.70	0.10	0.60	0.10
Pharmacy; Physical Therapy / Rehabilitation	Clinical_Area	0.90	0.95	0.70	0.10	0.60	0.10
Administrative Office	Hospital_Office	0.95	0.95	0.30	0.05	0.25	0.05
Kitchen – Food Prep.	Food_Prep	0.95	0.95	0.90	0.00	0.85	0.00
Kitchen - Dining	Food_Prep	0.95	0.95	0.90	0.00	0.85	0.00
Mechanical / Electrical Plant	Mech_Elec	0.50	0.50	0.50	0.50	0.50	0.50

The above updates significantly change the lower- or zero-off-hour occupancy assumptions in the current prototype for emergency rooms, operating rooms, clinical spaces, and nursing stations, which must be continuously staffed per California Health and Safety Code section 1276.4.

3. Lighting Power Density and Schedules

The lighting power density values in the current prototype applied a single generic nonresidential office lighting power density to all clinical zones regardless of function —

ICU rooms, operating rooms, corridors, and nurse stations, which do not adequately reflect the high-intensity lighting requirements of clinical spaces and current LED luminaire performance levels common in new hospital construction in California.

The updates to the prototype include revised power densities for the new space function as shown in Table 121 and new lighting schedule fractions by schedule type listed in Table 122.

Table 121: Hospital New Space Functions Lighting Power Density Update

Schedule Type	Space Function Name	Current W/ft²	Updated W/ft²	LPD Change
Patient_Room	Patient Room — ICU	0.90	0.70	-22%
Patient_Room	ICU Nurse Station / Lobby	0.85	0.62	-26%
24X7	OR Nurse Station / Lobby	0.85	0.50	-41%
24X7	ER Nurse Station / Lobby	0.85	0.71	-17%
24X7	Nurse Station / Care Team (24/7 floors)	0.85	0.65	-23%
24X7	Lobby / Records / Waiting	0.70	0.71	+1%
Clinical_area	Nurse Station (Clinical / Ancillary floor)	0.85	0.66	-23%
Clinical_area	Laboratory – Clinical	0.90	0.70	-22%
Clinical_area	Physical Therapy / Rehabilitation	0.75	1.15	+53%
Hospital_office	Administrative Office	0.65	0.60	-8%
Mech_Elec	Mechanical / Electrical Plant	0.60	0.43	-29%

These revisions are aligned with the new space functions and schedule types added to the existing prototype, considering the following items:

- Intensive and critical care patient rooms include procedure lighting
- Corridors serving patient care units must maintain the required minimum illuminance 24/7 per CMC
- Imaging suites (MRI, CT, fluoroscopy, X-ray) require low ambient lighting for monitor visibility
- Reductions in nurse station and ICU LPDs (17–41 percent) reflect displacement of fluorescent assumptions by LED sources.

- The Physical Therapy increase (0.75→1.15 W/ft²) corrects an understated base value — PT and rehabilitation spaces require higher illuminance per IES RP-29 for visual assessment and mobility assistance tasks
- All values are consistent with the 2025 Title 24 prescriptive ceiling of 0.90 W/ft² on a whole-building area-weighted basis

Table 122: Hospital New Lighting Schedule Fractions by Schedule Type

Schedule Type	Weekday Peak (8A–6P)	Weekday Evening (6P–10P)	Weekday Night (10P–6A)	Weekend Peak	Weekend Night	Comments/Notes
Patient_Room	0.90	0.70	0.60	0.85	0.60	Patient rooms operate 24 hrs; dimmed overnight for patient comfort.
24x7	1.00	1.00	1.00	1.00	1.00	Corridors, ER, nurse stations: full illuminance maintained at all hours per CMC minimum.
Operating_Room	0.80	0.60	0.25	0.50	0.25	Surgical schedule 6AM–10PM weekdays; overnight minimum for emergency cases and cleaning services.
Clinical_Area	0.95	0.70	0.10	0.60	0.10	Ancillary clinical depts (lab, PT, pharmacy, imaging): extended hours, minimal overnight.
Food_Prep	0.95	0.90	0.00	0.85	0.00	Hospital food service 5AM–9PM daily; no occupancy overnight.
Mech_Elec	0.50	0.50	0.50	0.50	0.50	Mechanical/electrical plant: constant 50% reflects task lighting with continuous equipment.

4. Equipment Power Density and Schedules

The current CBECC hospital prototype assigns a single-receptacle load density of approximately 1.50 W/ft² (16.15 W/m²) to all nonresidential zones, regardless of clinical function—equivalent to that of a commercial office building. This uniform density is incorrect, as it significantly understates load in high-intensity clinical zones (operating rooms, ICU, ER) and overstates load in administrative office zones. Table 123 summarizes the updated prototype representing space-type densities derived from measured hospital equipment surveys and published equipment power data.

