

Proposal Summary



2022 California Energy Code (Title 24, Part 6)

Multifamily All-Electric Compliance Pathway

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Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on September 10, 2019. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by September 24, 2019.

Measure Description

This measure will develop prescriptive and performance compliance pathway(s) for all-electric multifamily buildings that use electric appliances for all regulated and non-regulated end uses. This topic builds on the 2019 prescriptive requirements for low-rise residential buildings that allow heat pump water heating (individual water heaters) and space heating. The 2019 update did not address central water heating and non-regulated end uses such as appliances and plug loads.

The Statewide CASE Team will investigate suitable strategies for achieving all-electric multifamily buildings, including heat pump space heating and cooling, heat pump water heaters (HPWH), heat pump dryers, electric ranges, combined hydronic space and domestic water heating, induction cooking, and any additional energy efficiency measures necessary. Developing an all-electric pathway may involve one or more of the following changes:

- Prescriptive packages of measures for all-electric multifamily buildings that meet the respective high-rise and low-rise residential requirements. This effort will involve coordination with the effort to unify multifamily code requirements.
- For the performance pathway, revised multifamily building baselines for heating ventilation and air conditioning (HVAC) systems and, if central HPWH are used, for domestic hot water (DHW) systems. The CASE Team will coordinate with companion efforts on changes related to central HPWH.
- For both prescriptive and performance pathways, two compliance scenarios will be evaluated:
 - Create a single all-electric baseline: This scenario proposes that the baseline system fuel type would be electricity regardless of the fuel type of the end uses in the proposed design. The CASE Team would need to demonstrate that the proposed all-electric baseline



system would be cost-effective and save as much time dependent valuation (TDV) energy as the existing mixed fuel baseline system.

- Develop an alternate pathway for the proposed all-electric design: Revisions will propose that the baseline system fuel type is the same as the proposed design. The revision will make cost-effectiveness more achievable for all-electric multifamily buildings. The CASE Team will coordinate with the companion effort to update multifamily prototypes. In this option, proposed designs with gas water heaters will retain a gas water heater baseline.
- If needed, establish TDV equivalency, added energy efficiency measures for reduced load. With current TDV value, all-electric multifamily buildings need to include additional energy efficiency measures, compared to mixed-fuel buildings. This analysis will change depending on the metrics that the Energy Commission develops for 2022 code compliance. Where applicable, federal appliance standards will be assumed. This change would apply to both prescriptive and performance pathways.
- Modified appliances and miscellaneous electric load (MEL) modeling rulesets to account for electric dryers, and stovetop/ranges. This work will involve coordination with the effort to update plug load and appliance assumptions across all multifamily buildings.

Draft Code Language for dual baseline scenario

The Energy Commission plans to create a multifamily chapter for inclusion in 2022 Title 24, Part 6. The multifamily chapter will draw from the appropriate sections of the 2019 residential and nonresidential Standards. The Statewide CASE Team uses the language and section numbering from residential and nonresidential Standards and Reference Appendices to show the proposed changes below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions). Expected sections or tables of the proposed code (but not specific changes at this time) are highlighted in **yellow**. These changes are specific to multifamily buildings and not indicative of changes that apply to residential or nonresidential buildings.

2019 Title 24 SECTION 150.1(c)

8. Domestic Water-Heating Systems. Water-heating systems shall meet the requirements of either A B or C. For recirculation distribution systems serving individual dwelling unit, only Demand Recirculation Systems with manual on/off control as specified in the Reference Appendix RA4.4.9 shall be used:

A. For systems serving individual dwelling units, the water heating system shall meet the requirement of either i, ii, iii, iv, or v:

- i. One or more gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank.
- ii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume less than or equal to 55 gallons and that meets the requirements of Sections 110.1 and 110.3. The dwelling unit shall have installed fenestration products with a weighted average Ufactor no greater than 0.24, and in addition one of the following shall be installed:
 - a. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16; or

