California Energy Commission

CONSULTANT REPORT

Impact Analysis

2025 Update to the California Energy Code

Prepared for: **California Energy Commission**
Prepared by: **NORESCO and Frontier Energy**

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Primary Authors:
Eric Shadd, NORESCO, Rahul Athalye, NORESCO, Joe Singer, NORESCO, John Arent, NORESCO, Demian Vonder Kuhlen, NORESCO, Nasim Miriam, NORESCO, Alea German, Frontier Energy, Keith Saechao, Frontier Energy, Antonea Frasier, Frontier Energy

NORESCO
500 Capitol Mall – Suite 2350
Sacramento, CA 95814
Contract Number: 400-24-002

Michael Shewmaker
Contract Manager

Kyle Grewing
Project Manager

Gypsy Achong
Branch Manager
BUILDING STANDARDS BRANCH

Will Vicent
Deputy Director
EFFICIENCY DIVISION

Michael J. Sokol
Director
EFFICIENCY DIVISION

Drew Bohan
Executive Director

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ABSTRACT

This report describes the estimated impacts on energy use, grid demand, and emissions resulting from the adoption of the 2025 Energy Code (California Code of Regulations, Title 24, Part 6). The 2025 Energy Code was adopted by the California Energy Commission (CEC) in August 2024 and went into effect on January 1, 2026. The analysis in this report compares the prescriptive and mandatory requirements of the 2022 and 2025 Energy Codes using prototypical energy models in 16 California building climate zones. The analysis accounts for interactive effects between changes in requirements, such as how modifications to the building envelope influence heating and cooling loads. The analysis estimates savings in terms of site energy (kWh and therms), long-term system cost (LSC), hourly source energy (HSE), annualized grid demand (AGD), and greenhouse gas (GHG) emissions resulting from the 2025 Energy Code for the residential, multifamily, and nonresidential building sectors.

Keywords: Energy savings, LSC savings, long-term system cost savings, annualized grid demand, greenhouse gas, impact analysis, California, 2025 Energy Code, Title 24, Part 6.

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ACRONYMS AND ABBREVIATIONS

AC	Air conditioner
ACM	Alternative Compliance Manual
AGD	Annualized grid demand
ANSI	American National Standards Institute
BESS	Battery energy storage system
BPF	Building performance factor
Btu	British thermal unit
CASE	Codes and Standards Enhancement
CBECC	California Building Energy Code Compliance
CE	Capture efficiency
CEC	California Energy Commission
CFM	Cubic feet per minute
CSE	California Simulation Engine
CZ	Climate zone
DOAS	Dedicated outdoor air system
DOE	United States Department of Energy
ECPA	Energy Conservation and Production Act
EIA	Energy Information Administration
EMCS	Energy management control system
ERV	Energy recovery ventilator
EUL	Effective useful life
FID	Fault indicator display
GHG	Greenhouse gas
HERS	Home Energy Rating System
HID	High-intensity discharge
HP	Heat pump
HPWH	Heat pump water heater
HRV	Heat recovery ventilator
HSE	Hourly source energy
HSPF	Heating seasonal performance factor

HVI	Home Ventilating Institute
IECC	International Energy Conservation Code
IES	Illuminating Engineering Society
JA	Joint appendix
kW	Kilowatt
LED	Light-emitting diode
LSC	Long-term systemwide cost
PCI	Performance cost index
PRM	Performance rating method
PV	Photovoltaic
RA	Reference appendix
SARA	Solar access roof area
SEER	Seasonal energy efficiency ratio
SHGC	Solar heat gain coefficient
SHW	Service hot water
SP	Static pressure
SRR	Skylight-to-roof area ratio
SSL	Solid state lighting
SZ	Single zone
UEF	Uniform Energy Factor
US	United States
VAV	Variable air volume
VRF	Variable refrigerant flow
WHF	Whole-house fan
WWR	Window-to-wall ratio

TABLE OF CONTENTS

Contents

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

KEY TAKEAWAYS

- To evaluate the impacts of the 2025 Energy Code, relative to the 2022 Energy Code, California Energy Commission (CEC) staff completed a three-phase process: a qualitative analysis characterizing changes to the 2022 code, a quantitative analysis measuring their impacts, and a results aggregation phase providing sector-wide summaries.
- The initial qualitative analysis identified 187 measures that could affect the energy consumption of buildings and covered processes. Of those 187 measures, a subset of 148 measures were quantified in the quantitative analysis.
- The 2025 Energy Code is expected to deliver about $3.3 billion in total statewide long-term system cost (LSC) savings. Savings by category are as follows: nonresidential — $1.5 billion, single-family — $713 million, multifamily — $206 million, covered processes — $919 million.
- This analysis also demonstrates that the CEC has reviewed and updated the provisions of California’s Energy Code and that the 2025 Energy Code exceeds the revised national model energy codes for nonresidential and residential buildings as a basis for the state’s certification required by federal law under 42 U.S.C. §6833.

BACKGROUND

Whenever national model energy codes - ANSI/ASHRAE/IES Standard 90.1 for commercial buildings and the International Energy Conservation Code (IECC) for residential buildings – are revised, federal law (42 U.S.C. §6833) directs the U.S. Department of Energy (DOE) to make a determination as to whether the revision improves energy efficiency. Once DOE makes an affirmative determination for a residential model energy code revision, each state is then required within two years to certify to DOE that it has reviewed its building code to determine whether or not it believes it is appropriate to update its residential building code to meet or exceed the model energy code, and submit to DOE the reasons for such determination. Once DOE makes an affirmative determination for a commercial model energy code revision, each state is then required within two years to certify that it has reviewed and updated its commercial building code to meet or exceed the model energy code revision. Under California law, the CEC updates California’s Energy Code (Cal. Code Regs., Tit. 24, Part 6) every three years to improve energy efficiency.

The U.S. Department of Energy published affirmative determinations for ANSI/ASHRAE/IES Standard 90.1-2022 and the 2024 International Energy Conservation Code (IECC) in the Federal Register and state energy code certifications for commercial buildings are due on March 6, 2026, and for residential buildings on December 30, 2026. The CEC adopted the 2025 Energy Code in August 2024, and these new standards took effect on January 1, 2026.

Upon adoption of the 2025 Energy Code, the statewide impact of the new standards relative to the previous standards was evaluated. This report describes the evaluation of impacts from the 2025 Energy Code, relative to the 2022 Energy Code, including the impact of interactive effects of changes in requirements, and provides an estimate of the energy, grid demand, and emissions savings resulting from the adoption of the 2025 Energy Code. This analysis also demonstrates that the 2025 Energy Code is at least as stringent as the national model energy codes for commercial and residential buildings as a basis for the state's certification required by federal law.

The California Energy Code uses California-adopted metrics for determining code compliance and impact evaluation. California Public Resources Code §25402 (b)(3) states, "The standards adopted or revised…shall be cost-effective when taken in their entirety and when amortized over the economic life of the structure compared with historic practice". Resultingly, this report provides savings estimates in terms of long-term system cost (LSC), hourly source energy (HSE), annualized grid demand (AGD) savings, and greenhouse gas (GHG) emissions reductions. However, the CEC used the energy-cost metrics defined in national model codes to determine federal equivalency, applying the ASHRAE 90.1-2022 Performance Rating Method for nonresidential and high-rise multifamily buildings, and the 2024 IECC as the baseline for residential buildings.

The 2025 Energy Code expands the scope of heat pump systems as the standard in single-family, multifamily, and nonresidential buildings for space heating and water heating. The 2025 Energy Code also expanded the scope of the solar photovoltaic (PV) and battery energy storage system requirements to include more building types. There were several other measures targeting energy efficiency in buildings and covered processes that increase the stringency of the Energy Code. The scope of this impact analysis includes residential, multifamily, and nonresidential buildings and includes newly constructed buildings and alterations to existing buildings.

METHOD

To evaluate the impact of the new 2025 Energy Code, the following method was used:

1. **Qualitative analysis.** The first step of the qualitative analysis was to identify and characterize the changes made to the 2022 Energy Code. Furthermore, the qualitative analysis identified individual code changes between the two code editions and characterized the changes by the affected building type(s) and climate zone(s).
2. **Quantitative analysis.** Only the changes with energy impact were evaluated in the quantitative analysis. The quantitative analysis used building energy modeling and a set of prototypical building models – which represent the building stock in California – to capture the impact of the changes. Prototype models conforming to the mandatory and prescriptive requirements of the 2022 and 2025 Energy Code editions were created and these models were simulated in 16 California building climate zones. Process load measures that could not be directly modeled were separately quantified using external calculations and previously completed analyses.
3. **Results aggregation.** The quantitative analysis produced energy savings for individual building types in each climate zone. These results were aggregated to the statewide level using forecasted construction floor area by building type and climate zone. Using the construction weighting factors, the results were aggregated by prototypes, climate zones, and building sectors (residential, multifamily, and nonresidential). Savings estimates from process load measures, which were

analyzed separately, were added to the results from energy modeling to generate the total statewide impact of the 2025 Energy Code. Site energy savings estimates were converted to long-term system costs, hourly source energy, and emissions using California-specific conversion factors.

RESULTS

The qualitative analysis identified 187 measures as having an impact on the energy consumption of buildings and covered processes. Of these 187 measures, a subset of 148 measures were quantified in the quantitative analysis. The remaining 39 measures were not quantified because:

a) The code change aligned with a change in federal equipment efficiency standards,
b) The measure savings could not be feasibly modeled using prototypes, or
c) The change applied to an option or exception not used or represented in the prototypes. As a result, the estimated impact presented in the analysis likely underestimates the total impact.

Table ES-1 provides a summary of the estimated statewide impact of the 2025 Energy Code relative to the 2022 Energy Code.

Table ES-1: Statewide Impact of the 2025 Energy Code

Sector	Scope	LSC [M$]	HSE [GBtu]	Site Electricity [GWh/yr]	Natural Gas [Mtherms /yr]	Site Energy [GBtu/ yr]	GHG [ktCO2-e/ yr]	AGD Reduction [MW]
Nonresidential	Newly Constructed	980	561	192	5.1	997	34	7.8
Nonresidential	Alterations	522	353	57	4.9	243	24	26.2
Nonresidential Subtotal	Combined	1,501	914	249	10.0	1,240	58	34.0
Single Family	Newly Constructed	555	554	(64.5)	8.3	608	27.8	(19)
Single Family	Alterations	157	79	46	0.1	166	4.3	4.3
Single Family Subtotal	Combined	713	633	(19)	8.4	774	32	(14.7)
Multifamily	Newly Constructed	158	220	3.9	1.3	32.2	8.7	0.8
Multifamily	Alterations	48	18	4.8	0.1	29.5	1.1	0.3
Multifamily Subtotal	Combined	206	238	8.7	1.4	61.7	9.8	1.1
Covered Processes	Newly Constructed	214	111	34	0.7	124.1	6.4	2.2
Covered Processes	Alterations	705	595	81	5.4	329.2	35.2	4.9
Covered Processes Subtotal	Combined	919	706	115	6.1	453	42	7.1
Grand Total	Combined	3,339	2,491	354	25.9	2,529	142	41.1

Note: Sector totals may not exactly match values in Subtotal and/or Grand Total rows due to rounding.

Source: CEC consultant analysis

1.0 INTRODUCTION

The California Energy Commission (CEC) developed the first set of building efficiency regulations in 1978 in response to the mandate established by the Warren-Alquist Act of 1974. The building regulations specifically related to energy efficiency have since been published in Part 6 of the California Code of Regulations (CCR), Title 24 building regulations, known as the Energy Code. The CEC is responsible for updating the regulations every three years, continuously improving the energy efficiency of California's buildings.

Federal law (42 U.S.C. §6833) directs states to review and certify their determinations regarding updating their building energy codes to meet or exceed the latest revisions of model energy code. This is required within 2 years after the U.S. Department of Energy has issued an affirmative determination as to whether the model energy code revisions - ANSI/ASHRAE/IES Standard 90.1 for commercial buildings and the International Energy Conservation Code (IECC)[1] for residential buildings - will increase energy efficiency.

After the new Energy Code is adopted, the CEC analyzes the statewide impact of the new Energy Code relative to the previous edition (for example, the 2025 Energy Code compared to the 2022 Energy Code). The CEC adopted the 2025 Energy Code in August 2024, and it went into effect January 1, 2026. The U.S. Department of Energy published affirmative determinations for ANSI/ASHRAE/IES Standard 90.1-2022 and the 2024 International Energy Conservation Code in the Federal Register[2] and state energy code certifications for commercial buildings are due on March 6, 2026, and for residential buildings on December 30, 2026.

This report describes the evaluation of impacts from the 2025 Energy Code and provides an estimate of the energy, grid demand, and greenhouse gas emissions savings from incremental changes to the 2025 Energy Code relative to the 2022 Energy Code. This analysis demonstrates that the 2025 Energy Code is at least as stringent as the national model energy codes for nonresidential and residential buildings.

The 2025 Energy Code expands conditions under which heat pumps are required in single-family, multifamily, and nonresidential buildings for space heating and water heating. Similarly, the number of building types where solar photovoltaic (PV) and battery energy storage

[1] The "Council of Americal Building Officials (CABO) was responsible for development of the Model Energy Code (MEC). Contemporary energy codes are referred to and published as the International Energy Conservation Code (IECC)." While CABO is referenced in the statutory requirements (42 U.S.C. 6833) the current proper model code is the IECC and will be referenced as such throughout this report. https://www.energycodes.gov/determinations.

[2] https://www.regulations.gov/document/EERE-2023-BT-DET-0017-0001; https://www.govinfo.gov/content/pkg/FR-2024-12-30/pdf/2024-31024.pdf

systems are required has been increased in the 2025 Energy Code. Additional measures were adopted targeting energy efficiency in buildings and process load reductions.

This work has been performed by NORESCO and Frontier Energy, technical consultants to the CEC, and funded by the CEC under contract with NORESCO.

OBJECTIVE

This analysis determined the impact of prescriptive and mandatory changes adopted into the 2025 Energy Code, relative to the 2022 Energy Code, including the impact of interactive effects of changes in requirements. The scope of this estimate includes residential, multifamily, and nonresidential buildings, and includes newly constructed buildings, as well as additions and alterations to existing buildings. The analysis determined statewide energy savings, and estimates savings based on specific metrics adopted by the CEC, including long-term system cost (LSC), formerly known as *time dependent valuation*, and hourly source energy (HSE), also called *source energy*. The analysis also estimates demand savings and emissions reductions.

This analysis also demonstrates that the 2025 Energy Code is at least as stringent as the national model energy codes for nonresidential and residential buildings, ANSI/ASHRAE/IES Standard 90.1-2022 (ASHRAE 2022) and the 2024 International Energy Conservation Code (IECC) (ICC 2024), respectively. The nonresidential state certification analysis is presented in APPENDIX B, and the residential state certification analysis is presented in APPENDIX C: 2025 Energy Code State Certification for Low-Rise Residential Buildings.

REPORT LAYOUT

The report is organized as follows:

- Section 1 defines the objectives of the impact analysis.
- Section 2 documents the method used to estimate savings between the 2025 and 2022 Energy Code editions.
- Section 3 presents the summary of results from the impact analysis.
- Section 4 lists references cited in the report.
- Appendix A presents results from the qualitative analysis of the 2025 Energy Code.
- Appendix B describes an analysis to demonstrate that the nonresidential provisions of the 2025 Energy Code are at least as stringent as the national model code for nonresidential buildings, ASHRAE Standard 90.1-2022.
- Appendix C describes an analysis to demonstrate that the residential provisions of the 2025 Energy Code are at least as stringent as the national model code for residential buildings, 2024 IECC.
- Appendix D presents the floor area construction and a mapping of the prototype models to the construction forecast building types.

2.0 METHOD

The 2025 Energy Code Impact Analysis consisted of three main phases:

- A qualitative analysis, which characterized changes to the 2022 Energy Code,
- The quantitative analysis, which quantified the impact of the changes, and lastly,
- Results aggregation, in which results were aggregated to provide sector wide summaries of impacts.

The sections below describe each step of the approach in greater detail.