Table 123: Hospital Equipment Power Update Summary

Schedule Type	Space Function Name	Current W/ft²	Updated W/ft²	Change
Patient_Room	Patient Room — General Inpatient	1.50	2.00	+33%
Patient_Room	Patient Room — ICU / CCU	1.50	2.00	+33%
Patient_Room	ICU Nurse Station / Lobby	1.50	1.00	-33%
Operating_Room	Operating / Procedure Room	1.50	4.00	+167%
24x7	OR Nurse Station / Lobby	1.50	1.00	-33%
24x7	Emergency Dept — Exam / Trauma / Triage	1.50	2.00	+33%
24x7	ER Nurse Station / Lobby	1.50	1.00	-33%
24x7	Nurse Station / Care Team (24/7 floors)	1.50	1.00	-33%
24x7	Lobby / Records / Waiting	1.50	0.90	-40%
24x7	Corridor — Clinical (24/7)	1.50	0.25	-83%
Clinical_Area	Nurse Station (Clinical / Ancillary floor)	1.50	1.12	-25%
Clinical_Area	Laboratory — Clinical	2.00	2.00	—
Clinical_Area	Radiology / Imaging Room	1.50	3.00	+50%
Clinical_Area	Physical Therapy / Rehabilitation	1.50	1.00	-33%
Hospital_office	Administrative Office	1.50	1.00	-33%
Food_prep	Kitchen / Food Preparation	1.50	3.00	+100%
Food_prep	Dining / Cafeteria	0.50	1.00	+100%
Mech_Elec	Mechanical / Electrical Plant	1.50	0.5	-66%
Mech_Elec	Computer Room	-	20.0	New

Following are a list of items considered in updating the above listed power densities:

- Operating Room plug load density of 4.00 W/ft² (43.06 W/m²) is derived from equipment inventories in published hospital energy studies and is consistent with the 3.5–5.0 W/m² range reported in California hospital equipment surveys. A typical OR suite contains anesthesia machines (1–3 kW), electrosurgical units (0.3–0.5 kW each), patient monitoring systems (0.5–1 kW), surgical lighting power supplies (1–3 kW), irrigation pumps, warming units, and C-arm fluoroscopy units. These loads are largely independent of occupancy scheduling and run continuously during surgical blocks.

- The patient rooms and ICU power density of 2.00 W/ft² (21.53 W/m²) reflects the use of continuous monitoring equipment (patient monitor, IV pumps, infusion systems), bedside communication and entertainment systems, and nursing equipment. ICU bays carry higher per-bed loads than general medical/surgical rooms; the density used here is a blended average of both types, as shown in the prototype floor plan.
- Power density reduction from 1.50 to 1.00 W/ft² (16.15 to 10.76 W/m²) for administrative offices corrects the current prototype's application of a clinical-zone average to what are functionally standard office environments. The 1.0 W/ft² (10.76 W/m²) value is consistent with commercial office receptacle load assumptions used in other nonresidential prototype building types and with CBECS survey data for the office function within healthcare facilities.A new space function for computer rooms is added to model on-premise computer servers and telecommunication equipment power use.

5. HVAC System Type

The existing healthcare prototype uses VAV systems (system 6) for all zones. Though this is consistent with the HVAC system map for nonresidential buildings, many healthcare buildings use CAV systems and all healthcare buildings are exempted from current nonresidential building requirements. 2025 Title-24 exempts all health care facilities from requiring any specific baseline HVAC system type The Statewide CASE Team has revised the existing prototype to use CAV systems for all critical spaces.

Note on Water versus Air-Cooled Chiller: The Statewide CASE Team determined that most newly constructed hospitals install an air-cooled instead of a water-cooled chiller as the primary cooling equipment. [24] The prototype uses a water-cooled chiller as the baseline system for hospitals. The Statewide CASE Team conducted additional research to ensure the model accurately represents the primary and secondary cooling

[24] SMEs on the Statewide CASE Team indicated that it is common practice for hospitals to install air-cooled chillers instead of water-cooled chillers. Per CPC 611 and CMC 407.4, hospitals require backup on-site water storage capacity in case of an emergency to support essential functions. Cooling is an essential function, so a water-cooled chiller would require additional water storage capacity and nearly double the on-site tank size required without a water-cooled system. This is also allowed by exception for healthcare facilities if the air-cooled chiller is greater than 300 tons.

system in the hospital model. However, the Statewide CASE Team continued to model hospitals with a water-cooled chiller as the baseline and did not switch to air-cooled chillers. This is because continuing to use the water-cooled chiller represents a more conservative approach as it has lower costs and energy usage. This more conservative approach means that the proposed measure needs to save more energy to be shown as cost effective.

6. HVAC Controls and Ventilation Rates

The existing prototype used hardcoded maximum airflow rates for the VAV_PatRms air loop (9.109 m^3/s) and all terminal units serving patient rooms and laboratories. These values were derived from load calculations using commercial office schedule and plug load assumptions. With significantly higher loads and continuous operational schedules for healthcare spaces, these hardcoded values undersize the patient floor air system, resulting in significant unmet load hours. The updated prototype uses EnergyPlus Autosizing option for all patient room design air flow rates for supply and return fans, and water flow rate for cooling coils. In addition to this autosizing change, the following control system and ventilation rate changes are implemented in the updated prototype:

a. **Continuous Fan Operation**: All patient rooms, clinical, emergency and operating room areas require minimum total ACH and outdoor air requirements as per CMC Section 403.7. This update requires all supply and return fans in these spaces are scheduled to operate continuously regardless of the occupancy fraction.
b. **Fixed Supply Air Temperature:** All clinical areas are required to maintain fixed supply air temperature with no seasonal, diurnal or load-based reset. The existing prototype with VAV air loops includes supply air temperature reset which has been revised and fixed at 55 °F with no resets based on Exception 4, Section 140.4(f).
c. **Heat Recovery:** The existing prototype applied 60 percent sensible heat recovery in all zones including clinical areas. CMC Section 407.1 does not allow recirculation for Class 3 or Class 4 spaces. The existing prototype is updated removing heat recovery for all clinical and patient room areas.
d. **Ventilation Rates:** All clinical spaces have ventilation requirements based on space function. CMC Table 4-A provides minimum outdoor air requirements and minimum total air changes for these spaces. The existing prototype uses typical ventilation rates for nonresidential office occupancies and are updated with new ventilation space functions and flow rates to meet the CMC requirements as detailed in 124.

Table 124: Minimum Ventilation Requirements as per CMC Table 4-A

Space Function Name	**Minimum Outdoor Air** Requirement ACH	**Minimum Total Air** Requirement ACH
Patient Room	2	4
Patient Room — ICU	2	6
Nurse Station	2	4
Operating Room	4	20
Emergency Room	2	6
Emergency Triage Area	2	12
Corridor	N/A	2
Radiology/Imaging	2	6
Laboratory – Clinical	2	6
Kitchen / Food Preparation	2	10

The Statewide CASE Team implemented the above changes in the existing hospital prototype model and simulated its energy performance in all climate zones. The average EUI is 241.5 kBtu/sf with the highest EUI of 248.3 kBtu/sf in Climate Zone 8 and lowest EUI of 210.2 kBtu/sf in Climate Zone 16.

F.3 New Skilled Nursing Facility Prototype

The Statewide CASE Team has assembled a new Skilled Nursing Facility (SNF) prototype representing low-rise acute healthcare buildings modeled in accordance with California Title 24 requirements. The facility consists of a single-story, 64,000 ft² structure designed with 80 patient beds, corresponding to approximately 800 ft² per bed, which is consistent with typical SNF buildings in California.

The building program includes a mix of patient care areas (I-2 occupancy), support services, administrative offices, and assembly spaces such as dining and recreation. Patient care areas constitute the largest portion of floor area, followed by support and ancillary functions. The building form is assumed to be H-shaped as shown in Figure 2, slab-on-grade configuration with a flat roof, standard floor-to-floor height of 12 ft, and a finished ceiling height of 10 ft.

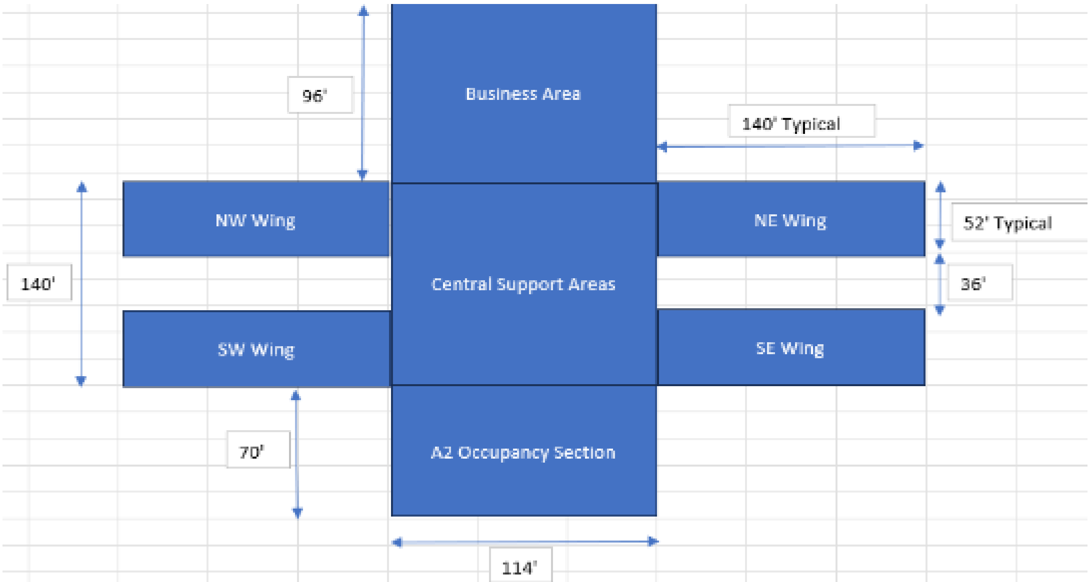

Figure 2: SNF Floor Layout

The SNF Floor layout consists of four patient-room wings, central support areas with nursing staff, business area for office staff and an A2 occupancy area for dining, storage and other spaces. Table 125 summarizes the SNF prototype model characteristics. The building envelope is defined using prescriptive Title 24 construction assemblies, with metal-framed exterior walls and a wood-framed roof system. The assembly U-factors for all envelope components are defined to meet the prescriptive requirements depending on climate zone. Fenestration is limited, with window-to-wall ratios ranging from approximately 7 percent to 16 percent by orientation, and includes fixed horizontal overhangs for solar control. Window thermal properties and solar heat gain coefficients are consistent with Title 24 prescriptive baseline assumptions.