- b. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.
 - iii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume of more than 55 gallons. iv. A single heat pump water heater. The storage tank shall be located in the garage or conditioned space. In addition, one of the following:
 - a. A compact hot water distribution system as specified in the Reference Appendix RA4.4.6 and a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9; or
 - b. For Climate Zones 2 through 15, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14; or
 - c. For Climate Zones 1 and 16, a photovoltaic system capacity of 1.1 kWdc larger than the requirement specified in Section 150.1(c)14.
 - iv. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. The storage tank shall be located in the garage or conditioned space. In addition, for Climate Zones 1 and 16, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14 or a compact hot water distribution system as specified in the Reference Appendix RA4.4.6.
- B. For systems serving multiple dwelling units, a central water-heating system that includes the following components shall be installed:
- i. Gas , propane water heating system or Heat pump water heater, and
 - ii . A recirculation system that meets the requirements of Sections 110.3(c)2 and 110.3(c)5, includes two or more separate recirculation loops serving separate dwelling units, and is capable of automatically controlling the recirculation pump operation based on measurement of hot water demand and hot water return temperature; and
EXCEPTION to Section 150.1(c)8B-ii: Buildings with eight or fewer dwelling units may use a single recirculation loop.
 - iii. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum solar savings fraction of either a or b below:
 - a. A minimum solar savings fraction of 0.20 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.35 in Climate Zones 10 through 16; or
 - b. A minimum solar savings fraction of 0.15 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.30 in Climate Zones 10 through 16. In addition, a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.
- C. A water-heating system serving multiple dwelling units determined by the Executive Director to use no more energy than the one specified in subsection B above

Nonresidential Alternative Calculation Method Reference Manual

5.1.2 HVAC System Map

The HVAC system in the standard design depends on the primary building activity, the size of the building, and the number of floors. Details about these systems are provided in subsequent sections.

Many of the building descriptors have a one-to-one relationship between the proposed design and the standard design; for example, every wall in the proposed design has a corresponding wall in the standard design. For HVAC systems, however, this one-to-one relationship generally does not hold. The HVAC system serving the proposed design and the standard design may be completely different, each with different components.

The HVAC system in the standard design shall be selected from Table 2: HVAC System Map, and be based on building type, number of floors, conditioned floor area, and heating source. Moreover, the selected system shall conform to the descriptions in Table 5: System Descriptions.

For systems 1, 2, 3, 7, 10, and 11, each thermal zone shall be modeled with a respective HVAC system. For systems 5, 6, and 9, each floor shall be modeled with a separate HVAC system. Floors with identical thermal zones and occupancies can be grouped for modeling. The standard design heating source is natural gas.

TABLE 2: HVAC System MAP

Building Type	Standard Design
Residential or h Hotel/motel guestrooms in a building with seven or fewer floors above grade	System 1 - SZAC
Residential with seven or fewer floors above grade	If a proposed design uses electricity as the space heating fuel type, the standard system shall be System 4 Otherwise, the standard system shall be System 1 - SZAC
Residential or h Hotel/motel guestrooms in a building with eight or more floors above grade	System 2 - FPFC
Residential with eight or more floors above grade	If a proposed design uses electricity as the space heating fuel type, the standard system shall be {TBD} Otherwise, the standard system shall be System 2 - FPFC
Retail building 2 floors or fewer	System 7 - SZVAV*
Warehouse and light manufacturing space types (per the Appendix 5.4A Schedule column) that do not include cooling in the proposed design	System 9 - HEATVENT
Covered process	See Table 4: System Map for Covered

	Processes
Healthcare Facilities	Same as the Proposed Design
All other space types	See Table 3: Nonresidential Spaces (Not Including Covered Processes)

