

**DOCKETED**

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<b>Project Title:</b>	2022 Energy Code Update CEQA Documentation
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<b>Document Title:</b>	Statewide CASE Team Construction Forecast Methodology
<b>Description:</b>	This document summarizes the methodology of projecting the number of building starts and associated effects of Energy Code requirements used in the code change proposals for the 2022 update to the Energy Code.
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**From:** Statewide CASE Team

**Date:** May 19, 2021

**Subject:** Statewide CASE Team Construction Forecast Methodology

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## 1. Where did the Statewide CASE Team get construction estimates?

The Energy Commission Building Standards Office provided the construction estimates when released with documents from the April 24, 2019 Staff Workshop on Triennial California Energy Code Measure Proposal Template. After this workshop, the Energy Commission posted an Excel version of the construction forecast at this location:

<https://www.energy.ca.gov/title24/participation.html>.

The Excel spreadsheet has since been removed from the Energy Commission's website, but the construction forecast values are available in Appendix A of the New Measure Proposal Template that the Energy Commission requested proposers use for the 2022 cycle. The New Measure Proposal Template is linked from two locations on the Energy Commissions' website:

- Materials from April 24, 2019 workshop: [Workshop Notice](#), [Presentation](#), [New Measure Proposal Template](#)
- Public Participation tab on the 2022 Building Energy Efficiency Standards page: <https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency>

We can provide a copy of the Excel version of the forecast if needed.

## 2. What are the changes the Statewide CASE Team made to the construction estimates from the Energy Commission?

### 2.1 Single Family

The Statewide CASE Team followed guidance provided in the Energy Commission's New Measure Proposal Template to calculate statewide energy savings using the Energy Commission's construction forecasts, including a request to assume a statewide weighting of 45 percent for the 2,100 square foot prototype and 55 percent for the 2,700 square foot prototype (Section 4.2 of New Measure Proposal Template).

The Statewide CASE Team did not make any changes to the Energy Commission's construction estimates.

The Statewide CASE Team estimated statewide impacts for the first year by multiplying per-unit savings estimates by the Energy Commission's statewide construction forecasts that the Energy Commission provided. The Statewide CASE Team made assumptions about the percentage of buildings in each climate zone that would be impacted by the proposed code change. Assumptions are documented in each CASE Report.

### 2.2 Multifamily

The Statewide CASE Team followed guidance provided in the Energy Commission's New Measure Proposal Template (developed by the Energy Commission) to calculate statewide energy savings using the Energy Commission's construction forecasts, including a request to assume a statewide weighting as follows: Low-Rise Garden (four percent), Loaded Corridor (33 percent), Mid-Rise Mixed-Use (58 percent) and High-Rise Mixed Use (five percent). See Section 4.2 of New Measure Proposal Template.

The Statewide CASE Team did not make any changes to the Energy Commission's construction estimates.

The Statewide CASE Team estimated statewide impacts for the first year by multiplying per-unit savings estimates by the Energy Commission's statewide construction forecasts that the Energy Commission provided. The Statewide CASE Team made assumptions about the percentage of buildings in each climate zone that would be impacted by the proposed code change. Assumptions are documented in each CASE Report.

### 2.3 Nonresidential

The Statewide CASE Team followed guidance provided in the Energy Commission’s New Measure Proposal Template (developed by the Energy Commission) to calculate statewide energy savings using the Energy Commission’s construction forecasts. The New Measure Proposal Template provides mapping factors for construction building types to nonresidential prototypes (see Table 2 below).

The Statewide CASE Team did not make changes to the construction forecast but did tailor the approach to savings estimates to be applied to the “miscellaneous” nonresidential building space in the forecast. The Energy Commission’s forecast allocated 19 percent of the total square footage of new construction in 2023 to the miscellaneous building type, which is a category for all space types that do not fit well into another building category. It is likely that the Title 24, Part 6 requirements apply to the miscellaneous building types, and savings would be realized from this floorspace. The new construction forecast does not provide sufficient information to distribute the miscellaneous square footage into the most likely building type, so the Statewide CASE Team redistributed the miscellaneous square footage into the remaining building types so that the percentage of building floorspace in each climate zone, net of the miscellaneous square footage, would remain constant. See Table 1 for a sample calculation for redistributing the miscellaneous square footage among the other building types.