Mechanical systems are modeled using a decentralized approach typical of SNF facilities. Packaged Terminal Air Conditioners (PTACs) serve individual patient rooms and select occupied spaces, providing both heating and cooling. A Dedicated Outdoor Air System (DOAS) supplies ventilation air to meet minimum outdoor air requirements per code. Variable Air Volume (VAV) systems are applied to common areas and support spaces, providing conditioned air through ducted distribution. No central plant (e.g., chiller/boiler) is included in the baseline configuration, although such systems are considered as potential alternatives.

Ventilation rates are established in accordance with the California Mechanical Code and Title 24 requirements, with airflow determined based on space type, occupant density, and minimum air change rates. The DOAS is modeled to deliver 100 percent outdoor air to satisfy these requirements, with exhaust ventilation applied as required for healthcare and support spaces.

Service hot water is provided by central gas-fired storage water heaters with baseline thermal efficiency of approximately 0.8, consistent with federal and state appliance standards. Hot water demand is calculated based on occupancy and space usage profiles derived from Title 24 Appendix data.

Lighting and plug loads are defined using Title 24 standard assumptions and consistent with the Healthcare Hospital prototype space functions and schedule types as detailed in the previous section. Interior lighting power densities vary by space type, generally ranging from 0.35 to 1.3 W/ft², while plug and process loads are applied using typical SNF benchmarks (on the order of ~1 W/ft²). Schedules reflect continuous operation for patient care areas and typical nonresidential schedules for administrative and common spaces, consistent with 24-hour healthcare facility operation.

Table 125: SNF Building Characteristics

Building Characteristic	Prototype Model Value
General	
Building Type	Skilled Nursing Facility (Healthcare)
Condition	New Construction
Floor Area	64,000 ft²
Number of Floors	1
Occupancy	80 beds
Operating Schedule	24/7
Space Types	Patient care, support, office, dining/assembly
Envelope	
Wall Construction	Wood/metal framed wall
Wall U-Factor	0.051 Btu/h-ft²-°F
Roof Type	Flat, wood-framed
Roof U-Factor	~0.028–0.039 (CZ dependent)
Fenestration	Code baseline glazing (T24 default)
Window-to-Wall Ratio	N: 8%, E: 12%, S: 7%, W: 16%
Shading	Fixed horizontal overhangs
Lighting– *Consistent with Hospital Prototype*	
Interior LPD	~0.35–1.3 W/ft² (space dependent)
Exterior Lighting	~0.05 W/ft²
Controls	Manual + occupancy sensors
Plug Loads– *Consistent with Hospital Prototype*	
Equipment Loads	~1 W/ft² typical
Medical Equipment	Included
Schedules – *Consistent with Hospital Prototype*	

Patient Areas	Continuous (24 hr)
Common Areas	Daytime peak
HVAC Operation	Continuous with setback
HVAC Systems	
System Type – Patient Areas	PTAC (DX cooling + electric heating)
System Type – Common Areas	VAV air systems (ducted)
Ventilation System	Dedicated Outdoor Air System (DOAS)
Cooling Source	Direct Expansion (DX)
Heating Source	Electric resistance / heat pump
Central Plant	None (baseline decentralized system)
Air Distribution	Ducted (DOAS/VAV) + terminal units
HVAC Controls/Thermostat Settings	
Cooling Setpoint	~68 °F
Heating Setpoint	~72 °F
Setback	~6 °F
Ventilation	
Standard	Title 24 CMC / ASHRAE 62.1 basis
Outdoor Air	100% OA via DOAS
Method	ACH + cfm/person + cfm/area
Exhaust	Provided based on space type
Domestic Hot Water	
System Type	Gas storage water heater
Efficiency	0.80

The Statewide CASE Team developed a new energy model prototype for SNF and simulated its energy performance in all climate zones. The average EUI is 212.8 kBtu/sf with the highest EUI of 222.7 kBtu/sf in Climate Zone 7 and lowest EUI of 189.5 kBtu/sf in Climate Zone 16.

F.4 Proposed Revisions to ACM Reference Manual

Table 126 summarizes all proposed changes to the ACM Reference Manual including changes associated with prototype updates and the proposed changes for shut-off and reset controls, space conditioning zone controls, and fan controls. ACM markup with details will be included in an Annex being prepared separately for CBECC Software update.