APPROACH OVERVIEW

The following steps were followed to develop an estimate of savings for the 2025 Energy Code:

1. Each change to the 2022 Energy Code, which has become part of the 2025 Energy Code, was evaluated to determine whether the change has an energy impact or whether it is editorial in nature[3]. Many changes made to the code do not directly affect the energy consumption of buildings; they may be clarifications to the intent of the code language; they may be related to labeling, submittal, or other compliance requirements that do not directly affect energy consumption of buildings. In addition to identifying whether individual code changes directly affect building energy consumption, the qualitative analysis characterized the change by listing the building types and climate zones impacted by the change, and whether the change will be captured in the quantitative analysis either through energy modeling or through other means.
2. The list of measures that have energy impacts, as identified in the qualitative analysis, was used in the quantitative analysis to evaluate the impact on energy consumption of buildings. The quantitative analysis used whole-building energy modeling and a set of prototypical building models, which represent the building stock, to perform the analysis. Prototype models conforming to the mandatory and prescriptive requirements of the 2022 and 2025 Energy Code editions were created and simulated in 16 California building climate zones. The impact of certain covered

3 Changes that are editorial in nature generally improve the clarity and consistency of existing provisions, without changing the performance of buildings that comply with the Energy Code.

process load measures, which cannot be directly captured using building energy models, was separately accounted for using external calculations.

3. The quantitative analysis used energy modeling to evaluate energy savings. Results from the analysis were converted to LSC, HSE, and GHG emissions using California-specific conversion factors. The results for building types in a climate zone were weighted using forecasted construction floor area by building type and climate zone, and then summed across prototypes, climate zones, and building sectors (residential, multifamily, and nonresidential). These results from energy modeling were merged with savings estimates for covered process load measures to generate the statewide impact of the 2025 Energy Code.

The scope of the analysis was limited to changes in the 2025 Energy Code in Part 6 of Title 24 in the California Code of Regulations. Changes to Part 6 resulting from changes to federal equipment efficiency standards (for example, a change to the minimum seasonal energy efficiency ratio [SEER] requirements for air conditioners) were excluded by using the same equipment efficiency in the 2022 and 2025 Energy Code models. Changes to Parts of Title 24 other than Part 6 were not included in the analysis, despite the potential impact on the energy consumption of buildings, because those changes are outside the scope of the CEC's regulations. This exclusion was done to avoid double-counting those impacts.

Further details regarding the method for different types of measures, savings from alterations, prototypes, climate zones, conversion factors and weighting factors, and forecasted floor area are provided below.

QUALITATIVE ANALYSIS

The qualitative analysis characterized changes to the 2022 Energy Code that were adopted in the 2025 Energy Code. The change characterizations include the following items:

1. A brief description of the change.
    a. A determination of whether the change impacts energy consumption of buildings. Changes were characterized either by having a direct impact on the energy consumption of buildings or not. Examples of code changes that do not affect the energy consumption of buildings include clarification of language or labeling and documentation requirements. Only those changes that have a direct impact on energy consumption were included in the quantitative analysis.
2. A determination of whether the change will be captured in the quantitative analysis. Where the change was not captured in the quantitative analysis, a rationale was provided. The main reasons for not capturing a change were as follows:
    a. Changes resulting from an update to the federal equipment efficiency standards. For example, the SEER rating for air-cooled variable refrigerant flow (VRF) systems smaller than 65,000 Btu/h changed from 13.0 SEER to 13.4 SEER2 for equipment sold after January 1, 2023, and this was a change to the federal equipment efficiency standards (CFR 2025). Since the change was the result of a change to federal standards, the associated impact is not

attributable to the 2025 Energy Code. Therefore, the same efficiency level was used for VRF systems in the 2022 and 2025 Energy Code models.

b. Changes applied to compliance options or exceptions not used, or changes that are not represented in the prototypes. For example, the floor display lighting credit, which is an optional allowance typically used by jewelry stores, was not used in the prototypes.

   i. Impacts that depend on occupant behavior. For example, a lower fault detection and diagnostics threshold is difficult to quantify because choosing a representative "baseline" condition where controls are not configured properly in the building, would be difficult. The savings estimate depends on how poorly the controls are configured, which varies widely in practice.

   ii. Changes that are difficult to quantify through energy modeling were estimated using external calculations and data. For example, the adoption of ASHRAE Guideline 36 (ASHRAE 2021) into the 2025 Energy Code requires the use of specific control sequences. This change will affect building energy consumption, but energy models do not require detailed control sequences to be modeled, nor can they always be modeled. Therefore, the estimate of savings from this change was adopted from the CASE report, which studied, quantified, and described the energy impact.

The qualitative analysis identified 187 measures that directly affect energy consumption of regulated loads in buildings and processes covered by the 2025 Energy Code. Of these measures, 148 were captured in the quantitative analysis. APPENDIX A: Qualitative Analysis of 2025 Energy Code, provides the complete list of changes that were identified, whether they were captured in the quantitative analysis, and the reason if they were not captured. Table 1 provides a summary of the most impactful changes between the 2022 and 2025 Energy Code. Because this analysis excludes the impact of certain measures, the total estimated statewide savings are likely an underestimate — the actual impact of the 2025 Energy Code may be higher.

Table 1: Summary of High-Impact Measures in the 2025 Energy Code

Code Change Brief Name	**Sector**	**Change Description**	**Qualitative Impact**
Laboratory Heating, Ventilating, and Air Conditioning (HVAC) System Efficiency	Newly constructed buildings and alterations	Specifies air changes per hour (ACH) setbacks, limits reheat, requires heat recovery, and exhaust fan control.	Laboratory floor area is forecasted to grow. This measure improves the efficiency of the exhaust and intake air system.
Controlled Environment Horticulture (CEH)	Covered processes: CEH facilities	This measure regulates the energy use from lighting.	CEH is a growing sector in California, and the regulation of processes within the CEH facility results in a large amount of electricity savings.

Code Change Brief Name	Sector	Change Description	Qualitative Impact
Photovoltaic (PV) and Battery Standards	Newly constructed buildings: Nonresidential and mid- and high-rise multifamily	Expands and revises PV and battery systems to include more building types. The capacity thresholds were refined using improved economic and cost assumptions relative to the 2022 standards.	This measure is widely applicable and results in significant electricity and carbon savings. The battery measure is highly impactful in reducing demand during peak hours and therefore results in utility bill savings.
Multizone Heat Pump Standards	Newly constructed buildings: nonresidential	Specifies multizone systems in medium office and school buildings to use heat-pump-based space heating.	Using heat pump-based space heat has large energy, LSC, and source savings. This measure expands the use of heat-pump-based space heating from single zone systems to also include multizone systems as standard.
Industrial Pipe Insulation and Verification	Industrial covered processes	Specifies same level of pipe insulation for industrial processes as that required in buildings.	High LSC and GHG savings. Covered processes operate at high water temperatures and insulating pipes has a large impact.
Heat Pump Space Heating	Newly constructed buildings: single-family	Heat pump space heating prescriptive standard for newly constructed single-family homes in all climate zones.	This measure expands existing prescriptive standards for heat pump space heating to all climate zones. High GHG, LSC, and source energy savings.
Heat Pump Water Heater	Newly constructed buildings and Additions: single-family, low-rise multifamily	This eliminates the prescriptive options for consumer instantaneous (tankless) gas or propane water heaters.	This measure expands existing heat pump water heater prescriptive standards for individual water heating systems to all climate zones. High GHG, LSC, and source energy savings.
Indoor Air Quality & Compartmentalization	Newly constructed buildings: multifamily	Eliminates exhaust-only ventilation in dwelling units. Requires compartmentalization with balanced or supply-only ventilation, with energy or heat recovery in some climate zones.	Compartmentalization reduces air transfer and exterior leakage, lowering heating and cooling energy. Energy or heat recovery further improves energy performance. Balanced or supply-only ventilation provides the co-benefit of improved indoor air quality.

Source: CEC consultant analysis

QUANTITATIVE ANALYSIS

The quantitative analysis estimated the impact of code changes that were deemed to have an impact on building energy consumption in the qualitative analysis. The quantitative analysis used a combination of whole-building energy modeling and engineering calculations to estimate the impact of measures. The following sections provide details about the quantitative analysis.

2.1.1 SIMULATION ENGINES

Except for measures affecting covered processes, the impacts of all measures were captured using whole-building energy modeling. California's code compliance software for nonresidential buildings, CBECC (CBECC 2025), was used as the starting point for developing the 2022 and 2025 Energy Code models for nonresidential buildings, high-rise and low-rise multifamily. CBECC uses the United States (U.S.) Department of Energy's (DOE) EnergyPlus (DOE 2025) building energy modeling software. EnergyPlus is a state-of-the-art simulation engine capable of modeling the impact of a wide variety of building energy efficiency, renewable energy generation, and demand response measures. It is under continuous development and receives funding from the DOE. For single-family homes, CBECC-Res (CEC 2025) was used, which uses the California Simulation Engine (CSE).

2.1.2 PROTOTYPES

Prototype building models were used to evaluate the impact of the 2025 Energy Code. Prototype building models, known simply as *prototypes*, are computer models of different building types within the building stock. Prototypes generally conform to the average features of the building stock, thereby allowing analysis of the impact of energy efficiency and other measures on the stock. Prototype building models used in the impact analysis were modeled using the state-approved compliance software, CBECC for nonresidential and multifamily buildings, and CBECC-Res for single-family homes. The models are sometimes referred to as "zero compliance" models because they are minimally compliant with the performance path requirements of the Energy Code. Table 2 lists the prototypes used in the analysis, along with key features of each prototype, including the number of stories, floor area, and a brief description of the building features captured in each model.

Building types, represented by prototype models, were selected for this analysis using two criteria: the total forecasted newly constructed floor area of the building type across the state and the total forecasted energy consumption of the building type across the state. The prototype models used in the analysis represent more than 95 percent of the total floor area of newly constructed buildings forecasted to be built in 2026. The Energy Code Accounting Methodology Report (CEC 2024) describes the process for selecting the prototypes for 2025 Energy Code development.

The prototype models used in this analysis were developed as follows:

1. Generate prototype models that meet the requirements of the 2022 Energy Code. These models were developed as minimally compliant with the 2022 Energy Code in the state-certified 2025 CBECC and CBECC-Res software.

2. The 2025 Energy Code models were developed by using the 2025 state-certified versions of CBECC and CBECC-Res.

   For some nonresidential and high-rise multifamily models, the EnergyPlus versions of the 2022 and 2025 Energy Code models were further edited to include novel changes not available in CBECC, then simulated directly with EnergyPlus.

3. Results from the 2025 and 2022 Energy Code models were used to determine the change in annual energy consumption between the two energy codes. The change in energy consumption was divided by the prototype floor area to calculate unit energy savings, which could then be scaled using the statewide construction floor area of building types.

Table 2: Prototype Model Description

Sector	Prototype Name	Number of Stories	Floor Area (square ft)	Description
NR	Hospital	3	241,374	5-Story Hospital prototype model, identical to the DOE Hospital prototype model.
NR	HotelSmall	4	42,554	4-story Hotel with 77 guest rooms. Window wall ratio (WWR)-11%.
NR	OfficeLarge	12	498,589	12-story + 1 basement office building with 5 zones and a ceiling plenum on each floor. WWR-40%.
NR	OfficeMedium	3	53,628	3-story office building with 5 zones and a ceiling plenum on each floor. WWR-33%.
NR	OfficeMediumLab	3	52,628	3-story office building with 5 zones and a ceiling plenum on each floor. WWR-33%
NR	OfficeSmall	1	5,502	1-story, 5-zone office building with pitched roof and unconditioned attic. WWR-24%.
NR	RestaurantFastFood	1	2,501	Fast food restaurant with a small kitchen and dining areas. WWR-14%. Pitched roof with an unconditioned attic.
NR	RetailLarge	1	240,000	Big-box type retail building with WWR-12% and Skylight roof ratio (SRR)-0.82%.
NR	RetailStandAlone	1	24,563	Similar to a Target or Walgreens.WWR-7% on the front façade, none on other sides. SRR-2.1%.
NR	RetailStripMall	1	9,375	Strip mall building. WWR-10%.
NR	SchoolPrimary	1	24,413	Elementary school. WWR-36%.
NR	SchoolSecondary	2	210,866	High school. WWR-35% and SRR-1.4%.
NR	Warehouse	1	49,495	Single story high ceiling warehouse. Includes one office space. WWR-0.7%, SRR-5%.
NR	Assembly	1	38,718	A campus of buildings including a Library, Exhibits & Events, Sports & Recreation, Religious Worship, and Terminal buildings.
MF	Mid-Rise Multifamily	5	113,100	88-unit building with 4-story residential plus first floor common areas. Concrete podium construction with wood framed wall construction, and flat roof. Window to Wall Ratio-0.10 (ground floor) 0.25 (residential floors). Individual space conditioning systems and a central domestic hot water system.
MF	High-Rise Multifamily	10	125,400	117-unit building with 9-story residential plus first floor common areas. Concrete podium construction with steel framed wall construction, and a flat roof. Window-to-Wall Ratio-0.10 (ground floor) 0.40 (residential floors). Individual space conditioning

Sector	Prototype Name	Number of Stories	Floor Area (square ft)	Description
				systems and a central domestic hot water system.
MF	3-Story Loaded Corridor Multifamily	3	39,372	36-unit residential building with slab on-grade foundation, wood framed wall construction, and a flat roof. Window to Wall Ratio 0.25. Dwelling units flank a central corridor and common area spaces included on bottom floor. Individual space conditioning systems and shared DHW system.
MF	2-Story Garden Multifamily	2	7,320	8-unit residential building with slab on-grade foundation, wood-framed wall construction and a sloped roof. Individual space conditioning serving each unit. Window-to-Wall Ratio 0.15. Each dwelling unit has individual HVAC and DHW systems.
SF	Single-Family Newly Constructed 1-Story	1	2,100	1-story detached single-family home with an attached garage, slab on-grade foundation, wood-framed wall construction and a vented attic.
SF	Single-Family Newly Constructed 2-Story	2	2,700	2-story detached single-family home with an attached garage, slab on-grade foundation, wood-framed wall construction and a vented attic.
SF	Single-Family Newly Constructed ADU	1	500	1-story detached single-family home, 1-bedroom, 9-ft ceilings, slab-on-grade foundation, wood-framed wall construction, and a vented attic.
SF	Single Family Existing Home	1	1,665	1- story existing single family house for evaluation of alteration measures. 2 variations: steep-sloped roof above attic with ducts in attic; low-sloped roof with ducts in conditioned space.