**Table 1: Example of Redistribution of Miscellaneous Category - 2023 New Construction in Climate Zone 1**

<b>Building Type</b>	<b>2020 Forecast (Million Square Feet) [A]</b>	<b>Distribution Excluding Miscellaneous Category [B]</b>	<b>Redistribution of Miscellaneous Category (Million Square Feet) [C] = B × [D = 0.145]</b>	<b>Revised 2020 Forecast (Million Square Feet) [E] = A + C</b>
Small Office	0.036	7%	0.010	0.046
Large Office	0.114	21%	0.031	0.144
Restaurant	0.015	3%	0.004	0.020
Retail	0.107	20%	0.029	0.136
Grocery Store	0.029	5%	0.008	0.036
Non-Refrigerated Warehouse	0.079	15%	0.021	0.101
Refrigerated Warehouse	0.006	1%	0.002	0.008

<b>Building Type</b>	<b>2020 Forecast (Million Square Feet) [A]</b>	<b>Distribution Excluding Miscellaneous Category [B]</b>	<b>Redistribution of Miscellaneous Category (Million Square Feet) [C] = B × [D = 0.145]</b>	<b>Revised 2020 Forecast (Million Square Feet) [E] = A + C</b>
Schools	0.049	9%	0.013	0.062
Colleges	0.027	5%	0.007	0.034
Hospitals	0.036	7%	0.010	0.046
Hotel/Motels	0.043	8%	0.012	0.055
Miscellaneous [D]	0.145	---	0.000	0.145
<b>TOTAL</b>	<b>0.686</b>	<b>100%</b>	<b>0.147</b>	<b>0.83370</b>

After the miscellaneous floorspace was redistributed, the Statewide CASE Team made assumptions about the percentage of newly constructed floorspace that would be impacted by the proposed code change. Assumptions on how measures apply to prototypes and climate zones vary by code change proposal. Assumptions are documented in CASE Reports.

### 3. How did CASE Authors use construction estimates?

The Statewide CASE Team used the construction estimates in accordance with the Energy Commission’s guidance, as provided in the staff workshop on April 24, 2019 and in the New Measure Proposal Template. Appendix A of each CASE Report provides details on the approach and assumptions for the statewide savings estimates including how the construction estimates were used. In summary:

1. CASE Authors developed per-unit (often per square foot) impacts for their specific measures.
2. Per-unit impacts were then extrapolated to statewide impacts by applying them to statewide construction forecasts provided by the Energy Commission.
3. CASE Authors considered how the measure would apply to each building prototype included in the statewide construction forecasts.
  - a. The building types used in the construction forecast (provided by the Energy Commission) do not match prototypical building types available in CBECC-

Com/Res so the Energy Commission provided guidance on which prototypes to use when calculating statewide energy impacts. This is guidance is provided in Table 2 and Table 3 below.

- b. CASE Authors developed estimates of percentage of buildings that each measure applies to based on best available data sources collected through research and stakeholder outreach. Assumptions were presented in the Title24Stakeholders public meetings held in the fall of 2019 and the winter of 2020.<sup>1</sup> They are also documented in the Draft CASE Reports which were available for public review. The assumptions were also included in the Final CASE Reports. Example tables of the assumptions are found below.

The assumptions made for each measure on impacted square footage can be found in Appendix A of the respective CASE Report. A generic version of Appendix A is found in the New Measure Proposal Template. CASE Authors use Appendix A and must make a determination of what fraction of building areas are impacted by the code change proposal.

**Table 2: Nonresidential Building Types and Associated Prototype Weighting**

<b>Building Type ID from Statewide Construction Forecast</b>	<b>Building Prototype for Energy Modeling</b>	<b>Weighting Factors for Statewide Impacts Analysis</b>
Small Office	OfficeSmall	100%
Large Office	OfficeMedium	50%
	OfficeLarge	50%
Restaurant	RestaurantFastFood	100%
Retail	RetailStandAlone	10%
	RetailLarge	75%
	RetailStripMall	5%
	RetailMixedUse	10%
Grocery Store	Grocery	100%
Non-Refrigerated Warehouse	Warehouse	100%