Table 126: Proposed ACM Reference Manual Changes

ACM Section	Description	Proposed Change
5.1.3 HVAC System Map	Table 1: Nonresidential HVAC System Map	Standard design would no longer be the same as proposed design. Standard design is TBD for non-critical spaces.
5.4 Space Uses	5.4.2 Infiltration, 5.4.3 Occupancy, 5.4.4 Lighting Schedules	Standard design would no longer be same as proposed. Schedules for non-critical spaces will be modified to reflect real world hospital designs.
5.6 HVAC Zone Level System	5.6.3 Terminal Heat Capacity	Standard design would no longer be the same as proposed design. Standard design should be the same as other nonresidential buildings.
5.6 HVAC Zone Level System	5.6.4 Terminal Heat Capacity	Standard design would no longer be the same as proposed design. Standard design should be the same as other nonresidential buildings.
5.6 HVAC Zone Level System	5.6.7 Terminal Airflow	Standard design would no longer be the same as proposed design. Standard design should be the same as other nonresidential buildings.
5.6 HVAC Zone Level System	5.6.9 Outdoor Air Ventilation	Standard Design would be updated for healthcare facilities to reflect the CMC ventilation rate for healthcare facilities.
5.7 HVAC Secondary System	5.7.1 Basic System Information	Standard design would no longer be the same as proposed design. Standard design is TBD for non-critical spaces.
5.7 HVAC Secondary System	5.7.2 System Controls	Cooling and heating supply temperature standard design would be updated to reflect the same as other nonresidential buildings.
5.7 HVAC Secondary System	5.7.2.3 Supply Air Temperature Control	Standard design would no longer be the same as proposed design. Standard design should be the same as other nonresidential buildings.
5.7 HVAC Secondary System	5.7.3 Fan and Duct Systems	Standard design would no longer be the same as proposed design. Standard design should be the same as other nonresidential buildings.
5.8 HVAC Primary System	5.8.2 Chillers	If proposed chiller is an air-cooled chiller, then same as proposed. If not, it must follow Table 18, same as other nonresidential building types.

Appendix G: Code Language Markup (Non-restructured) from March 2026 Draft CASE Report

Shut-off and Reset Controls

120.2(e) Shut-off and reset controls for space conditioning systems. Each space conditioning system shall be installed with controls that comply with the following:

1. The control shall be capable of automatically shutting off the system during periods of nonuse and shall have:

A. An automatic time switch control device complying with Section 110.9 with an accessible manual override that allows operation of the system for up to 4 hours; or

B. An occupancy sensor; or

C. A 4-hour timer that can be manually operated.

Exception 1 to Section 120.2(e)1: Mechanical systems serving retail stores and associated malls, restaurants, grocery stores, churches and theaters equipped with 7-day programmable timers.

Exception 2 to Section 120.2(e)1: Systems serving healthcare facilities

2. The control shall automatically restart and temporarily operate the system as required to maintain:

A. A setback heating thermostat setpoint if the system provides mechanical heating; and

Exception to Section 120.2(e)2A: Thermostat setback controls are not required in nonresidential buildings in areas where the Winter Median of Extremes outdoor air temperature determined in accordance with Section 140.4(b)3 is greater than 32°F.

B. A setup cooling thermostat setpoint if the system provides mechanical cooling.

Exception to Section 120.2(e)2B: Thermostat setup controls are not required in nonresidential buildings in areas where the Summer Design Dry Bulb 0.5 percent temperature determined in accordance with Section 140.4(b)3 is less than 100°F.

3. **Occupant sensing zone controls.** Where the system providing space conditioning also provides the ventilation required by Section 120.1 and includes occupant sensor ventilation control as specified in Section 120.1(d)5, the occupant sensing zone controls shall additionally comply with the following:

A. In 5 minutes or less after entering occupied-standby mode as described in Section 120.1(d).

i. Automatically set up the operating cooling temperature set point by 2°F or more and set back the operating heating temperature set point by 2°F or more; or

ii. For multiple zone systems with Direct Digital Controls (DDC) to the zone level, setup the operating cooling temperature setpoint by 0.5°F or more and setback the operating heating temperature setpoint by 0.5°F or more.

B. In 5 minutes or less after entering occupied-standby mode, mechanical ventilation to the zone shall remain off whenever the space temperature is between the active heating and cooling setpoints.

Exception 1 to Sections 120.2(e)1, 2, 3: Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.

Exception 2 to Sections 120.2(e)1, 2, 3: Systems with full load demands of 2 kW or less, if they have a readily accessible manual shut-off switch.

Exception 3 to Sections 120.2(e) 1 and 2: Systems serving hotel/motel guest rooms, if they have a readily accessible manual shut-off switch.

4. Hotel and motel guest rooms shall have captive card key controls, occupancy sensing controls or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, setpoints are set up at least +5°F (+3°C) in cooling mode and set down at least -5°F (-3°C) in heating mode.

5. In healthcare facilities, for each space where airflow turndown is permitted by Table 4-A of the California Mechanical Code and/or Title 24, Part 6, the serving HVAC system shall have controls that reset zone or terminal supply airflow to no less than the minimum allowed for that space based on occupied or unoccupied status.

Exception to Sections 120.2(e) 5: Where a zone or system serves multiple spaces, airflow shall not be reduced below the most restrictive applicable minimum required for any space served.

~~**Exception 1 to Section 120.2(e):** Systems serving healthcare facilities.~~

Space Conditioning Zone Controls

SECTION 100.1—DEFINITIONS AND RULES OF CONSTRUCTION

Zone, Mixed Requirement, is a group of two or more spaces within a building with sufficiently similar comfort requirements but refer to different ventilation criteria such as CMC Table 4-A and Title 24 Part 6. The mixed requirement zone ventilation rate shall be the sum of the separately calculated minimum supply air flow rates and outside air flow rates for each space from each reference

140.4(d) Space conditioning zone controls. Each space conditioning zone shall have controls designed in accordance with 1, 2, or 3:

1. Each space conditioning zone shall have controls that prevent:
   A. Reheating; and
   B. Recooling; and
   C. Simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems; or
2. Zones served by variable air-volume systems that are designed and controlled to reduce, to a minimum, the volume of reheated, recooled, or mixed air are allowed only if the controls meet all of the following requirements:
   A. For each zone with direct digital controls (DDC):
      i. The volume of primary air that is reheated, recooled, or mixed air supply shall not exceed the larger of:
         a. 50 percent of the peak primary airflow; or
         b. The design zone outdoor airflow rate as specified by Section 120.1(c)3.
      ii. The volume of primary air in the deadband shall not exceed the design zone outdoor airflow rate as specified by Section 120.1(c)3.
      iii. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no higher than 95ºF while the airflow is maintained at the dead band flow rate.
      iv. The second stage of heating consists of modulating the airflow rate from the dead band flow rate up to the heating maximum flow rate.
   B. Control sequences of operation for reheat zones shall be in accordance with ASHRAE Guideline 36. For each zone without DDC, the volume of primary air that is reheated, re-cooled, or mixed air supply shall not exceed the larger of the following:
      i. 30 percent of the peak primary airflow; or
      ii. The design zone outdoor airflow rate as specified by Section 120.1(c)3.

Exception to Section 140.4(d)1,2: Systems serving healthcare facilities

3. Zones or Mixed Requirement Zones served by variable air-volume systems that include a space(s) designed to California Mechanical Code Table 4-A shall be designed to meet the following requirements:

A. For each occupied zone or mixed requirement zone:

   i. the volume of primary air supplied to the space designed per CMC Table 4-A shall not exceed the minimum ventilation rates defined in CMC Table 4-A for the occupied condition unless required to meet temperature or humidity setpoints or pressure differential requirements.

   ii. the volume of primary air supplied to the space not designed per CMC Table 4-A shall comply with the referenced design standard in such that it does not prevent the space designed per CMC Table 4-A from meeting ventilation, temperature, humidity, and pressure requirements.

B. For each unoccupied zone or mixed requirement zone:

   i. the volume of primary air supplied to the space designed per CMC Table 4-A shall not exceed the minimum ventilation rates defined in CMC Table 4-A for the unoccupied condition unless required to meet temperature or humidity setpoints or pressure differential requirements.

   ii. the volume of primary air supplied to the space not designed per CMC Table 4-A shall comply with the referenced design standard in such that it does not prevent the space designed per CMC Table 4-A from meeting ventilation, temperature, humidity, and pressure requirements.

Exception 1 to Section 140.4(d): Zones with special pressurization relationships or cross contamination control needs.

Exception 2 to Section 140.4(d): Zones served by space conditioning systems in which at least 75 percent of the energy for reheating, or providing warm air in mixing systems, is provided from a site-recovered or site-solar energy source.

Exception 3 to Section 140.4(d): Zones in which specific humidity levels are required to satisfy non-covered process loads. Computer rooms or other spaces where the only process load is from IT equipment may not use this exception.

Exception 4 to Section 140.4(d): Zones with a peak supply-air quantity of 300 cfm or less.

~~**Exception 5 to Section 140.4(d):** Systems serving healthcare facilities~~

Fan Control

140.4(m) Fan control. Each cooling system listed in Table 140.4-I shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements:

1. DX and chilled water cooling systems that control the capacity of the mechanical cooling directly based on occupied space temperature shall:

A. Have a minimum of two stages of fan control with no more than 66 percent speed when operating on stage 1; and

B. Draw no more than 40 percent of the fan power at full fan speed, when operating at 66 percent speed.

2. All other systems, including but not limited to DX cooling systems and chilled water systems that control the space temperature by modulating the airflow to the space, shall have proportional fan control such that at 50 percent air flow the power draw is no more than 30 percent of the fan power at full fan speed.
3. Systems that include an air side economizer to meet Section 140.4(e)1 shall have a minimum of two speeds of fan control during economizer operation.

Exception 1 to Section 140.4(m): Modulating fan control is not required for chilled water systems with all fan motors < 1 HP, or for evaporative systems with all fan motors < 1 HP, if the systems are not used to provide ventilation air and all indoor fans cycle with the load.

~~**Exception 2 to Section 140.4(m):** Systems serving healthcare facilities.~~

Alterations

SECTION 141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS

Additions, alterations, and repairs to existing nonresidential, and hotel/motel buildings, existing outdoor lighting for these occupancies, and internally and externally illuminated signs, shall meet the requirements specified in Sections 100.0 through 110.12, and 120.0 through 130.5 that are applicable to the building project, and either the performance compliance approach (energy budgets) in Section 141.0(a)2 (for additions) or 141.0(b)3 (for alterations), or the prescriptive compliance approach in Section 141.0(a)1 (for additions) or 141.0(b)2 (for alterations), for the Climate Zone in which the building is located. Climate zones are shown in FIGURE 100.1-A.

Covered process requirements for additions, alterations, and repairs to existing nonresidential, and hotel/motel buildings are specified in Section 141.1.

~~**Exception to Section 141.0:** Alterations to healthcare facilities are not required to comply with this Section.~~

(b) **Alterations.** Alterations to components of existing nonresidential, hotel/motel, or relocatable public school buildings, including alterations made in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy shall meet item 1, and either Item 2 or 3 below:

1. **Mandatory Requirements**. Altered components in a nonresidential, or hotel/motel building shall meet the minimum requirements in this Section.