Source: CEC consultant analysis

2.1.3 CLIMATE ZONES

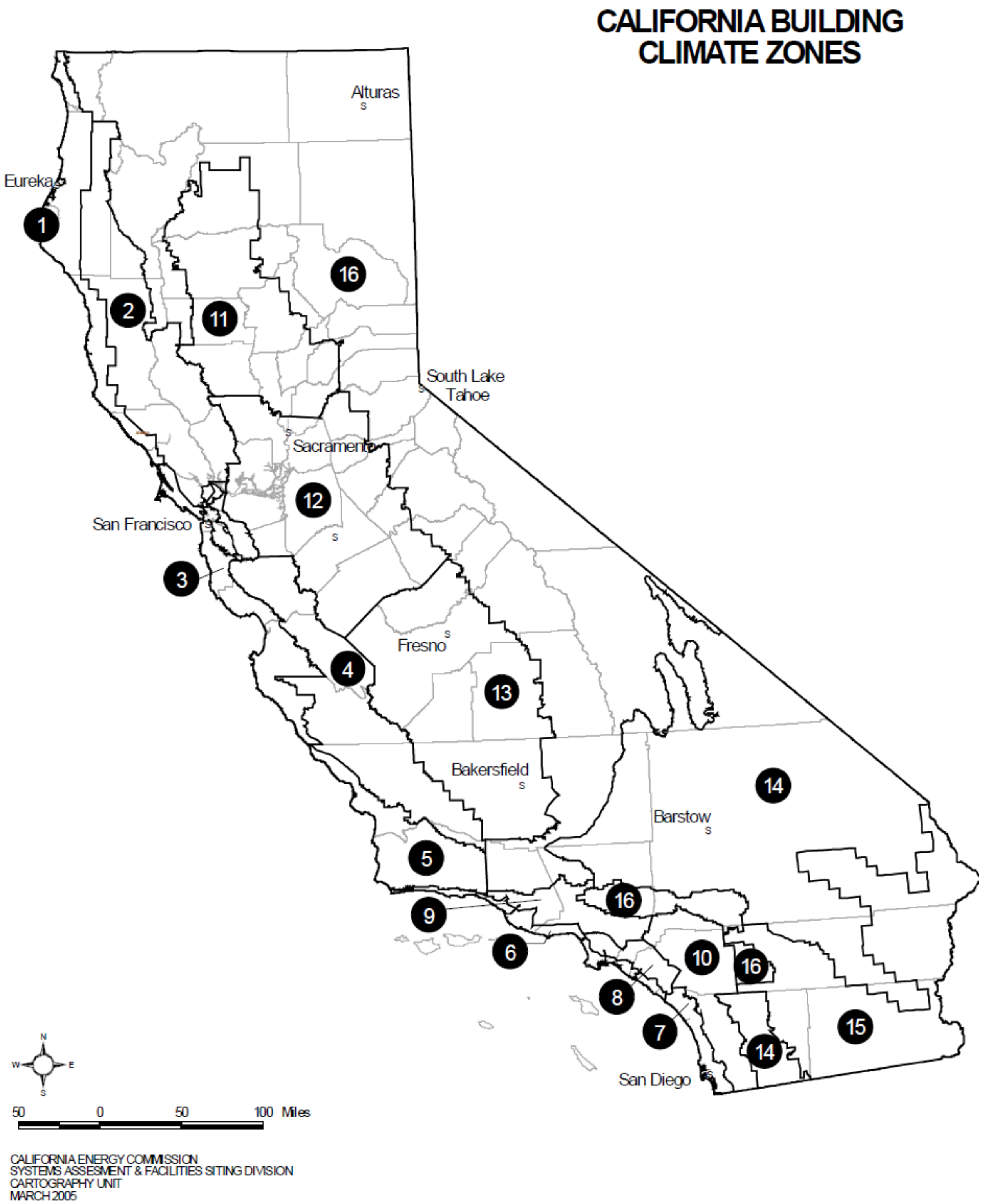
The CEC establishes representative cities and weather stations to represent each of California's 16 building climate zones in the analysis. These weather stations were used for the 2025 Energy Code development cycle, as described in the 2025 Energy Code Accounting Methodology Report (CEC 2024). The LSC and HSE conversion factors (described in Section 2.4.2 of this report) were used in conjunction with these weather files developed for the 2025 Energy Code development. These representative cities and the weather files were specified for use by Joint Appendix 2 of the 2025 Energy Code. Table 3 shows the climate zone, the city representing the climate zone, the weather file location, and the Weather Bureau Army Navy (WBAN) ID, and Figure 1 is a map of the climate zones.

Table 3: Weather Files Used for Modeling California Climate Zones

Climate Zone	Representative City	Location	WBAN ID
1	Arcata	California Redwood Coast Humboldt County Airport	725945
2	Santa Rosa	Charles M. Schulz Sonoma County Airport	724957
3	Oakland	San Francisco Bay Oakland International Airport	724930
4	Paso Robles	Paso Robles Municipal Airport	723965
5	Santa Maria	Santa Maria Airport	723940
6	Los Angeles	Los Angeles International Airport	722950
7	San Diego	San Diego International Airport	722900
8	Fullerton	Fullerton Municipal Airport	722976
9	Burbank	Hollywood Burbank Airport	722880
10	Riverside	Riverside Municipal Airport	722869
11	Red Bluff	Red Bluff Airport	725910
12	Sacramento	Sacramento Executive Airport	724830
13	Fresno	Fresno Yosemite International Airport	723890
14	Palmdale	Palmdale Regional Airport	723820
15	Palm Springs	Palm Springs International Airport	722868
16	Blue Canyon	Blue Canyon Nyack Airport	725845

Source: CEC consultant analysis

Figure 2-1: Map of California Climate Zones



2.1.4 PROCESS MEASURES

Several industrial and other process loads are regulated by the Energy Code. These processes may or may not be part of a building. If the process load occurred in prototypes included in the analysis and could be captured using the energy modeling software, they would have been included in the energy models. In many instances, these covered process loads cannot be captured using building energy models. For example, there is a new requirement for fan-powered refrigeration evaporators, which are not included in the current set of prototypes. These process load code changes were proposed by the CASE Team and later adopted by the CEC. During development of the 2025 Energy Code, detailed reports describing the measure and related impacts of these code change proposals were provided by the CASE Team. Ultimately, where process measures could not be modeled, these reports were used to account for the impact of the changes and then included in the aggregate savings calculation.

2.1.5 ALTERATIONS MEASURES

For existing buildings, alterations that trigger the Energy Code requirements were evaluated by applying an estimate of the effective useful life (EUL) of each measure to the existing building stock. For instance, an HVAC measure that has an EUL of 20 years will see a replacement rate of 1/20, or 5 percent each year. This replacement rate was multiplied by the percentage of the building stock impacted by the measure, and by the total existing building stock, to determine the statewide impact. Early retirement and upgrades of equipment were not included in the impact calculation, resulting in a potential underestimate of savings.

Alteration results were taken from the CASE team measure reports. Since alteration requirements are typically triggered individually, interactive effects of measures are not as applicable when calculating the statewide impact. In addition, each alteration measure has a specific, individual EUL and building stock applicability, rendering modeling efforts to capture all the combinations of alterations measures unfeasible for this analysis.

The approach to calculate per unit and statewide savings for single-family and multifamily alterations was taken from the CASE team measure reports (Statewide CASE Team 2025).

2.1.6 STATE CERTIFICATION ANALYSIS

Whenever the model energy codes - ANSI/ASHRAE/IES Standard 90.1 for commercial buildings and the International Energy Conservation Code (IECC) for residential buildings – are revised, federal law (42 U.S.C. §6833) directs the U.S. Department of Energy to make a determination as to whether the revision improves energy efficiency. Once DOE makes an affirmative determination for a residential model energy code revision, each state is then required within two years to certify to DOE that it has reviewed its building code to determine whether or not it believes it is appropriate to update its residential building code to meet or exceed the model energy code, and submit to DOE the reasons for such determination. Once DOE makes an affirmative determination for a commercial model energy code revision, each state is then required within two years to certify that it has reviewed and updated its commercial building code to meet or exceed the model energy code revision.The deadline for states to provide documentation regarding their certifications is March 6, 2026, for nonresidential energy codes, and December 30, 2026, for residential energy codes. The 2025 Energy Code Impact Analysis was expanded to produce a comparison with the national energy codes to determine if California's 2025 Energy Code meets and exceeds the national energy codes.

For nonresidential buildings, a comparison to the national energy codes was performed using the Performance Rating Method (PRM) within Standard 90.1-2022. For residential buildings, a comparison was performed between the residential provisions of California's Energy Code and those within the 2024 IECC. Further details of this analysis have been provided in APPENDIX B for nonresidential buildings, and in APPENDIX C for residential buildings.

RESULTS AGGREGATION

Aggregation of results from individual prototype models to determine statewide savings, savings by climate zone, and savings by building type, was performed using construction weighting factors. New construction weighting factors were used to determine the impact of changes applicable to newly constructed buildings and to additions to existing buildings. Savings resulting from building alterations were aggregated to the statewide level using a similar methodology by using existing building floor area and weighting factors. Lastly, the savings from covered processes were added to the statewide savings from newly constructed buildings, as well as additions and alterations to existing buildings to calculate the total statewide savings.

2.1.7 CONSTRUCTION WEIGHTING FACTORS

Per-unit consumption (kWh per square foot and therms per square foot) from prototype models were scaled to the climate zone and statewide level by multiplying unit consumption by the forecasted construction floor area. The construction forecast was developed by the CEC Demand Analysis Office[4] and is based on an econometric model. The forecast was adjusted to map to the prototypes used in the analysis, as described in the 2025 Energy Code Accounting Methodology Report (CEC 2024).

The construction forecast used was the same as the "Mid" forecast scenario from the California 2022 *Integrated Energy Policy Report (IEPR)*[5] (Bailey, et al. 2022). Further, the forecast is based on certain building categories deemed appropriate for the Demand Analysis Office's forecasting purposes, and these categories were mapped to prototypes used in the impact

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4 Construction forecast was developed the Demand Analysis Office within the Energy Assessment Division at the CEC. The data were provided to the public at the beginning of the 2025 Energy Code development cycle.

5 https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report-iepr/2022-integrated-energy-policy-report

analysis. Appendix D provides further details on the floor area (in million square feet) and the construction weight for each prototype in each climate zone.

2.1.8 METRIC CONVERSION FACTORS

For the 2025 Energy Code, the CEC adopted LSC as a compliance metric and the metric used for evaluating the cost-effectiveness of new proposed measures (CEC 2024). LSC is a cost metric, with units of $/kWh and $/therm for electricity and natural gas, respectively, accounting for the time value of energy use, that is, energy used at different times during the day and year is valued at different rates. It represents the cost to produce and deliver an additional unit of energy to the building and promotes building designs and measures that save energy during times of peak demand. LSC is part of the energy accounting and code development process and is used by the code compliance software to evaluate compliance. Further details about the LSC metric can be found in the 2025 Energy Code Accounting Report (CEC 2024).

To convert from hourly electricity and natural gas consumption, hourly conversion factors ($/kWh and $/therm) were used. The resulting values were reported in terms of LSC dollars.

In addition to the LSC metric, the hourly source energy metric (HSE) was used for evaluating code changes (CEC 2024). HSE is the long run hourly marginal source energy of fossil fuels that are combusted because of building energy consumption either directly at the building site or caused to be consumed to meet the electrical demand of the building considering the long-term effects of Commission-projected energy resource procurement. HSE enables the measurement of the Energy Code's progress towards decarbonization, a major goal for the CEC. Results for HSE are presented in this report. Emissions factors (GHG) were developed based on the marginal hourly emissions of California's energy systems serving the buildings that were addressed by the analysis. These emissions factors were applied to the hourly electricity and natural gas consumption from the models to calculate the emissions impact.

Annualized grid demand (AGD) factors were also developed based on the LSC factors. These factors were applied to the hourly electricity consumption from energy models to calculate the impact of the peak demand at times of high electricity grid demand. The AGD factors represent hours when load reduction is most valuable for improving electric grid reliability. To identify these hours, we ran a loss-of-load probability model that simulates load, renewable generation, and grid operations across hundreds of years of weather conditions. The model produces hourly system operations for days with the highest loss-of-load (i.e., outage) probability. Hours with loss-of-load events and storage dispatch are then used to represent high-value periods for load reduction.

3.0 RESULTS

Table 4 shows the statewide impact of the 2025 Energy Code relative to the 2022 Energy Code. Table 5 through Table 9 provide detailed results by sector and climate zone for statewide savings for each of the metrics. Of the measures evaluated, the highest LSC savings result from the residential heat pump space heating and water heating measure, followed by the group of laboratory measures, horticultural lighting efficacy, updates to PV and battery specifications, and the nonresidential multizone heat pump space heating measure. These measures also generate most of the energy and GHG savings.

As the lead agency for undertaking an environmental review of proposed amendments to the Energy Code under the California Environmental Quality Act (CEQA), the CEC developed the California Environmental Quality Act (CEQA) Initial Study (CEC 2025) that considered whether the proposed amendments to the 2025 Energy Code had potential significant adverse environmental impacts. Compared to the California Environmental Quality Act (CEQA) Initial Study published by the CEC during the adoption process (CEC 2025), the statewide savings from this analysis are higher because unit savings from measures have been applied to more prototypes than were analyzed for the initial study and thus the resulting construction floor area to which the savings are applicable is higher. Further, this analysis includes the impact of interaction between changes, which were not captured previously in the analysis of individual measure impacts.

Table 4: Statewide Impact of the 2025 Energy Code

Sector	Scope	LSC [M$]	HSE [GBtu]	Electricity [GWh/yr]	Natural Gas [Mtherms/yr]	Site Energy [GBtu/yr]	GHG [ktCO2-e/ yr]	AGD Reduction [MW]
Nonresidential	Newly Constructed	980	561	192	5.1	997	34	7.8
Nonresidential	Alterations	522	353	57	4.9	243	24	26.2
Nonresidential Subtotal	Combined	1,501	914	249	10.0	1,240	58	34.0
Single Family	Newly Constructed	555	554	(64.5)	8.3	608	27.8	(19)
Single Family	Alterations	157	79	46	0.1	166	4.3	4.3
Single Family Subtotal	Combined	713	633	(19)	8.4	774	32	(14.7)
Multifamily	Newly Constructed	158	220	3.9	1.3	32.2	8.7	0.8
Multifamily	Alterations	48	18	4.8	0.1	29.5	1.1	0.3
Multifamily Subtotal	Combined	206	238	8.7	1.4	61.7	9.8	1.1
Covered Processes	Newly Constructed	214	111	34	0.7	124.1	6.4	2.2
Covered Processes	Alterations	705	595	81	5.4	329.2	35.2	4.9
Covered Processes Subtotal	Combined	919	706	115	6.1	453	42	7.1
Grand Total	Combined	3,339	2,491	354	25.9	2,529	142	41.1

Note: Sector totals may not exactly match values in Subtotal and/or Grand Total rows due to rounding.
Source: CEC consultant analysis

Table 5: Nonresidential Newly Constructed Building Savings by Climate Zone

-	LSC	HSE	Electricity	Natural Gas	Site Energy	GHG	AGD Reduction
Climate Zone	**[M$]**	**[GBtu]**	**[GWh/yr]**	**[MTherms/yr]**	**[GBtu/yr]**	**[tonnes CO2-e/yr]**	**[MW]**
1	1.5	1.8	0.2	0.02	2.5	0.1	(0.01)
2	17.8	17.5	3.4	0.18	30.0	1.05	(0.11)
3	70.1	57.7	12.7	0.60	103.3	3.46	(0.57)
4	42.9	37.3	7.5	0.39	64.8	2.24	(0.33)
5	5.1	4.8	0.8	0.05	8.0	0.29	(0.04)
6	51.3	20.6	12.1	0.14	55.3	1.19	0.11
7	37.2	15.1	9.3	0.10	41.4	0.87	0.13
8	103.4	40.4	25.3	0.26	112.6	2.32	0.19
9	158.1	65.5	37.7	0.45	173.8	3.78	0.26
10	86.7	31.0	22.1	0.18	93.8	1.77	0.12
11	16.6	9.9	3.6	0.09	21.3	0.58	(0.05)
12	83.9	53.1	17.8	0.51	111.2	3.15	(0.30)
13	32.0	15.2	7.3	0.12	37.2	0.89	(0.00)
14	20.3	9.2	4.8	0.07	23.3	0.53	(0.02)
15	17.3	6.1	4.0	0.03	17.0	0.35	0.06
16	4.9	3.6	0.9	0.04	6.8	0.21	(0.02)
Total	749	389	170	3.24	902	23	(0.59)

Source: CEC consultant analysis

Table 6: Multifamily Newly Constructed Building Savings by Climate Zone

-	LSC	HSE	Electricity	Natural Gas	Site Energy	GHG	AGD Reduction
Climate Zone	**[M$]**	**[GBtu]**	**[GWh/yr]**	**[MTherms /yr]**	**[GBtu/yr]**	**[tonnes CO2-e/yr]**	**[MW]**
1	0.48	0.72	0.02	0.00	0.08	24.08	0.00
2	4.14	5.84	0.14	0.03	0.51	217.66	0.04
3	21.43	31.31	0.10	0.18	3.97	1,289.84	0.05
4	10.77	13.95	0.37	0.09	1.69	541.30	0.13
5	0.87	1.30	0.03	0.00	0.12	48.68	(0.00)
6	6.95	9.13	0.16	0.06	1.83	385.86	0.03
7	15.63	19.84	0.30	0.11	3.48	832.32	0.07
8	26.37	34.07	0.47	0.20	6.85	1,449.85	0.10
9	30.65	41.61	0.28	0.25	7.48	1,786.17	0.12
10	10.63	16.61	0.32	0.10	1.27	611.03	0.04
11	3.58	5.62	0.26	0.03	0.45	173.74	0.03
12	16.86	24.58	0.78	0.14	2.11	857.95	0.13
13	3.07	5.22	0.28	0.03	0.35	146.12	0.02
14	4.14	6.10	0.20	0.03	0.57	214.10	0.04
15	1.05	1.85	0.07	0.01	0.09	56.16	(0.00)
16	1.50	1.99	0.17	0.02	1.31	101.19	0.03
Total	158	220	3.94	1.28	32.16	8,736	0.83