<sup>1</sup> See more details here: <https://title24stakeholders.com/events/>

<b>Building Type ID from Statewide Construction Forecast</b>	<b>Building Prototype for Energy Modeling</b>	<b>Weighting Factors for Statewide Impacts Analysis</b>
Refrigerated Warehouse	RefrigWarehouse	N/A
Schools	SchoolPrimary	60%
	SchoolSecondary	40%
Colleges	OfficeSmall	5%
	OfficeMedium	15%
	OfficeMediumLab	20%
	PublicAssembly	5%
	SchoolSecondary	30%
	ApartmentHighRise	25%
Hospitals	Hospital	100%
Hotel/Motels	HotelSmall	100%

**Table 3: Residential Building Types and Associated Prototype Weighting**

<b>Building Type ID from Statewide Construction Forecast</b>	<b>Building Prototype for Energy Modeling</b>	<b>Weighting Factors for Statewide Impacts Analysis</b>
Single Family	SF2100	45%
	SF2700	55%
Multifamily Restaurant	LowRiseGarden	4%
	LoadedCorridor	33%
	MidRiseMixedUse	58%
	HighRiseMixedUse	5%

The tables below are presented in Appendix A of each CASE Report. However, the tables presented below in Table 4 and Table 5 contain the new construction forecast for 2023 and the total building stock in 2023 for single family and multifamily buildings by climate zone. The impacted number of buildings in each climate zone are a function of the fraction of buildings that impacted by a given measure multiplied by the total new construction activity or for alterations, multiplied by the total building stock. These fractions of impacted buildings differ by measure.

**Table 4: Estimated New Construction and Existing Building Stock for Single Family Buildings by Climate Zone**

<b>Building Climate Zone</b>	<b>New Construction in 2023 (number of buildings)</b>	<b>Existing Building Stock in 2023 (number of buildings)</b>
1	545	43,798
2	3,238	260,224
3	12,451	963,408
4	6,267	489,254
5	1,258	95,423
6	6,617	589,387
7	5,299	488,748
8	9,870	913,789
9	13,622	1,237,621
10	17,792	1,043,549
11	5,145	317,948
12	19,927	1,275,153
13	8,790	612,938
14	3,401	236,635
15	3,389	168,190
16	1,434	92,126
<b>TOTAL</b>	<b>119,045</b>	<b>8,828,191</b>



**Table 5: Estimated New Construction and Existing Building Stock for Multifamily Buildings by Climate Zone**

Building Climate Zone	Total Dwelling Units Completed in 2023 [A]	Total Existing Dwelling Units in 2023 [D]
1	265	17,126
2	1,573	101,721
3	7,630	530,089
4	3,975	278,535
5	706	44,816
6	3,370	315,784
7	3,623	291,804
8	4,738	489,337
9	11,124	1,086,699
10	3,930	316,384
11	1,122	81,820
12	6,335	455,265
13	1,849	154,048
14	840	79,142
15	547	40,033
16	339	27,505
<b>TOTAL</b>	<b>51,966</b>	<b>4,310,108</b>

**Table 6: Allocation of Building Subtypes for Mapping of Prototypes to Nonresidential Building Areas**

<b>Building Type Building sub-type</b>	<b>Composition of Building Type by Subtypes<sup>a</sup></b>
Small Office	
Restaurant	
Retail	
<i>Stand-Alone Retail</i>	10%
<i>Large Retail</i>	75%
Strip Mall	5%
<i>Mixed-Use Retail</i>	10%
Food	
Non-Refrigerated Warehouse	
Refrigerated Warehouse	
Schools	
<i>Small School</i>	60%
<i>Large School</i>	40%
College	
<i>Small Office</i>	5%
<i>Medium Office</i>	15%
<i>Medium Office/Lab</i>	20%
<i>Public Assembly</i>	5%
<i>Large School</i>	30%
<i>High-Rise Apartment</i>	25%
Hospital	
Hotel/Motel	
Offices	
<i>Medium Office</i>	50%
<i>Large Office</i>	50%

- a. Presents the assumed composition of the main building type category by the building subtypes. All 2022 CASE Reports assumed the same percentages of building subtypes.
- b. When the building type is composed of multiple subtypes, the overall percentage for the main building category was calculated by weighing the contribution of each subtype.
- c. Percent of existing floorspace that would be altered during the first year the 2022 standards are in effect.