A. **Roof/Ceiling Insulation.** The opaque portions of the roof/ceiling that separate conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of Section 141.0(b)2Bii.

B. **Wall Insulation.** For the altered opaque portion of walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 4 below:

1. **Metal Building.** A minimum of R-13 insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed U-0.113.

2. **Metal Framed.** A minimum of R-13 insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed U-0.217.

3. **Wood Framed and Others.** A minimum of R-11 insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed U-0.110.

4. **Spandrel Panels and Glass Curtain Walls.** A minimum of R-4, or the area-weighted average U-factor of the wall assembly shall not exceed U-0.280.

Exception 1 to Section 141.0(b)1B: Light and heavy mass walls.

Exception 2 to Section 141.0(b)1B: Alterations to healthcare facilities.

C. **Floor Insulation.** For the altered portion of raised floors that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. **Raised Framed Floors.** A minimum of R-11 insulation between framing members, or the area-weighted average U-factor of the floor assembly shall not exceed the U-factor of U-0.071.

2. **Raised Mass Floors in Hotel/Motel Guest Rooms.** A minimum of R-6 insulation, or the area-weighted average U-factor of the floor assembly shall not exceed the U-factor of U-0.111.

3. **Raised Mass Floors in Other Occupancies.** No minimum U-factor requirement.

Exception to Section 141.0(b)1C: Alterations to healthcare facilities.

D. **Fan Energy Index:** New fan systems serving an existing building shall meet the requirements of Section 120.10.

E. **Exterior windows.** Fenestration alterations other than repairs shall meet the following requirements:

1. Vertical fenestration alterations. Where over 150 square feet of the entire building's vertical fenestration is replaced, the maximum U-factor of the replaced units shall not exceed U-0.58.

2. Added vertical fenestration. Where over 50 square feet of vertical fenestration is added, it shall meet the requirements of Section 120.7(d). Where 50 square feet or less of vertical fenestration is added, this requirement shall not apply.

2. **Prescriptive approach.** The altered components of the envelope, or space conditioning, lighting, electrical power distribution and water heating systems, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 120.0 through 120.6, and Sections 120.9 through 130.5.

Exception to Section 141.0(b)2: The requirements of Section 120.2(i) shall not apply to alterations of space conditioning systems or components.

A. Fenestration alterations other than repair and those subject to Section 141.0(b)2 shall meet the requirements below:

i. Vertical fenestration alterations shall meet the requirements in Table 141.0-A.

ii. Added vertical fenestration shall meet the requirements of TABLE 140.3-B, C, or D.

iii. All altered or newly installed skylights shall meet the requirements of TABLE 140.3-B, C or D.

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Exception 4 to Section 141.0(b)2A: Alterations to healthcare facilities.

C. **New or Replacement Space conditioning Systems or Components** other than new or replacement space conditioning system ducts shall meet the requirements of Section 140.4 applicable to the systems or components being altered and meet the following:

i. Additional Fan Power Allowances are available when determining the Fan Power Budget (Fan kW budget) as specified in Table 141.0-D. These values can be added to the Fan Power Allowance values in Tables 140.4-A and Table 140.4-B.

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ii. New or replacement single zone packaged rooftop systems with direct expansion cooling with rated cooling capacity less than 65,000 Btu/hr shall meet the applicable requirements specified in Table 141.

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Exception 7 to Section 141.0(b)2C: Alterations to healthcare facilities.

D. **Altered Duct Systems.** New or replacement space conditioning system ducts installed to serve an existing building shall meet the requirements of Section 120.4(a) through (f) and meet i, ii, or iii below:

i. Entirely new or complete replacement duct systems installed as part of an alteration shall be leakage tested in accordance with Section 120.4(g). This applies to replacement duct systems installed as part of an alteration that are constructed of at least 75 percent new duct material. Up to 25 percent of that alteration may consist of reused parts from the building's existing duct system, including registers, grilles, boots, air handlers, coils, plenums, and ducts, if the reused parts are accessible and can be sealed to prevent leakage.

ii. If the new ducts are an extension of an existing duct system and the combined new and existing duct system meets the criteria in Subsections 1, 2, 3, and 4 below, the duct system shall be sealed to a leakage rate not to exceed 15 percent of the nominal air handler airflow rate as confirmed through acceptance testing, in accordance with the applicable procedures in Reference Nonresidential Appendix NA7.5.3:

1. The duct system does not serve a healthcare facility;

2. The duct system provides conditioned air to an occupiable space for a constant volume, single zone, space conditioning system;

3. The space conditioning system serves less than 5,000 square feet of conditioned floor area; and

4. The combined surface area of the ducts located outdoors or in unconditioned space is more than 25 percent of the total surface area of the entire duct system.

Exception 1 to Section 141.0(b)2Dii: When it is not possible to achieve the duct leakage criterion in Section 141.0(b)2Dii, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test performed by a certified mechanical acceptance test technician utilizing the methods specified in Reference Nonresidential Appendix NA7.5.3.

Exception 2 to Section 141.0(b)2Dii: Duct Sealing. Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos are not required to comply with subsection 141.0(b)2Dii.

iii. If new ducts installed as part of an alteration are not required to comply with leakage testing specified by section 141.0(b)2Di or 141.0(b)2Dii, then the new ducts shall meet the duct leakage testing requirements of CMC Section 603.9.2.