Source: CEC consultant analysis

Table 7: Single-Family Newly Constructed Building Savings by Climate Zone

-	LSC	HSE	Electricity	Natural Gas	Site Energy	GHG	AGD Reductio n
Climate Zone	**[M$]**	**[GBtu]**	**[GWh/yr]**	**[MTherms /yr]**	**[GBtu/yr]**	**[tonnes CO2-e/yr]**	**[MW]**
1	9	9.00	(0.99)	0.13	10	465	(0.24)
2	27	28.65	(3.44)	0.44	32	1,394	(1.07)
3	28	29.47	(3.72)	0.39	26	1,680	(0.20)
4	25	25.32	(2.98)	0.33	23	1,447	(0.19)
5	4	4.16	(0.51)	0.07	5	195	(0.21)
6	4	3.96	(0.51)	0.07	5	173	(0.19)
7	5	3.71	(0.40)	0.06	4	178	(0.10)
8	8	8.02	(1.10)	0.14	10	327	(0.48)
9	14	13.00	(1.76)	0.23	17	549	(0.74)
10	25	24.81	(3.27)	0.43	32	1,062	(1.66)
11	74	73.45	(8.59)	1.15	86	3,479	(3.36)
12	185	189.86	(22.96)	2.93	215	9,133	(8.28)
13	70	63.24	(5.80)	0.80	61	3,687	(0.38)
14	38	33.71	(3.19)	0.43	32	1,988	(0.16)
15	6	2.66	0.64	0.04	6	125	(0.23)
16	35	41.58	(5.87)	0.65	45	2,009	(1.52)
Total	555.49	554.62	(64.46)	8.28	608	27,891	(19.02)

Source: CEC consultant analysis

Table 8: Multifamily Alterations Savings by Climate Zone

-	LSC	HSE	Electricity	Natural Gas	Site Energy	GHG	AGD Reductio n
Climate Zone	**[M$]**	**[GBtu]**	**[GWh/yr]**	**[MTherms /yr]**	**[GBtu/yr]**	**[tonnes CO2-e/yr]**	**[MW]**
1	0.23	0.16	0.00	0.00	0.10	9.75	0.00
2	0.45	0.13	0.07	0.00	0.27	7.08	0.01
3	10.53	7.51	0.09	0.08	7.81	452.68	0.03
4	4.74	2.43	0.30	0.02	3.48	152.24	0.03
5	0.81	0.62	(0.00)	0.01	0.55	37.64	0.00
6	1.15	0.25	0.18	0.00	0.68	13.90	0.01
7	1.69	0.33	0.24	0.00	0.88	18.37	0.02
8	4.41	0.77	0.72	0.00	2.56	41.45	0.03
9	8.40	1.44	1.33	0.00	4.79	79.12	0.06
10	3.17	0.51	0.52	0.00	1.85	28.11	0.02
11	1.74	0.68	0.17	0.00	0.92	40.78	0.01
12	3.89	0.81	0.58	0.00	2.08	44.84	0.05
13	3.09	1.05	0.32	0.00	1.60	57.07	0.02
14	1.69	0.70	0.16	0.00	0.91	44.73	0.01
15	0.98	0.15	0.16	0.00	0.56	7.99	0.01
16	0.71	0.63	(0.03)	0.01	0.45	38.85	(0.00)
Total	48	18	4.81	0.13	29.50	1,075	0.30

Source: CEC consultant analysis

Table 9: Single-Family Alterations Savings by Climate Zone

-	LSC	HSE	Electricity	Natural Gas	Site Energy	GHG	AGD Reductio n
Climate Zone	**[M$]**	**[GBtu]**	**[GWh/yr]**	**[MTherms /yr]**	**[GBtu/yr]**	**[tonnes CO2-e/yr]**	**[MW]**
1	2	0.95	0.31	0.00	1	50	0.06
2	6	2.49	0.86	0.01	3	136	0.15
3	22	8.95	2.64	0.01	10	484	0.74
4	19	7.29	4.07	0.01	15	403	0.45
5	2	0.85	0.26	0.00	1	46	0.08
6	4	1.98	1.28	0.00	5	106	0.08
7	3	1.18	1.26	0.00	5	69	0.02
8	8	4.92	3.59	0.01	13	264	0.20
9	13	7.71	4.84	0.01	18	422	0.38
10	12	7.22	5.56	0.01	20	390	0.43
11	8	4.43	2.79	0.01	10	240	0.18
12	31	15.12	6.70	0.02	25	823	0.82
13	14	8.18	5.93	0.01	21	442	0.33
14	7	3.40	2.00	0.00	7	184	0.21
15	2	2.11	2.82	0.00	10	112	0.02
16	5	1.92	0.62	0.00	2	100	0.14
Total	157	79	45.52	0.11	166	4,272	4.28

Source: CEC consultant analysis

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GLOSSARY

ANNUALIZED GRID DEMAND (AGD) — Average annual increase in electricity usage on the grid over time.

BATTERY ENERGY STORAGE SYSTEM (BESS) — Stationary equipment that receives electrical energy and then utilizes batteries to store that energy for later use to supply electrical energy when needed. The BESS consists of one or more modules, a power-conditioning system, and balance of plant components.

BUILDING ENERGY MODEL — A software simulation of building energy use.

CARBON DIOXIDE EQUIVALENT — A measure used to compare emissions from different greenhouse gases based on their related global warming potential. The carbon dioxide equivalent for a gas is derived by multiplying the mass of the gas by the associated global warming potential.

CLIMATE ZONE — A climate zone is a region of California with a distinct climate. California is divided into 16 climate zones.

COVERED PROCESS — An aspect of a building that affects building energy consumption but cannot be accounted for by building energy modeling software.

CALIFORNIA SIMULATION ENGINE (CSE) — A general purpose building simulation model developed primarily to perform the required calculations for the California Building Energy Code Compliance for Residential buildings software.

ENERGY EFFICIENCY — Using less energy to perform the same task or produce the same result.

ENERGY MANAGEMENT CONTROL SYSTEM (EMCS) — An automated control system that regulates the energy consumption of a building by controlling the operation of energy consuming systems and can monitor loads and adjusting operations to optimize energy usage and respond to demand response signals.

GREENHOUSE GAS — Any gas that absorbs infrared radiation in the atmosphere. Common examples of greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

HEATING SEASONAL PERFORMANCE FACTOR (HSPF) — The total heating output of a central air-conditioning heat pump (in Btu) during its normal use period for heating divided by the total electrical energy input (in watt-hours) during the same period, as determined using the applicable test method in the Appliance Efficiency Regulations.

HOURLY SOURCE ENERGY (HSE) — The long run hourly marginal source energy of fossil fuels that are combusted because of building energy consumption either directly at the building site or caused to be consumed to meet the electrical demand of the building considering the long-term effects of Commission-projected energy resource procurement. For a given hour, the value in that hour for each forecasted year is averaged to establish a lifetime average source energy.

LONG-TERM SYSTEM COST (LSC) — The CEC-projected present value of costs to California's energy system over 30 years. LSC does not represent a prediction of individual utility bills.

PHOTOVOLTAIC (PV) — Relating to the production of electric current at the junction of two substances exposed to light. Solar panels convert sunlight into electricity by using photovoltaic cells made of materials that generate electrons when exposed to sunlight.

SEASONAL ENERGY EFFICIENCY RATIO (SEER) — A measure of the efficiency of a cooling system.

SITE ENERGY — The amount of natural gas or other fuel and electricity consumed by a building [therms for natural gas, kWh for electricity]. Conversion of these units to site Btus ignores the energy required to generate, transmit, distribute and deliver that energy to the building.

SOLAR ACCESS ROOF AREA (SARA) –— The roof area that is newly constructed when a building is permitted that provides acceptable solar access for PV generation. The SARA includes the building’s roof areas , and the area of all roof space on covered parking areas, carports and all other newly constructed structures on the site, which are compatible with supporting a PV system consistent with Title 24, Part 2, Section 1511.10

SOLAR HEAT GAIN COEFFICIENT (SHGC) — The ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes Fdirectly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.

UNIFORM ENERGY FACTOR (UEF) — A measure of overall water heater efficiency, as determined using the applicable test method in the Appliance Efficiency Regulations.

VARIABLE AIR VOLUME (VAV) SYSTEM — A space-conditioning system that maintains comfort levels by varying the volume of supply air to the zones served.

WINDOW-TO-WALL RATIO (WWR) – The ratio of (i) the total window area of the entire building to (ii) the total gross exterior wall area of the entire building.

5.0 APPENDIX A: QUALITATIVE ANALYSIS OF THE 2025 ENERGY CODE

Table A-1 shows the results of the qualitative analysis of the 2022 and 2025 Energy Code. Changes that directly impact energy consumption are shown in the table, along with whether the change was included in the quantitative analysis, and if it was not included, then the reason for excluding it.

Table A-1: Qualitative Analysis of the 2025 Energy Code

#	2025 Energy Code Section No./Table No.	Change Description	Included in Quantitative Analysis	Reason If not Included in Quantitative Analysis
1	Section 120.1(c)3	Revision of Equation 120.1-F: Added second criteria for determining the mechanical ventilation Rp x Pz (15cfm per person X expected number of occupants) - Incorporated Equation 120.1-G. Removed exception for designed occupancy - made it part of Section 120.1(c)3.	Yes	-
2	Section 120.2(l)	For zones that use hot water for space heating, limit hot water supply temperature to 130F.	Yes	-
3	Section 120.3(a)4	Specifies new insulation requirements for process heating system piping.	Yes (Note 1)	-
4	Section 120.3(a)5	Specifies new insulation requirements for process heating system piping.	Yes (Note 1)	-
5	Section 120.6(a)3D and E	Mandatory requirements for fan-powered evaporators: evaporator specific efficiency of 25 to 50 Btuh/Watt, depending on evaporator type (Table 120.6-A-2) Limit evaporator static pressure drop to 0.5 in H2O.	Yes (Note 1)	-
6	Section 120.6(a)4	Mandatory requirements for commercial refrigeration condensers.	Yes (Note 1)	-
7	Section 130.1(b)	Change/Add Space of 100 sqft and 0.5 W/sqft General Lighting shall have multi-level dimming from 100-10%.	Yes	-
8	Section 130.1(c)1A	Adds occupancy sensing control set to no more than a 20-minute time delay.	No	Marginal energy savings, since (1) the 2022 Energy Code includes occupant sensing controls, and (2) the requirement can be met with time clocks.
9	Section 130.1(c)6	Restructured for clarity and adds text for full or partial-off controls. Warehouse open areas, book stack aisles, adds parking garages, loading, and unloading areas.	No	Occupancy sensing controls require building circulation modeling which is infeasible for this analysis.

10	Exception 1 to Section 130.1(c)6A	Removes exception for warehouse lighting less 80% than prescriptive - controls reduce lighting power by 40%.	No	Exception not captured in building models and does not change prescriptive stringency.
11	Section 130.1(c)6C	Added to part: Lighting in stairwells and common area that have access to guestrooms shall comply with Section 130.1(c)1.	Yes	-
12	Exception 3 to Section 130.1(d):	Revised Exception: Secondary sidelit daylit zone installed wattage less than 85 Watts - changed from 120 Watts.	Yes	-
13	Section 130.2(c)3	Motion sensing outdoor lighting controls.	No	Minor clarifying change from capability to reduce lighting power up to 90 percent, to 50 to 90 percent.
14	Section 135(d)	Disallow plug-in strips for receptable control.	No	This has an indirect savings only if tenants remove installed controls.
15	Table 140.3-B	Decreases the U-factor for Metal Building and Wood Framed and Other roofs.	Yes	-
16	Table 140.3-B	Decreases the U-factor for Metal Building, Mass, and Wood Framed and Other walls.	Yes	-
17	Exception to Section 140.4(a)2	Removed Exception: the exception for single-zone heat pumps when using recovered heat for space heating.	No	No prototype used recovered heat for space heating and the practice is considered to be infrequent in construction.
18	Section 140.4(a)3	Adds Subsection: Multi zone space conditioning system types with a requirement that offices and schools below a certain size that use multizone systems, must use one of the listed heat pump system alternatives.	Yes	-
19	Section 140.4(a)3Aiii	Adds criteria: Option for systems under Section 140.4(a)3A for office buildings in CZ - 2,4 and 8-16 will use variable air volume (VAV) systems with air-to-water heat pump (AWHP) supplying hot water. Adds/Revises criteria for Office buildings to note that Perimeter zones will be Fan Powered depending on Climate Zone, - Ventilation will have HR depending on Climate Zone, - max fan power will be 15% lower than 140.4(c)1 in CZ 3 and 5.	Yes	-
20	Section 140.4(a)3B	Adds a standard for electricity-based heating for multizone HVAC systems in school buildings	Yes	-
21	Section 140.4(a)3Aiv	Added/Revised criteria for multi-Zone HVAC systems - Shall be Dual Fan Dual Duct separate decks for heating and cooling, Economizers when required by Section 140.4(d), Hot deck will use 100% return air.	No	This is a prescriptive option, an alternative to the base package.
22	Section 140.4(a)3C	Added/Revised Subsection AWHP space-heating hot water loop - sets standards for systems used to comply with	Yes	-

		sections 140.4(a)3AIii,iii, or 140.4(a)3B when used for space heating.		
23	Section 140.4(a)3Cii	Revised criteria for AWHP's chilled water production criteria for heat recovery systems.	No	The prototype models do not trigger requirements for condenser heat recovery.
24	Section 140.4(a)3Ciii	Revised/added criteria that supplemental heating will be supplied by an electric resistance boiler sized no greater than 50%.	Yes	-
25	Exception to Section 140.4(c)	Added an exception for the fan power calculation for the multizone heat pump systems in Section 140.4(a)3. This states that when specified, the systems use the fan power requirements of 140.4(a)3 instead of 140.4(c).	Yes	-
26	Section 140.4(c)2Bii	Added requirement that static pressure (SP) reset for VAV systems must follow ASHRAE Guideline 36 control sequences.	Yes (Note 1)	-
27	Section 140.4(d)2Av	Added requirement that reheat control for VAV systems must follow ASHRAE Guideline 36 control sequences.	Yes (Note 1)	-
28	Exception 8 to Section 140.4(e)1	Added an exception for economizers on dedicated outdoor air systems (DOAS) systems in the multizone heat pump systems in Section 140.1(a)3.	Yes (Note 1)	-
29	Section 140.4(e)2D	Added requirement that economizers must follow ASHRAE Guideline 36 control sequences.	Yes (Note 1)	-
30	Section 140.4(f)3	Added requirement that supply air temperature reset controls must follow ASHRAE Guideline 36 control sequences.	Yes (Note 1)	-
31	Exception 7 to Section 140.4(g)	Added an exception allowing electric resistance reheat in the multizone heat pump systems in Section 140.1(a)3.	Yes	-
32	Section 140.4(h)5	Increases the efficiency of cooling towers for certain climate zones.	Yes	-
33	Exception 7 to Section 140.4(p)1	Added an exception for the fan power calculation for the DOAS systems in the multizone heat pump systems in Section 140.1(a)3.	Yes	-
34	Section 140.4(q)	Added a requirement that exhaust air heat recovery that is required by multizone heat pump systems in Section 140.4(a)3 meet the requirements of this section.	Yes	-
35	Section 140.4(s)1	Adds a requirement for mechanical heat recovery for buildings with certain levels of load and demand.	Yes (Note 1)	-
36	Exception 1 to Section 140.4(s)	Exempts Labs that require heat recovery ventilator (HRV)/energy recovery ventilator (ERV) in Section 140.9(c)6	Yes	-
37	Exception 2 to Section 140.4(s)	Exempts buildings in CZ 15 when the service hot water (SHW) load is below a certain threshold.	Yes	-
38	Section 140.4(s)2	Adds a requirement for mechanical heat recovery must also cover the SHW for buildings with certain threshold of SHW load.	Yes (Note 1)	-

39	Exception to Section 140.6(a)	Removed the exception that allowed 0.3 W/sf of portable lighting in offices to not be counted in indoor lighting power.	No	Prototype models do not include portable (task) lighting.
40	Section 140.6(a)2Iiv	Added a requirement that occupant sensors be shown on plans for offices greater than 250 sf.	No	This measure captures shortcomings in previous compliance and would require a derating of the baseline, which, already does not have credit for occupancy sensors in the Alternative Calculation Method (ACM) Reference Manual.
41	Section 140.6(c)2Gviii	Adds restrictions on floor display allowances.	No	The special allowances in Table 140.6-C, carried over from the tailored lighting table, are not included in the prototype model.
42	Section 140.6(c)2Gix-xi	Adds Qualifying wall lighting definitions for allowances.	No	The special allowances in Table 140.6-C, carried over from the tailored lighting table, are not included in the prototype model.
43	Table 140.6-C	Adds Additional Lighting Power Allowance for Wall and Floor Displays: Convention, Conference, Multipurpose, Meeting, Dining, Lobby, Main Entry and Retail Sales.	No	The special allowances in Table 140.6-C, carried over from the tailored lighting table, are not included in the prototype model.
44	Section 140.9(c)3B	Add exhaust fan system input power limits as specified by Section 140.4(c)1A.	Yes	-
45	Exception to Section 140.9(c)3B	Removes exception for lab exhaust systems where requirements specify devices that cause more than 1" of static.	Yes	-
46	Section 140.9(c)3D	New Exhaust System Prescriptive Compliance requirements including 1.3 W/cfm fan power and variable speed controls.	Yes	-
47	Exception 2 to Section 140.9(c)5	Systems in CZ 7 or 15.	Yes	-
48	Section 140.9(c)6	Exhaust Air Heat Recovery for systems with > 10k CFM of exhaust.	Yes	-
49	Table 140.10-A	New/Revised Table PV Capacity Factors based on Building Type.	Yes	-
50	Table 140.10-B	New/Revised Table battery energy storage system (BESS) Capacity based on Building Type.	Yes	-
51	Section 141.0(b)2Cii	New or replacement single zone (SZ) packaged rooftop, <65k Btu/hr shall use Table 141.0-E-1 or Performance compliance requirements in Section 141.0(b)3.	Yes (Note 1)	-
52	Table 141.0-E-1	Removed options with Furnace as an option for replacement equipment.	Yes (Note 1)	-
53	Exception 4 to Section 141.0(b)2C:	Adds that a new or replacement gas hot water boiler system with a total system input of at least 1 MMBtu/h but no more	Yes (Note 1)	-

		than 10 MMBtu/h need not comply with the requirements of 140.4(k)8.		
54	Exception 6 to Section 141.0(b)2C:	Section 140.4(e) is not applicable to systems that meet both of the following: The system is not a single package air-cooled commercial unitary air conditioner or heat pump and cooling capacity is less than 54k btu/h.	No	No prototype meets the criteria for the exception.
55	Section 150.0(a)1	In Climate Zones 4 and 8 through 16, roof decks in newly constructed attics that are above conditioned space shall be insulated to achieve an area-weighted average U-factor not exceeding U-0.184. This revision tightens the (U-factor) requirements, which improves insulation performance, lowers conductive heat transfer through assemblies, and reduces heating and cooling energy consumption statewide.	Yes	-
56	Section 150.0(a)1	Exception 1 to Section 150.0(a)1A: The Space-conditioning system is a ductless system. This new addition expands code scope or clarifies performance criteria, which may improve design consistency and increase adoption of energy-efficient practices.	Yes	-
57	Section 150.0(a)1	Exception 2 to Section 150.0(a)1: Space-conditioning duct systems buried within insulation in an attic that complies using Section 150.1(b) and is verified according to Reference Appendix (RA) 3.1.4.1. This new addition expands code scope or clarifies performance criteria, which may improve design consistency and increase adoption of energy-efficient practices.	Yes	-
58	Section 150.0(c)5	Masonry/Mass walls shall be insulated to meet the wall insulation requirements of Table 150.1-A. Mass. This new addition expands code scope or clarifies performance criteria, which may improve design consistency and increase adoption of energy-efficient practices.	Yes	-
59	Section 150.(c)6	In wood framed assemblies, compliance with U-factors may be demonstrated by installing wall insulation with an R-value of R-15 (instead of 13) in 2x4 assemblies, and R-21 (instead of R-20) in 2x6 assemblies, with 16 inches on center spacing (this last statement. This revision tightens the thermal transmittance (U-factor) requirements, which improves insulation performance, lowers conductive heat transfer through assemblies, and reduces heating and cooling energy consumption statewide.	Yes	-
60	Section 150.0(h)2Bii	Removes Equipment Volume and Applications Volume as an allowed source of design conditions for HVAC sizing	Yes	-

61	Section 150.0(h)2C	The outdoor design temperatures for heating shall be no lower than the 99.0 percent Heating Dry Bulb. This new addition expands code scope or clarifies performance criteria.	Yes	-
62	Section 150.0(h)6	A completely new Defrost section was added to the standards, including installer requirements, documentation rules, and climate-zone-based exceptions.	Yes	-
63	Section 150.0(h)7	A complete new set of requirements for heat pumps with supplementary heat, including lockout temperature, CF2R verification, permitted exceptions, and control requirements. New functional requirements for how supplementary heat must be controlled, including staging, cut-off temperatures, and preventing unnecessary backup heat. New exception for room air conditioner (AC) style heat pumps.	Yes	-
64	Section 150.0(h)8	Adds a new statewide requirement to limit the size of electric resistance supplemental heat relative to heat pump cooling capacity.	Yes	-
65	Section 150.0(h)9	Adds new verification and performance requirements for systems using third-party thermostats on variable/multi-speed heat pumps.	Yes	-
66	Section 150.0(i)2	New thermostat requirements specific to heat pumps that use supplemental electric or gas heating. New requirement for outdoor temperature sensing and display for supplemental heat control. Adds new mandatory thermostat behaviors, indicators, lockout requirements, and CF2R verification. New exception for systems where another control device already locks out supplementary heat above 35°F and exception for room air-conditioner heat pumps	Yes	-
67	Section 150.0(k)1A	Deletes the old efficacy reference table and adds new requirement that all luminaires must be Joint Appendix (JA) 8-certified unless exempt. Clarifies that integrated device lighting subject to DOE standards is exempt from JA8, Removes outdated wattage threshold; aligns with JA8 navigation light exemption. Adds four NEW exempt categories: outdoor light emitting diode (LED), inseparable solid state lighting (SSL), high intensity discharge (HID) lamps, and induction lamps	Yes	-
68	Section 150.0(k)1B	Deletes luminaires-with-screw-base compliance rule.	Yes	-
69	Section 150.0(k)1D	Old language prohibiting non-JA8 high-temp lamps was deleted. New added language explicitly requiring JA8 elevated-temperature compliance for all lamps used in enclosed/recessed luminaires.	Yes	-

70	Section 150.0(k)2C	All lighting controls expands code scope or clarifies performance criteria, which may improve design consistency and increase adoption of energy-efficient practices.	Yes	-
71	Section 150.0(k)2D	Clarifies energy management and control system (EMCS) definition but does not change performance requirements. Adds new rule preventing bypass of dimmers, occupancy sensors, and vacancy sensors.	Yes	-
72	Section 150.0(k)2F	New addition expands code scope or clarifies performance criteria for dimming controls, which may improve design consistency and increase adoption of energy-efficient practices. Removes the wattage threshold for navigation lighting. Reintroduces and clarifies wattage requirement using updated wording.	Yes	-
73	Section 150.0(k)3A	Clarifies that requirement applies to lighting mounted on the main residence or other buildings on the same lot. Clarifies that options are mutually exclusive control choices.	Yes	-
74	Section 150.0(m)1Bi	Introduces a new exception pathway for ducts located in unvented attics. This provides an alternate compliance option that did not exist previously.	Yes	-
75	Section 150.0(m)1Bii	Removes the requirement that duct-location-within-conditioned-space must be field-verified and diagnostic-tested according to RA3.1.4.3.8. This simplifies compliance and removes a Home Energy Rating System (HERS) verification step.	Yes	-
76	Section 150.0(m)13C	Edits to exception to 150.0(m)13C that removes allowance for single-speed compressor systems to use this exception. Now only multispeed or variable-speed systems qualify. Replaces zoning-based fan variation with simpler fan-call-based control, removing zoning dependency. Clarifies installer certification.	Yes	-
77	Section 150.0(o)1C	Removes reference to townhouses and simplifies category to "single-family detached dwelling units and attached dwelling units." Updates building-type terminology to align with revised definitions and avoids redundant phrasing. A new rule stating that vertically attached dwelling units (e.g., stacked flats) cannot apply reduced ventilation rates. This closes a loophole and ensures proper ventilation for units with vertical adjacency.	Yes	-
78	Section 150.0(o)1Civ	Introduces a new subsection establishing requirements specific to balanced and supply-only ventilation systems.	Yes	-
79	Section 150.0(q)	Removes reference to "Item 1 or 2," meaning the section no longer includes alternative compliance pathways. Tightens the U-factor requirement from U-0.45 to U-0.40 for all	Yes	-

		fenestration (including skylights). This is a stricter thermal performance requirement. New Exemption added for fenestration in WUI-regulated buildings is exempt from the normal U-factor requirements.		
80	Table 150.0-E	The compliance criteria for "Vented range hood must meet either the capture efficiency (CE) or airflow rate as specified by Table 150.0-G" remains unchanged. Removes the alternative compliance path of "5 ACH." Now only 300 cfm is allowed for these fans. Removes the separate row for "Non-enclosed Kitchen" and consolidates into the row above.	Yes	-
81	Section 150.1(b)1	Adds the list of components included in Efficiency LSC energy. Introduces self-utilization credit (related to on-site PV usage) into the Efficiency LSC framework. Ensures BESS energy is accounted for uniformly across the performance method and expands Total LSC to include lighting, demand-flexibility loads, and plug loads. This broadens the LSC scope. Defines Source Energy in simple terms.	Yes	-
82	Section 150.1(b)2	Added new language indicating that community shared systems may also offset the demand flexibility Energy Design Rating requirement. Expands the exception to cover demand-flexibility credits.	Yes	-
83	Section 150.1(c)1A	Removes requirement that insulation must be in a ventilated attic for the general rule.	Yes	-
84	SectionN 150.1(c)1Aii	Specifies Option B applies to insulation in a ventilated attic, making this requirement explicit within the option rather than the main section.	Yes	-
85	Section 150.1(c)1Aiii	Deleted "ventilated", expanding option to apply to any attic, not only ventilated ones. Adds the cathedral ceiling allowance to qualify for this option.	Yes	-
86	Section 150.1(c)1Aiii	This exemption note is deleted entirely. These buildings now must comply with the same insulation options as all others.	Yes	-
87	Section 150.1(c)3A	Retained/clarified that the exception applies only to CZ 5 with U-factor 0.30. Deleted climate zones 6–10 and 15 from the small dwelling exception. Exception now applies only to CZ 5. Removes "new" before "tubular skylights area." Clarifies applicability but not performance strictness. U-factor requirement became stricter (from 0.55 to 0.40) and added new rule specifying no SHGC requirement in these CZs 1,3 ,5 and 16, which expands flexibility.	Yes	-
88	Section 150.1(c)6	Removes the previous limitation of heat pump standards only in specific climate zones. This means the rule now applies statewide, not only in CZ 3, 4, 13, and 14.	Yes	-

89	Section 150.1(c)7A	Removes the option of using a fault indicator display (FID) as an alternative to full refrigerant charge verification. This eliminates a compliance pathway that previously allowed simplified verification.	Yes	-
90	Section 150.1C7Aicii	Removes the option of using a FID device as an acceptable alternative to refrigerant charge verification.	Yes	-
91	Section 150.1(c)8	This eliminates the allowance for small instantaneous gas or propane tankless water heaters in CZ 3, 4, 13, 14. Also removes an obsolete cross-reference linked to the now-deleted exception.	Yes	-
92	Section 150.1(c)9B	Removes the old title/requirement phrase and replaces it with a more detailed requirement. Clarifies that both ducts and air handlers must be entirely in conditioned space (more stringent). Requires field verification and diagnostic testing to ensure ducts/air handlers qualify as "entirely in conditioned space."	Yes	-
93	Section 150.1(c)14	Removes SARA from the PV sizing calculation. SARA was previously an optional way to determine maximum allowable PV system size based on available roof area. Introduces a new, explicit multiplier for PV sizing for steep-sloped roofs (18) and a new multiplier for PV sizing for low-sloped roofs (14).	Yes	-
94	Section 150.1(c)15	Adds a mandatory FID requirement for all HRV (Heat Recovery Ventilator) and ERV (Energy Recovery Ventilator) systems in individual dwelling units. It also requires ECC-rater field verification following JA17.	Yes	-
95	Table 150.1-A	This measure (roof deck insulation option) was removed from the prescriptive package.	Yes	-
96	Table 150.1-A	A new "Option C" reinstates roof deck insulation requirements for cathedral ceilings.	Yes	-
97	Table 150.1-A	Adds or clarifies a separate radiant-barrier option for vented attics.	Yes	-
98	Table 150.1-A	Increased required insulation for below-grade exterior walls in CZ 15 and CZ 16 (from R-5 to R-10 and R-19).	Yes	-
99	Table 150.1-A	Adds prescriptive insulation for slab edges in the coldest zone (CZ 16).	Yes	-
100	Table 150.1-A	Raises required insulation for concrete raised floors in colder zones, increasing resistance from R-8 to R-10 or R-13.	Yes	-
101	Table 150.1-A	Introduces explicit water-heating line items tied to §150.1 (c) 8.	Yes	-
102	Table 150.1-A	Specifies distinct prescriptive options for duct insulation levels (e.g., R-6 vs R-8) tied to new section references. Clarifies	Yes	-

		climate-zone applicability and ensures duct efficiency consistency statewide.		
103	Table 150.1-A	Consolidates duplicate entries for Options B and C into clearly titled rows. Does not change R-values (R 6 and R 8 remain); editorial clarity only.	Yes	-
104	Table 150.1-A	Splits refrigerant-charge verification into two equipment categories (AC vs HP). Clarifies that verification is required for both cooling and heating equipment supports proper system efficiency in the field.	Yes	-
105	Table 150.1-A	Reflects federal transition from SEER to SEER2 ratings. This improves alignment with national efficiency standards without altering prescriptive levels.	Yes	-
106	Table 150.1-A	Clarifies compliance method for roof assembly U-factors. Distinguishes cavity and continuous insulation paths and references updated JA4 4.2.2 instead of older tables.	Yes	-
107	Table 150.1-A	Introduces the updated HSPF2 efficiency metric (replacing HSPF) for heat-pump heating systems.	Yes	-
108	Table 150.1-A	Specifies that only whole house fans (WHF) listed in the Home Ventilating Institute's (HVI) Certified Products Directory may be used and that airflow per conditioned-floor area must meet 1.5 CFM/ft².Strengthens compliance verification and ensures proper installation performance.	No	Not a modeling change, product reference directory change.
109	Table 150.1-A	Clarifies allowance for small supplemental heaters (≤ 2 kW) controlled by a time-limit device.	Yes	-
110	Table 150.1-A	Clarifies allowance for small supplemental heaters (≤ 2 kW) controlled by a time-limit device.	Yes	-
111	Table 150.1-A	Newly added prescriptive exception that allows very small new dwelling units (≤500 ft²) in CZ 5–10 and 15 to comply with the window requirement using a less stringent U-factor of 0.30	Yes	-
112	Exception 3 to Section 150.2(a)	Exception is deleted, removes outdated references to CBC/CRC section numbers.	Yes	-
113	Exception 5 to Section 150.2(a)	Phrasing change for additions ≤ 1,000 ft² referencing ventilation cooling exemptions.	Yes	-
114	Section 150.2	Eliminates the prescriptive permission for either heat-pump or gas heating for additions.	Yes	-
115	Section 150.2(a)1Aiii	Deletes exception and inserts a specific solar-heat-gain limit (SHGC 0.23) for CZ 15. .	Yes	-
116	Section 150.2(a)1Diii	Changes 150.2(d)iii to 150.2(d)iv. Retains the provision for small additions but clarifies electric point-of-use water heating as the only permitted technology.	Yes	-