Exception 1 to Section 141.0(b)2D: Alterations to healthcare facilities.

E. **Altered Space conditioning Systems.** When a space conditioning system is altered by the installation or replacement of space conditioning system equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil:

i. For all altered units where the existing thermostat does not comply with the requirements for demand responsive controls specified in Section 110.12, the existing thermostat shall be replaced with a demand responsive thermostat that complies with Section 110.12. All newly installed space conditioning systems requiring a thermostat shall be equipped with a demand responsive thermostat that complies with Section 110.12; and

ii*.* The duct system that is connected to the new or replaced space conditioning system equipment shall be sealed in accordance with Section 141.0(b)2Dii.

Exception 1 to Section 141.0(b)2Eii: Duct Sealing. Buildings altered so that the duct system no longer meets the criteria of Section 141.0(b)2Dii.

Exception 2 to Section 141.0(b)2Eii: Duct Sealing. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in the Reference Nonresidential Appendix NA2.

Exception 3 to Section 141.0(b)2Eii: Duct Sealing. Existing duct systems constructed, insulated, or sealed with asbestos are not required to comply with Subsection 141.0(b)2Eii.

Exception 1 to Section 141.0(b)2E: Alterations to healthcare facilities.

H. New internally and externally illuminated signs shall meet the requirements of Sections 110.9, 130.3 and 140.8.

Exception to Section 141.0(b)2H: Alterations to healthcare facilities.

L. Alterations to existing outdoor lighting systems in a lighting application listed in TABLE 140.7-A or 140.7-B shall meet the applicable requirements of Sections 130.0, 130.2(b), and 130.4, and:

i. In alterations that increase the connected lighting load, the added or altered luminaires shall meet the applicable requirements of Section 130.2(c) and the requirements of Section 140.7 for general hardscape lighting or for the specific lighting applications containing the alterations; and

ii. In alterations that do not increase the connected lighting load, where 10 percent or more of the existing luminaires are replaced in a general hardscape or a specific lighting application, the alterations shall meet the following requirements:

a. In parking lots and outdoor sales lots where the bottom of the luminaire is mounted 24 feet or less above the ground, the replacement luminaires shall comply with Section 130.2(c)1 AND Section 130.2(c)3; and

b. For parking lots and outdoor sales lots where the bottom of the luminaire is mounted greater than 24 feet above the ground and for all other lighting applications, the replacement luminaires shall comply with Section 130.2(c)1 AND EITHER comply with Section 130.2(c)2 or be controlled by lighting control systems, including motion sensors, that automatically reduce lighting power by at least 40 percent in response to the area being vacated of occupants.

Exception to Section 141.0(b)2Lii: Alterations where less than 5 existing luminaires are replaced.

iii. In alterations that do not increase the connected lighting load, where 50 percent or more of the existing luminaires are replaced in general hardscape or a specific application, the replacement luminaires shall meet the requirements of subsection ii above and the requirements of Section 140.7 for general hardscape lighting or specific lighting applications containing the alterations.

Exception 1 to Section 141.0(b)2Liii: Alterations where the replacement luminaires have at least 40 percent lower power consumption compared to the original luminaires are not required to comply with the lighting power allowances of Section 140.7.

Exception 2 to Section 141.0(b)2Liii: Alterations where less than 5 existing luminaires are replaced.

Exception to Section 141.0(b)2L: Acceptance testing requirements of Section 130.4 are not required for alterations where controls are added to 20 or fewer luminaires.

Exception to Section 141.0(b)2L: Alterations to healthcare facilities.

M. Alterations to existing internally and externally illuminated signs that increase the connected lighting load, replace and rewire more than 50 percent of the ballasts, or relocate the sign to a different location on the same site or on a different site shall meet the requirements of Section 140.8.

Exception to Section 141.0(b)2M: Replacement of parts of an existing sign, including replacing lamps, the sign face or ballasts, that do not require rewiring or that are done at a time other than when the sign is relocated, is not an alteration subject to the requirements of Section 141.0(b)2M.

Exception to Section 141.0(b)2M: Alterations to healthcare facilities.

P. **Electrical Power Distribution Systems.** Alterations to electrical power distribution systems shall meet the applicable requirements of Section 130.5 as follows:

i. **Service Electrical Metering.** New or replacement electrical service equipment shall meet the requirements of Section 130.5(a) applicable to the electrical power distribution system altered.

ii. **Separation Of Electrical Circuits for Electrical Energy Monitoring.** For entirely new or complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of Section 130.5(b).

iii. **Voltage Drop.** Alterations of feeders and branch circuits where the alteration includes addition, modification, or replacement of both feeders and branch circuits, the altered circuits shall meet the requirements of Section 130.5(c).

Exception to Section 141.0(b)2Piii: Voltage drop permitted by California Electrical Code Sections 647.4, 695.6 and 695.7.

iv. **Circuit Controls for 120-Volt Receptacles and Controlled Receptacles**. For entirely new or complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of Sections 130.5(d) and 130.5(e).

Exception to Section 141.0(b)2P: Alterations to healthcare facilities.