117	Section 150.2(a)1E	Clarifies that airflow verification must occur. Adds an exemption for ductless systems that follow standard capacity-limit rules. Introduces another exception for variable-speed equipment whose ratings fall between table values and supports accurate load matching and modern HVAC designs.	Yes	-
118	Section 150.2(a)1E	Clarifies that airflow verification must occur. Adds an exemption for ductless systems that follow standard capacity-limit rules. Introduces another exception for variable-speed equipment whose ratings fall between table values and supports accurate load matching and modern HVAC designs.	Yes	-
119	Table 150.2-A	Adds an explicit row identifying multi-speed and variable-speed equipment; text formatting aligned for clarity only. New row defines heating-capacity limits at the lowest speed for variable-speed systems (80 % of design load HL).	Yes	-
120	Table 150.2-B	Adds new table for cooling mode, defining capacity at lowest speed. Ensures variable-speed equipment is sized for efficiency at part-load conditions.	Yes	-
121	Table 150.2-C	Adds new prescriptive infiltration limits for various dwelling types appear unchanged; values carried over from prior code cycle.	Yes	-
122	Section 150.2(a)D	Adds cross-reference ensuring additions use the same load-calculation and system-capacity rules as newly constructed buildings.	Yes	-
123	Section 150.2(b)1A	Removes an outdated area-based exemption for small window additions. Adds a specific SHGC limit for newly added or enlarged fenestration in hot-dry CZ 15.	Yes	-
124	Exception 2 to Section 150.2(b)1B:	Tightens skylight-replacement U-factor from 0.55 to 0.40 and SHGC limit to 0.30.	Yes	-
125	Section 150.2(b)1C	Lists a new subsection 150.2(b)1Fii, for entirely new or complete replacement space-conditioning systems.	Yes	-
126	150.2(b)1Fii	Removes the limited list of climate zones (2 and 8–15) so the rule now applies to all climate zones statewide. Extends the requirement beyond air-cooled AC units to include air-source heat pumps.	Yes	-
127	Section 150.2(b)1Fiibii	Removes the previous FID (fault indicator display) verification requirement. FID devices are no longer a compliance option under 2025 standards.	Yes	-
128	Section 150.2(b)1Fiii	Removes the limited list of climate zones (2 and 8–15) and redundant wording referring only to “air-cooled air conditioners.”	Yes	-

129	Section 150.2(b)1Jiv	Updates the code reference to the specific residential section (R806) governing attic ventilation. This aligns the standard with residential compliance documentation.	No	Code change for alignment with compliance documentation
130	Table 150.2-G	Removes outdated generic default U-factor/SHGC assumptions. These static placeholder values no longer accurately reflect verified existing conditions.	Yes	-
131	Table 150.2-DG	References specific fenestration criteria in section 150.1(c)3A instead of fixed default numbers.	Yes	-
132	Section 160.1(b)2	Revises maximum allowed Metal framed U-factor to 0.148 from 0.151.	Yes	-
133	Section 160.1(b)3A.	Lowers nominal 2x4 framing U-factor of the wall to 0.095 from 0.102.	Yes	-
134	Section 160.1(b)3B.	Lowers nominal 2x6 framing U-factor of the wall to 0.069 from 0.071.	Yes	-
135	Section 160.1(e)1.	Change in language for Exception 1 Up to 0.5 percent of the conditioned floor area is not required to comply with the maximum U-factor requirement	No	This is a change in the exception for this section
136	Section 160.1(g)	Specifies ASTM C272 as test method for maximum water absorption rate.	No	This is a material testing change.
137	Section 160.2(b)1.E	Allows exception to evaporative coolers where they are not required to comply with the air filtration requirements in Section 160.2(b)1.	No	Evaporative coolers were not modeled in the prototypes.
138	Section 160.2(b)2.A.iv.b.	Removes language about dwelling unit ventilation system having exhaust as an option and must comply with section 1 and 2 balanced or supply only plus compartmentalization	Yes	-
139	Section 160.2(b)2.B.1.iv.	Allows field verification and diagnostic testing required in Section 160.2(b)2Bi, ii and iii which requires an Energy Code Compliance (ECC) Program-Rater may alternatively be performed by a certified Mechanical Acceptance Test Technician.	No	Energy model assumes ideal operation; energy impact of field testing not captured.
140	Section 160.2(b)2.C. Exception	Specifies that multifamily buildings with three or fewer habitable stories in Climate Zone 7 are not required to comply with Section 160.2(b)2C.	Yes	-
141	Section 160.2(d)	Removes infiltration effectiveness weather and shielding factors	Yes	-
142	Section 160.2(d)	Changing Table 160.2B from Minimum Ventilation Rates for multifamily Common Use Areas to Minimum Occupant Load Density and ventilation Rates for Multifamily Common Use	Yes	-
143	Section 160.3(b)2.C.	Specifies that the outdoor design temperatures for heating shall be no lower than the 99.0 percent	Yes	-
144	Section 160.3(b)7.A.-B.	Specifies defrost delay timer operation for heat pumps and requires that the installer state on the Certificate of	Yes	-

		Installation that the control configuration has been tested in accordance with the testing procedure found in the CF2R.		
145	Section 160.3(b)8.A.-B.	Adds a new section for thermostat control using variable or multi-speed systems.	No	Prototypes do not model thermostat settings.
146	Section 160.3(d)1.D.	Requires DOAS, HRV or ERV systems to be tested in accordance with NA7.5.4.	Yes	-
147	Section 160.4(a)	Removes all language for individual dwelling units having gas or propane water heaters.	Yes	-
148	Section 160.4(f)	Adds general requirements for pipe insulation	Yes	-
149	Section 160.4(f)2.	Specifies insulation thickness requirements.	Yes	-
150	Section 160.4(f)2.	Adds conductivity equation and language for pipe insulation.	Yes	-
151	Section 160.4(f)2.A.3	Specifies that appurtenance insulation covers shall be removable and re-installable.	Yes	-
152	Section 160.4(f)4.	Requires insulation for hot water pipes and plumbing appurtenances to be field verified as specified in Residential RA3.6.3.	Yes	-
153	Exception 1 to 160.5(a)2F	Removes exemption for integrated lighting in range hoods and bathroom exhaust fans. These must now meet dimming/lighting control rules unless covered elsewhere.	No	Prototypes do not model bathrooms.
154	Section 160.5(a)3A.ii	Removes motion sensor from allowable pairings, now photocell and time switch is required.	No	Prototypes do not model setting from sensors.
155	Table 160.5-A	Deletes the entire classification table. Table 160.5 previously indicated which luminaire/light-source types qualified as "high-luminous-efficacy" and which required JA8 certification.	No	Prototypes do not model this requirement.
156	Section 160.5(a)4B	Deletes legacy performance requirements that are now covered under Section 110.9(h) and JA8 dimming requirements.	No	Prototypes do not model this requirement.
157	Exception to Section 160.5(b)4Ciii	This section was added to make an exception to areas where occupant sensing controls are installed.	No	Prototypes do not model setting from sensors.
158	Section 160.5(b)4Cvb	Removes restrooms from the required list under section 150.6(b)4B.	No	Prototypes do not model bathrooms.
159	Section 160.5(b)4Cvba	Automatic full-on was added for occupant sensing control.	No	Prototype models do not model settings for occupant sensors.
160	Section 160.5(b)4Cvi	Revises occupant sensor requirements by removing the mandate for full-off or partial-off operation and removing cross-reference to Section 160.5(b)4Ci. The subsection now explicitly includes parking garages, parking areas, loading areas, and unloading areas, changing the applicability of control requirements for these spaces.	No	Prototype models do not model settings for occupant sensors.
161	Section 160.5(b)4Cvibi	Replaces the allowance that allowed each luminaire with an integral occupancy sensor to qualify as its own control zone.	No	Prototype models do not model settings for occupant sensors.

162	Section 160.5(b)4Cvic	Creates a new subsection to explicitly include parking garages, parking areas, and loading/unloading areas within the scope of general lighting control requirements under 160.5(b)4C.	No	Prototype models do not model parking area lighting.
163	Section 160.5(b)4Dv6(d)2.	Section was added to include parking garage areas where the total installed wattage. Changed split-wired to multiple	No	Prototype models do not model lighting in the parking area.
164	Section 160.6(d)	Specifies that plug-in strips are not allowed when complying with the receptacle control requirements.	No	Prototypes do not model plug-in strips.
165	Section 160.7(b).	Requires pool and spa systems installed for public use comply with the requirements in sections 150.0(p)2, 150.0(p)3, and 150.0(p)4.	Yes (Note 1)	-
166	Section 160.9 (a)	Adds new requirements to ensure multifamily building electrical capacity is sized to meet future electric ready requirements specified in sections 160.9(a) through (e).	No	Prototypes do not model electric readiness.
167	Section 160.9(e)	Adds individual Heat Pump Water Heater Ready requirements.	No	Prototypes do not model electric readiness.
168	Section 160.9(f)	Adds central Heat Pump Water Heater Ready requirements.	No	Prototypes do not model electric readiness
169	Section 170.1(D)	Adds Thermal Balancing Valve verification requirement and deletes “Reserved.” This restores an active performance compliance test for valves with variable-speed pumps.	Yes	-
170	Section 170.2(c)3Biv.	Adds climate zones for HRV/ERV (1,2,4,11-14,16) and rewording language.	Yes	-
171	Section 170.2(c)3Biv.	Requires HRV/ERV systems serving individual dwelling units to have a Fault Indicator Display (FID) that is manufacturer certified in compliance with the requirements in Joint Appendix JA17.4. The FID certification shall be verified by an ECC-Rater.	Yes	-
172	Exception 6 to Section 170.2(c)4Ci.	Specifies requirements for DOAS units when they are used.	No	A DOAS system was not modeled in the prototypes.
173	Section 170.2(c)4F.v.	Specifies cooling tower efficiency in new Table 170.2-I based on climate zone.	Yes	-
174	Table 170.2-I	Removes the option for gas or propane instantaneous water heating	No	A cooling tower is not modeled in the multifamily prototypes.
175	Exception 1 to Section 170.2(d)1:	Allows multifamily buildings four habitable stories or greater to install a gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less with no storage tank.	Yes	-
176	Exception 2 to Section 170.2(d)1:	Allows 120V HPWH to be installed in place of a 240V HPWH for new dwelling unit with one bedroom or less.	Yes	-
177	Section 170.2(d)2.	Requires systems serving multiple dwelling units to meet prescriptive requirements for central water heating systems or meet the performance compliance requirements of Section 170.1.	Yes	-

178	Section 170.2(d)2C	Requires hot water distribution piping to be sized in accordance with the California Plumbing Code Appendix M.	Yes	-
179	Section 170.2(d)2D	Specifies recirculation requirements for central water heating systems.	Yes	-
180	Section 170.2(f)	Establishes separate PV requirements for buildings with steep-sloped roofs and for buildings with low-sloped roofs.	Yes	-
181	Section 170.2(f)Biii	Deletes the provision that allowed local building code requirements to reduce the available Solar Access Roof Area (SARA).	Yes	-
182	Exception 2 to Section 170.2(f)	Increases the PV system size threshold below which a PV system is not required from 1.8 to 4 kWdc	Yes	-
183	Equation 170.2-E	Modernizes equation to align power-capacity sizing with updated BESS terminology and removes PV-system cross-references. Consolidates and updates all variable definitions to consistently use BESS terminology. Deletes obsolete PV references and clarifies which floor area applies to storage sizing.	Yes	-
184	Table 170.2-V	Introduces a new BESS Capacity Factor table that defines Wh/ft^2 factors by building type and climate zone. Establishes the standardized values used in Equations 170.2-E/F for determining required BESS size.	Yes	-
185	Exception to Section 180.2(b)5A.	Allows altered dwelling units to not perform the dwelling unit air leakage test.	No	Field testing, not a modeled change.
186	Exception to Section 180.2(b)5A.	Allows the new or replacement ventilation type to be supply, balanced, or the existing ventilation type being replaced.	Yes	-
187	Table 180.2-B	Specifies changes to fenestration maximum U-factor and SHGC requirements.	Yes	-

Note 1 – Due to difficulty in directly modeling the measure or determining applicability to building prototypes, the energy savings from CASE measure reports included in the rulemaking record were applied to applicable prototypes.

Source: CEC consultant analysis

6.0 APPENDIX B: 2025 ENERGY CODE STATE CERTIFICATION FOR NONRESIDENTIAL AND HIGH-RISE MULTIFAMILY BUILDINGS

BACKGROUND

Federal law (42 U.S.C. 6833 n.d.) requires that when a new national model energy code is published, DOE evaluates if the new code edition is more stringent than the previous edition. For commercial buildings, the national model energy code is ANSI/ASHRAE/IES Standard 90.1 (Standard 90.1). DOE issued an affirmative determination for Standard 90.1-2022 (ASHRAE 2022), which is the latest Standard 90.1 edition, stating that it would increase efficiency relative to the previous edition. Upon publication of an affirmative determination, federal law requires states to certify that their energy code meets or exceeds the stringency set by the latest Standard 90.1 edition (42 U.S.C. 6833 n.d.). For Standard 90.1-2022, state certifications must be submitted by March 6, 2026. To certify, states must demonstrate "…that the provisions of such State's commercial building code regarding energy efficiency meet or exceed such revised [Standard 90.1-2022]."[6]

The Performance Rating Method (PRM), a performance compliance approach within Standard 90.1, was used to determine the stringency of the 2025 Energy Code relative to Standard 90.1-2022. The PRM provides a convenient way to compare the stringency of an energy code to that of Standard 90.1. This Appendix describes the method used and the results comparing the stringency of the 2025 Energy Code with Standard 90.1-2022.

METHOD

The method used for this analysis is identical to that used for the 2022 Energy Code Impact Analysis (Athalye, et al. 2023). The PRM compares the proposed design, which in this case is the 2025 Energy Code model, to the baseline design specified by the PRM to calculate the performance cost index (PCI) of the proposed design. PCI equals the proposed building performance divided by the baseline building performance (as specified by the PRM). When PCI is equal to or less than the target PCI, PCI_t, the proposed design meets the stringency of Standard 90.1. The PCI_t was set by Standard 90.1 based on the stringency of Standard 90.1-2022. The approach used here uses prototypes meeting the requirements of the 2025 Energy

[6] 42 U.S.C. 6833(b)(2)(B)(i).

Code. The PCI for these prototypes was calculated and compared to the PCI_t to determine the relative stringency of the 2025 Energy Code with Standard 90.1-2022.

Section 4.2.1.1 within Standard 90.1-2022 provides the calculation methodology for determining the PCI and PCI_t. The PCI_t calculation includes the building performance factor (BPF), which prescribes the percent improvement in regulated loads between Standard 90.1-2022 and the PRM baseline by building type and climate zone. The target BPFs are specified in Section 4.2.1.1 of Standard 90.1-2022 and are reproduced here for reference. Table B-1 shows the BPFs by building area type for ASHRAE climate zones (further described in the climate zone section below) applicable to California.

Table B-1: Standard 90.1-2022 BPFs

PRM Building Area Type			
Climate Zone	3B	3C	4C
Multifamily	0.76	0.63	0.71
Healthcare/Hospital	0.66	0.64	0.63
Hotel/motel	0.65	0.65	0.63
Office	0.54	0.48	0.48
Restaurant	0.53	0.51	0.54
Retail	0.43	0.44	0.46
School	0.49	0.50	0.47
Warehouse	0.21	0.19	0.22
All others	0.52	0.55	0.55

Source: CEC consultant analysis

The PCI and PCI_t were calculated in the same manner as described in the 2022 Impact Analysis report (Athalye, et al. 2023). Details about the prototypes, climate zones, energy costs, and renewable energy contributions used in this analysis are described in greater detail below.

6.1.1 PROTOTYPES

A subset of prototypes was selected for this comparison representing more than 86 percent of the forecasted new construction floor area within California. Table B-2 shows the prototypes selected for the analysis and their mapping to the PRM building area types. The 2025 Energy Code models for the prototypes were already created as part of the impact analysis. The PRM baseline models for these prototypes were created using the PRM ruleset in CBECC.

Table B-2: Prototypes Selection for Nonresidential State Certification Analysis

PRM Building Area Type	Selected Prototypes
Multifamily	Apartment Mid-rise
Assembly	Assembly
Healthcare/Hospital	Not included
Hotel/motel	Hotel Small
Office	Office Small Office Medium Office Large
Restaurant	Not included
Retail	Retail Large Retail Standalone
School	School Large School Small
Warehouse	Warehouse

Source: CEC consultant analysis

6.1.2 CLIMATE ZONE MAPPING

ASHRAE Standard 169-2013 (ASHRAE 2013) is listed as the reference for climatic data to be used with Standard 90.1-2022. Standard 169-2013 provides a mapping of counties within the United States to 16 climate zones created within Standard 169. These climate zones are then used by a variety of other standards including Standard 90.1. The California Energy Code uses climate zones that are different from those used by Standard 90.1. Table B-3 shows the mapping of California climate zones to the Standard 90.1 (or ASHRAE) climate zones. Of the 16 climate zones within ASHRAE, only 3 are mapped to California counties. This mapping is used to determine the BPFs applicable to the California building climate zones used in the analysis.

Table B-3: Mapping of California Climate Zones to ASHRAE Climate Zones

California Building Climate Zone	Representative City	County	ASHRAE Standard 169-2013 County to Climate Zone Mapping
01	Arcata	Humboldt	4C
02	Santa Rosa	Sonoma	3C
03	Oakland	Alameda	3C
04	Paso Robles	Santa Clara	3C
05	Santa Maria	Santa Barbara	3C
06	Los Angeles	Los Angeles	3B
07	San Diego	San Diego	3B
08	Fullerton	Orange	3B
09	Burbank	Los Angeles	3B
10	Riverside	Riverside	3B
11	Red Bluff	Tehama	3B
12	Sacramento	Sacramento	3B
13	Fresno	Fresno	3B
14	Palmdale	Los Angeles	3B
15	Palm Springs	Riverside	3B
16	Blue Canyon	Placer	3B

Source: CEC consultant analysis

6.1.3 ENERGY COSTS

The PRM allows the use of either a project-specific energy cost to calculate the performance of the project or it specifies the use of average energy prices published by the Energy Information Administration (EIA). For this analysis, a blended rate was sourced from EIA and is shown in Table B-4.

Table B-4: Average Annual Retail Prices for Electricity and Natural Gas in California in 2024

Fuel	Blended energy cost rate
Electricity Average retail price for California commercial sector in 2024 (EIA 2024)	$0.2554/kWh
Natural Gas Average retail price for California commercial sector in 2024 (EIA 2024)	$1.3353/therm
Electricity Average retail price for California residential sector in 2024 (EIA 2024)	$0.3197/kWh
Natural Gas Average retail price for California residential sector in 2024 (EIA 2024)	$1.81/therm

Source: CEC consultant analysis

6.1.4 RENEWABLE ENERGY

The PRM caps the benefit of PV systems to 5 percent of the baseline design energy cost. This cap is intended to prevent trade-offs between renewable energy generation and energy efficiency when a building applies for compliance. Note that the Energy Code separately requires compliance for 1) energy efficiency (LSC) alone without any PV/battery onsite generation trade-offs, and 2) total energy savings resulting from the combination of energy efficiency and onsite generation. In all the prototypes selected for the analysis, the renewable energy cost fraction for the Energy Code exceeds the 5 percent cap. This analysis focuses on the comparison between two energy codes and is not a typical compliance comparison. Thus, even though the 2025 Energy Code requires PV/battery installations that would provide greater benefit than the maximum 5 percent that is allowed, the additional benefit is disregarded and not taken in this comparison, resulting in a very conservative estimate of the stringency of the 2025 Energy Code.

RESULTS

Table B-5 shows the results of the comparison between the 2025 Energy Code and the stringency established by Standard 90.1-2022. When the PCI is equal to or lower than the target PCI, the 2025 Energy Code is more stringent than Standard 90.1-2022. The results show that the 2025 Energy Code is more stringent than Standard 90.1-2022 when compared at the prototype and building area level.

To aggregate the results by prototype and building area type, construction weights described in Section 0 were used. The statewide aggregated PCI margin is 1 – Target PCI/PCI. The result for All Buildings is positive, meaning that the 2025 Energy Code is more stringent than Standard 90.1-2022.

Table B-5: PRM Performance Comparison by Prototype

	Target PCI	PCI	PCI Margin
PRM Building Area Type	**[$/$]**	**[$/$]**	**[$/$]**
Multifamily	0.87	0.82	0.05
Assembly	0.65	0.46	0.29
Hotel	0.86	0.64	0.25
Office	0.75	0.66	0.12
Retail	0.60	0.50	0.16
School	0.65	0.63	0.04
Warehouse	0.58	0.33	0.44
All Buildings	**0.78**	**0.67**	**0.14**

Source: CEC consultant analysis

7.0 APPENDIX C:
2025 ENERGY CODE STATE CERTIFICATION FOR LOW-RISE RESIDENTIAL BUILDINGS

BACKGROUND

The U.S. DOE is required by law (42 U.S.C. §6833) to issue a determination on whether the latest version of the International Energy Conservation Code (IECC) is more efficient than the previous version for low-rise residential buildings. DOE has issued an affirmative determination stating that the 2024 IECC (ICC 2024) will improve energy efficiency in residential buildings. Upon publication of an affirmative determination, states are required to certify that they have reviewed the provisions of their residential building code regarding energy efficiency and decide whether they believe it is appropriate to revise their code to meet or exceed the updated edition of the IECC. State certifications for the 2024 IECC must be submitted by December 30, 2026 and demonstrate compliance with the requirements in 42 U.S.C. 6833(a)(5).

METHOD

7.1.1 PROTOTYPES

Table C-1shows the prototypes applied in this analysis. These are the same newly constructed single-family prototypes used elsewhere in this report. The results were weighed to represent 2 percent for the 500 square foot prototype, 42 percent for the 2,100 square foot prototype, and 56 percent for the 2,700-square-foot prototype.

Table C-1: Prototypes Selected for Residential DOE Certification Analysis

Prototype Name	**Number of Stories**	**Floor Area (square ft)**	**Description**
Single-Family Newly Constructed 1-Story	1	2,100	1-story detached single-family home with an attached garage, slab-on-grade foundation, wood-framed wall construction, and a vented attic.
Single Family Newly Constructed 2-Story	2	2,700	2-story detached single-family home with an attached garage, slab-on-grade foundation, wood framed wall construction, and a vented attic.
Single Family Newly Constructed ADU	1	500	1-story detached single family home, 1-bedroom, 9-ft ceilings, slab-on-grade foundation, wood framed wall construction, and a vented attic.

Source: CEC consultant analysis

7.1.2 CLIMATE ZONE MAPPING

The California to IECC climate zone mapping mimics ASHRAE climate zone mapping in APPENDIX B. Table C-2 represents the IECC climate zones that correspond with each of California's 16 climate zones.

Table C-2: California to IECC Climate Zone Mapping

California Building Climate Zone	Representative City	County	IECC Climate Zone Mapping
01	Arcata	Humboldt	4C
02	Santa Rosa	Sonoma	3C
03	Oakland	Alameda	3C
04	San Jose	Santa Clara	3C
05	Santa Maria	Santa Barbara	3C
06	Torrance	Los Angeles	3B
07	San Diego	San Diego	3B
08	Fullerton	Orange	3B
09	Burbank	Los Angeles	3B
10	Riverside	Riverside	3B
11	Red Bluff	Tehama	3B
12	Sacramento	Sacramento	3B
13	Fresno	Fresno	3B
14	Palmdale	Los Angeles	3B
15	Palm Springs	Riverside	3B
16	Blue Canyon	Placer	3B

Source: CEC consultant analysis

7.1.3 ANALYTICAL APPROACH

CBECC-Res 2025 software was utilized to estimate energy use. Two models were developed, one prescriptively compliant with the 2025 Energy Code and another minimally code compliant with the 2024 IECC in each California climate zone and prototype. Table C-3 presents the 2024 IECC code-compliant building specifications for IECC Climate Zone 3 and Climate Zone 4 for this analysis.

Table C-3: IECC Building Specifications

Description	IECC Climate Zone 3	IECC Climate Zone 4C (Marine)
Exterior Wall Assembly	2x6 R-20	2x6 R-20 R-5
Interior Demising Wall Assembly	2x6 R-20	2x6 R-20
Quality Insulation Installation	None	None
Air Leakage	2.5 ACH50	2.0 ACH50
Slab Edge Insulation	R-10 edge, 2ft deep	R-10 edge 3ft deep
Raised Floor Insulation	R 19	R 30
Attic Type	Ventilated	Ventilated
Ceiling Insulation	R 38	R 49
Roof Deck Insulation	None	None
Radiant Barrier	No requirement	No requirement
Roof Reflectivity	No requirement (0.10)	No requirement (0.10)
Roof Emissivity	No requirement (0.85)	No requirement (0.85)
Glazed Door U-factor	0.3	0.28
Window U-factor	0.3	0.28
Window SHGC	0.25	No requirement (0.4)
HVAC System Type	Same as Tile 24 All CZs: Heat pump	Same as Tile 24 All CZs: Heat pump
Heating Efficiency	7.5 HSPF2	7.5 HSPF2
Cooling SEER	14.3 SEER2	14.3 SEER2
Cooling EER	11.7 EER2	11.7 EER2
Cooling System Airflow	No requirement (350 cfm/ton)	No requirement (350 cfm/ton)
Refrigerant Charge Verification	Not Verified	Not Verified
Cooling System Fan Efficacy	No requirement (0.58 W/cfm)	No requirement (0.58 W/cfm)
Duct Location	Attic	Attic
Duct Leakage	4 cfm per 100 sqft	4 cfm per 100 sqft
Duct Insulation	R-8	R-8
IAQ Fan Type	Exhaust	HRV Mechanical Ventilation, 75% SRE/ASRE
IAQ Fan W/cfm	0.26W/cfm	0.83 W/cfm
DHW System Type	HPWH, UEF3.3(50 Gallon)	HPWH, UEF3.3(50 Gallon)
DHW Compact Distribution	No requirement	No requirement
Drain Water Heat Recovery	No requirement	No requirement
PV System	None	None
Appliance Fuel	Same as Energy Code: Gas stove/oven and dryer	Same as Energy Code: Gas stove/oven and dryer

Source: CEC consultant analysis

The 2024 IECC requirement for duct leakage is based on a maximum cfm of leakage per 100 square feet of conditioned floor area. To evaluate this requirement in CBECC-Res, the maximum cfm of leakage per 100 square feet of conditioned floor area was converted to a percent of system airflow. Total allowable leakage was calculated as 84 cfm for the 2,100-square-foot prototype and 108 cfm for the 2,700-square-foot prototype. Total system airflow was calculated based on the modeled system cooling capacity for each climate zone and applying 350 cfm per ton. Leakage as a percentage of system airflow was calculated by dividing the IECC allowable leakage by the system airflow. Where the results differed for the two prototypes, the lower percentage value was used for this analysis. The results are presented in Table C-4.

Table C-4: Duct Leakage Calculation

Climate Zone	Duct Leakage (percentage of the system airflow)
1	19%
2	9%
3	9%
4	12%
5	9%
6	9%
7	9%
8	10%
9	10%
10	9%
11	9%
12	10%
13	9%
14	10%
15	6%
16	12%

Source: CEC consultant analysis

7.1.4 RESULTS

Table C-5 presents CBECC-Res simulation results comparing site energy, LSC, and source energy between 2024 IECC and 2025 Energy Code cases. Figure C-1 and Figure C-2 present the comparison of LSC and source energy between the 2024 IECC and 2025 Energy Code, respectively.

The 2025 Energy Code uses less electric energy than the 2024 IECC in all climate zones for all single-family prototypes. Hourly Source Energy use is 2 percent to 34 percent lower, and LSC is 8 percent to 46 percent lower. Dwelling units in low-rise multifamily buildings generally use less energy than single-family dwelling units due, in part, to the reduced surface area exposed to the outdoors[7]. Further, since IECC and California Energy Code requirements are very similar between dwelling units in single-family and low-rise multifamily buildings, the performance of low-rise multifamily dwelling units was not directly evaluated. Instead, low-rise multifamily dwelling units are expected to perform no worse than single-family dwelling units. The 2025 Energy Code is deemed to be more stringent than the 2024 IECC for residential buildings.

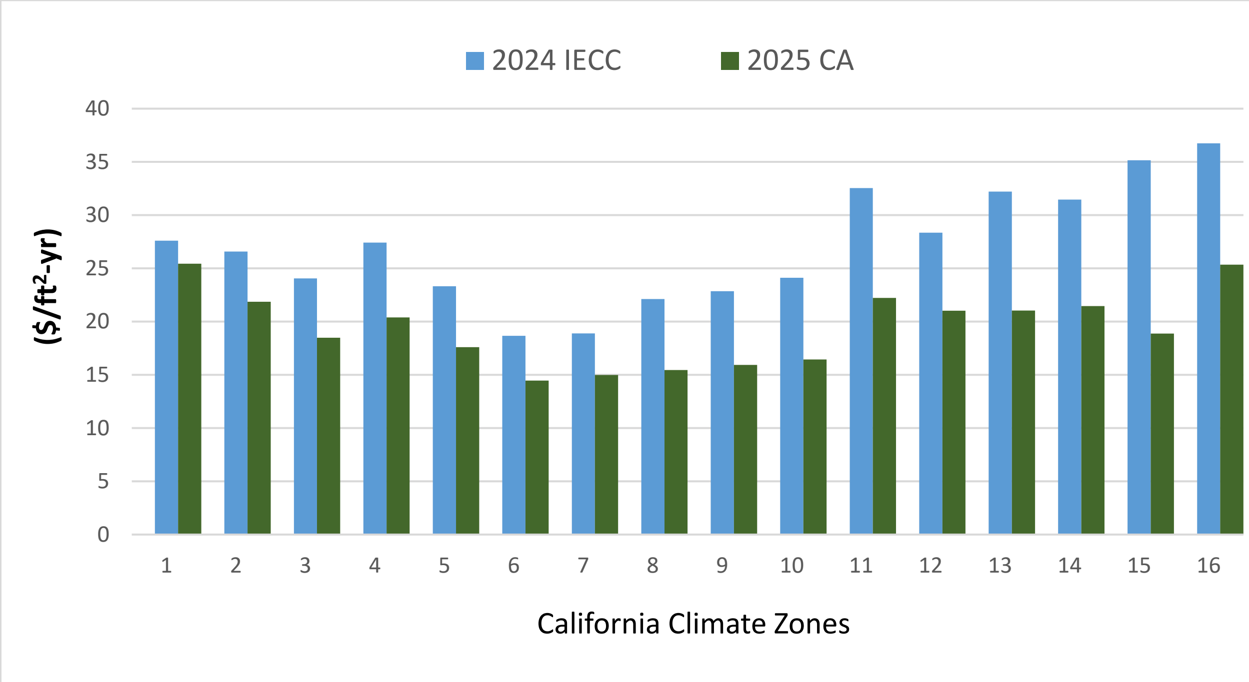
[7] For example, see U.S. Energy Information Administration, 2015 Residential Energy Consumption Survey, https://www.eia.gov/energyexplained/use-of-energy/electricity-use-in-homes.php

Table C-5: 2024 IECC and 2025 Energy Code Energy Use Comparison

California Building Climate Zone	Site Electric Energy (kWh)	Site Electric Energy (kWh)	Site Fuel Use (Therms)	Site Fuel Use (Therms)	LSC ($/ft²-yr)	LSC ($/ft²-yr)	Source Energy (kBtu/ft²-yr)	Source Energy (kBtu/ft²-yr)
California Building Climate Zone	2024 IECC	2025 Energy Code	2024 IECC	2025 Energy Code	2024 IECC	2025 Energy Code	2024 IECC	2025 Energy Code
01	8,240	4,982	45	45	27.61	25.44	9.27	9.13
02	7,795	3,739	45	45	26.58	21.86	9.14	8.14
03	6,953	2,621	45	45	24.06	18.48	8.17	6.86
04	8,098	3,231	45	45	27.41	20.39	9.22	7.65
05	6,859	2,568	45	45	23.32	17.60	7.95	6.55
06	5,452	1,316	45	45	18.66	14.47	6.22	5.43
07	5,474	1,753	45	45	18.88	14.99	6.10	5.36
08	6,728	1,814	45	45	22.13	15.46	6.83	5.65
09	6,881	1,703	45	45	22.85	15.94	7.21	5.89
10	7,409	1,940	45	45	24.11	16.45	7.31	5.96
11	9,977	3,410	45	45	32.54	22.22	10.01	8.08
12	8,385	3,221	45	45	28.36	21.03	9.37	7.87
13	9,894	2,750	45	45	32.21	21.04	9.30	7.41
14	9,724	3,207	45	45	31.46	21.46	10.07	7.99
15	11,822	853	45	45	35.16	18.87	8.29	5.51
16	11,039	4,728	45	45	36.75	25.35	12.46	9.35
Average	8,171	2,740	45	45	27.01	19.44	8.56	7.05

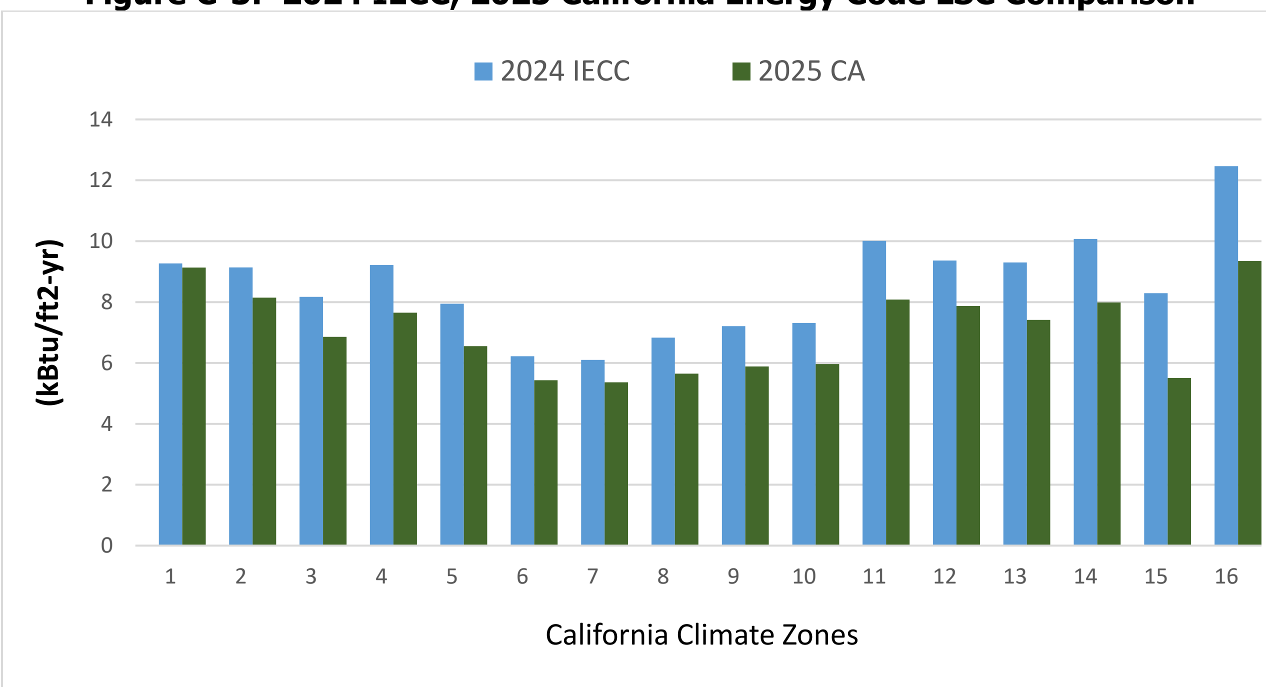
Source: CEC consultant analysis

Figure C-2: 2024 IECC, 2025 California Energy Code LSC Comparison



Source: CEC consultant analysis

Figure C-3: 2024 IECC, 2025 California Energy Code LSC Comparison



Source: CEC consultant analysis

8.0 APPENDIX D: FLOOR AREA FORECAST, PROTOTYPE MAPPING, AND CONVERSION FACTORS

Table D-1: Newly Constructed Nonresidential Building Floor Area (million square feet) by Prototype and Climate Zone

Prototype	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Assembly-Exhibits	0.0035	0.1332	0.5357	0.1886	0.0199	0.2663	0.2704	0.4842	0.6172	0.3871	0.0565	0.4785	0.1030	0.0830	0.0399	0.0285
Assembly-Library	0.0008	0.0324	0.1305	0.0459	0.0048	0.0649	0.0659	0.1180	0.1503	0.0943	0.0138	0.1166	0.0251	0.0202	0.0097	0.0069
Assembly-Religious	0.0020	0.0774	0.3112	0.1096	0.0115	0.1547	0.1571	0.2814	0.3586	0.2249	0.0328	0.2780	0.0598	0.0482	0.0232	0.0166
Assembly-Sports	0.0033	0.1264	0.5085	0.1790	0.0189	0.2527	0.2567	0.4597	0.5859	0.3675	0.0536	0.4542	0.0977	0.0788	0.0379	0.0271
Assembly-Terminals	0.0006	0.0241	0.0971	0.0342	0.0036	0.0483	0.0490	0.0878	0.1119	0.0702	0.0102	0.0867	0.0187	0.0150	0.0072	0.0052
Healthcare Hospital	0.0284	0.1688	0.8137	0.4213	0.0771	0.3176	0.5308	0.4266	0.7632	0.7858	0.1411	0.7979	0.2638	0.1370	0.1112	0.0465
HotelSmall	0.0363	0.2154	1.0330	0.5306	0.1095	0.5527	0.4822	0.7835	1.1830	0.5716	0.1534	0.8029	0.2557	0.1375	0.1248	0.0440
Lab	0.0074	0.1919	1.2920	0.7133	0.0727	0.4164	0.2682	0.4612	0.8426	0.3493	0.1278	0.4340	0.1160	0.0807	0.0396	0.0313
Office Large	0.0000	0.0000	2.9010	1.4150	0.0000	1.2760	0.7400	2.0520	3.7240	0.3513	0.0976	0.5155	0.0000	0.1796	0.0117	0.0448
Office Medium	0.1302	0.4761	1.3720	0.7442	0.3705	1.2010	0.8046	1.6460	3.1840	1.1740	0.2685	2.7990	0.5859	0.3482	0.2629	0.1020
Office Small	0.0129	0.4330	0.1852	0.0200	0.0637	0.1468	0.2318	0.1580	0.3568	0.4129	0.0925	0.5394	0.3817	0.0436	0.1042	0.0328
Enclosed Parking Garage	0.0002	0.0091	1.8300	1.2450	0.0046	2.5850	0.7059	2.2650	1.5270	0.0505	0.0016	0.0412	0.0030	0.0152	0.0037	0.0072
Restaurant Small	0.0139	0.0826	0.3269	0.1667	0.0340	0.3365	0.2036	0.4933	0.8189	0.4129	0.0710	0.3135	0.1414	0.1015	0.0474	0.0296
Retail Large	0.0000	0.0000	1.0970	0.5497	0.1491	0.6978	0.3746	0.8316	1.6640	0.6327	0.2997	1.3030	0.3564	0.1442	0.1803	0.0555
Retail Medium	0.0842	0.3480	0.7947	0.4459	0.0857	0.6027	0.2856	0.8641	1.4240	0.8224	0.1420	0.6274	0.3790	0.1800	0.1242	0.0812

Prototype	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Retail StripMall	0.0011	0.1543	0.5040	0.2256	0.0074	0.5629	0.4878	0.9855	1.0650	1.3450	0.0716	0.5928	0.3253	0.3206	0.1001	0.0602
School Large	0.0057	0.1122	0.7718	0.3892	0.0320	0.5234	0.5360	0.7975	1.2520	0.7519	0.3123	1.0150	0.5417	0.1463	0.0755	0.0600
School Small	0.0665	0.2698	0.4566	0.2294	0.1395	0.3155	0.2944	0.3516	0.6581	0.3481	0.0988	0.7763	0.3025	0.1070	0.0373	0.0449
Warehouse	0.0618	0.3672	2.1600	1.1180	0.1776	1.3630	0.7108	1.9480	3.0100	1.3600	0.6315	2.8440	0.8203	0.3618	0.3673	0.1381
Grocery	0.0069	0.0451	0.1048	0.0618	0.0119	0.0465	0.0172	0.0519	0.0915	0.0494	0.0089	0.0388	0.0228	0.0108	0.0076	0.0060
Refrigerated Warehouse	0.0000	0.0000	0.0610	0.0507	0.0143	0.0220	0.0000	0.0068	0.0132	0.0387	0.0000	0.0685	0.1181	0.0076	0.0079	0.0052
Controlled-environment Horticulture	0.0927	0.0775	0.3197	0.0399	0.2021	0.2578	0.0015	0.0234	0.0261	0.2780	0.3027	0.3053	0.0901	0.0108	0.0480	0.0047
Vehicle Service	0.0019	0.0775	0.5473	0.3582	0.0291	0.5513	0.3416	0.7989	1.8090	0.5735	0.0215	0.3892	0.2476	0.1954	0.0567	0.0491
Manufacturing	0.0009	0.0190	0.2098	0.0711	0.0155	0.0147	0.0510	0.1075	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000
Miscellaneous	0.0000	0.0000	0.0003	0.4212	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000

Source: CEC consultant analysis

Table D-2: Nonresidential Existing Building Floor Area (million square feet) by Prototype and Climate Zone

Prototype	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Assembly-Exhibits	1.465	6.152	30.909	15.248	2.231	19.373	13.841	30.165	40.676	31.048	5.533	23.593	10.196	6.413	4.003	2.179
Assembly-Library	0.154	0.914	3.984	2.033	0.417	2.329	2.238	3.361	5.760	3.264	0.916	4.383	1.854	0.726	0.415	0.267
Assembly-Religious	0.035	0.788	7.261	5.517	0.301	2.401	3.380	3.069	3.797	2.125	0.134	2.387	0.864	0.339	0.076	0.112
Assembly-Sports	0.196	1.162	4.728	2.407	0.497	5.287	3.447	7.638	12.849	10.411	1.129	5.445	2.487	2.203	1.109	0.609
Assembly-Terminals	0.001	0.033	2.497	1.898	0.018	1.788	1.268	3.583	4.449	0.164	0.021	0.190	0.030	0.052	0.010	0.027
HealthcareHospital	1.866	11.090	48.330	24.670	5.055	28.250	27.150	40.770	69.880	39.600	11.110	53.180	22.490	8.802	5.034	3.234
HotelSmall	1.771	10.520	48.100	24.730	5.011	30.490	32.660	41.970	66.010	37.090	7.218	40.530	13.080	8.006	5.876	2.439
Lab	0.178	4.010	36.930	28.060	1.531	12.210	17.190	15.610	19.310	10.810	0.679	12.140	4.396	1.723	0.387	0.572
OfficeLarge	0.128	3.102	139.800	72.350	1.832	99.540	72.710	162.600	303.100	58.480	2.608	78.610	9.264	20.270	4.434	4.663
OfficeMedium	3.379	30.990	78.790	42.280	13.320	47.810	43.870	59.110	86.340	66.690	16.940	101.700	25.180	13.330	10.250	4.063
OfficeSmall	4.178	12.750	22.190	11.330	7.504	13.220	8.516	13.280	20.880	24.430	10.600	43.940	21.470	4.987	6.181	2.676
OpenParkingGarage	0.219	7.024	55.030	41.820	3.864	41.140	35.170	82.440	102.400	34.570	4.461	39.960	6.314	11.050	2.155	5.616
RestaurantSmall	0.609	3.616	14.720	7.494	1.546	16.460	10.730	23.780	40.000	32.410	3.515	16.950	7.742	6.859	3.453	1.897
RetailLarge	1.002	8.665	58.680	26.900	4.200	31.960	25.340	43.460	66.530	53.310	11.400	58.160	22.510	10.910	9.402	3.207
RetailMedium	1.176	13.110	44.520	25.740	5.433	44.270	34.660	66.720	108.200	66.890	10.370	60.500	24.150	15.530	8.769	5.170
RetailStripMall	3.336	9.842	37.420	18.430	5.095	40.230	28.290	55.760	83.700	66.920	12.250	48.370	24.180	15.270	8.696	4.591
SchoolLarge	0.759	8.020	34.830	13.950	2.071	28.370	22.540	42.910	73.580	56.010	10.130	53.380	26.410	12.060	7.621	3.589
SchoolSmall	2.230	11.130	25.570	9.979	6.060	25.690	14.960	34.440	54.310	33.030	13.500	42.080	23.440	8.720	4.251	3.645
Warehouse	3.330	20.220	108.300	53.430	9.802	89.980	51.480	128.400	207.300	182.700	33.730	148.300	51.080	38.870	29.050	11.630

Source: CEC consultant analysis

Table D-3: Newly Constructed Multifamily Dwelling Unit Projections by Climate Zone

CZ	Low-Rise Garden Style (dwelling units)	Low-Rise Loaded Corridor (dwelling units)	Mid-Rise Mixed Use (dwelling units)	High-Rise Mixed Use (dwelling units)
1	6	48	84	7
2	56	459	807	70
3	308	2,541	4,465	385
4	137	1,128	1,982	171
5	11	94	165	14
6	90	740	1,301	112
7	206	1,701	2,990	258
8	344	2,838	4,988	430
9	412	3,400	5,975	515
10	172	1,421	2,497	215
11	47	387	680	59
12	221	1,827	3,211	277
13	40	333	585	50
14	58	477	839	72
15	15	123	216	19
16	7	62	108	9
TOTAL	2,131	17,578	30,895	2,663

Source: CEC consultant analysis

Table D-4: Multifamily Existing Dwelling Unit Estimates by Climate Zone

CZ	Low-Rise Garden Style (dwelling units)	Low-Rise Loaded Corridor (dwelling units)	Mid-Rise Mixed Use (dwelling units)	High-Rise Mixed Use (dwelling units)
1	878	2,107	5,267	9,306
2	5,295	12,707	31,768	56,124
3	27,659	66,382	165,956	293,189
4	14,439	34,654	86,636	153,057
5	2,284	5,481	13,701	24,206
6	16,126	38,702	96,754	170,932
7	15,364	36,873	92,182	162,854
8	25,757	61,816	154,541	273,023
9	55,880	134,113	335,282	592,331
10	16,465	39,516	98,791	174,530
11	4,267	10,241	25,602	45,230
12	23,594	56,625	141,563	250,094
13	7,854	18,849	47,123	83,250
14	4,174	10,018	25,044	44,244
15	2,058	4,938	12,346	21,811
16	1,403	3,368	8,420	14,875
TOTAL	223,496	536,389	1,340,974	2,369,053

Source: CEC consultant analysis

Table D-5: Single-Family Newly Constructed Dwelling Unit Projections and Existing Dwelling Unit Estimates by Climate Zone

CZ	New Construction (homes)	Existing Buildings (homes)
1	359	44,875
2	1,861	265,807
3	3,035	972,513
4	2,689	497,321
5	616	97,271
6	1,719	594,544
7	1,869	494355
8	4,163	926,278
9	4,286	1,250,479
10	7,950	1,067,399
11	5,840	355,468
12	14,542	1,318.779
13	7,257	634,709
14	3,739	247,852
15	3,160	177,670
16	1937	97,937
TOTAL	65,022	9,023,257

Source: CEC consultant analysis