TABLE 5: System Descriptions

System Type	Description	Detail
System 1 – SZAC	Residential Air Conditioner	Single zone system with constant volume fan, no economizer, DX cooling and furnace
System 2 – FPFC	Four-Pipe Fan Coil	Central plant with terminal units with hot water and chilled water coils, with separate ventilation source
System 3 – SZAC	Packaged Single Zone	Single-zone constant volume DX unit with gas heating
System 4 – RESERVED SZHP	Split Ducted Heat pump	Single-zone ducted split heat pump system
System 5 – PVAV	Packaged VAV Unit	VAV reheat system; packaged variable volume DX unit with gas heating and with hot water reheat terminal units
System 6 – VAVS	Built-up VAV Unit	Variable volume system with chilled water and hot water coils, water-cooled chiller, tower and central boiler
System 7 – SZVAV	Packaged Single-Zone VAV Unit	Single-zone variable volume DX unit with variable-speed drive and gas heating
System 8 – RESERVED		
System 9 – HEATVENT	Heating and Ventilation Only	Gas heating and ventilation
System 10 – CRAH	Computer Room Air Handler	Built-up variable volume unit with chilled water, no heating
System 11 – CRAC	Computer Room Air Conditioner	Packaged variable volume DX unit with no heating
System 12 – LAB	Laboratory HVAC System	Laboratory spaces in a building having a total laboratory design maximum exhaust rate of 15,000 cfm or less use Table 3, Nonresidential System Map. Laboratory spaces in a building with building floor area < 150,000 ft ² : System 5 – PVAV

		Laboratory spaces in a building with building floor Area \geq 150,000 ft ² : System 6 – VAVS
System 13 – KITCH	Kitchen HVAC System	Dedicated single-zone makeup air unit (MAU) with dedicated exhaust fan. If the building is VAVS per Table 3, the cooling source is chilled water and the heating source is hot water. Otherwise, cooling source is DX and heating source is a gas furnace.

Residential Alternative Calculation Method Reference Manual

2.9.3 Multiple Dwelling Units

When the proposed design is a central water heating system, the standard design consists of the water heating devices, a recirculation system, and solar systems as follows:

Water-heating device. The standard design consists of the same number of water-heating devices as the proposed design using the efficiencies required in the Appliance Efficiency Standards. The standard design is natural gas when the proposed device is natural gas. The standard design is propane if the proposed device is propane. Each water-heating device in the proposed system is examined separately. If the proposed water-heating device is gas or propane, the standard design is set to the same type and characteristics as the proposed design.

If the proposed water-heating device is electric resistance or heat pump with no recirculating loops (fewer than eight dwelling units), then the standard design is a heat pump water heater with 2.0 UEF with no recirculating loop. If the proposed central water-heating device is electric resistance or heat pump with recirculating loops, the standard design is natural gas or propane a heat pump water heater with 2.0 UEF with TBD (design features that allow hot water return temperature can be maintained at no higher than 85°F).

Draft Code Language for single baseline scenario

The Energy Commission plans to create a multifamily chapter for inclusion in 2022 Title 24, Part 6. The multifamily chapter will draw from the appropriate sections of the 2019 residential and nonresidential Standards. The Statewide CASE Team uses the language and section numbering from residential and

nonresidential Standards and Reference Appendices to show the proposed changes below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions). These changes are specific to multifamily buildings and not indicative of changes that apply to residential or nonresidential buildings.

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ii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume less than or equal to 55 gallons and that meets the requirements of Sections 110.1 and 110.3. The dwelling unit shall have installed fenestration products with a weighted average Ufactor no greater than 0.24, and in addition one of the following shall be installed:

a. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16; or

b. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.

iii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume of more than 55 gallons. iv. A single heat pump water heater. The storage tank shall be located in the garage or conditioned space. In addition, one of the following:

a. A compact hot water distribution system as specified in the Reference Appendix RA4.4.6 and a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9; or

b. For Climate Zones 2 through 15, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14; or

c. For Climate Zones 1 and 16, a photovoltaic system capacity of 1.1 kWdc larger than the requirement specified in Section 150.1(c)14.

iv. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. The storage tank shall be located in the garage or conditioned space. In addition, for Climate Zones 1 and 16, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14 or a compact hot water distribution system as specified in the Reference Appendix RA4.4.6.

- B. For systems serving multiple dwelling units, a central water-heating system that includes the following components shall be installed:
- i. ~~Gas or propane water heating system~~ Heat pump water heater; and
 - ii. A recirculation system that meets the requirements of Sections 110.3(c)2 and 110.3(c)5, includes two or more separate recirculation loops serving separate dwelling units, and is capable of automatically controlling the recirculation pump operation based on measurement of hot water demand and hot water return temperature; and
EXCEPTION to Section 150.1(c)8Bii: Buildings with eight or fewer dwelling units may use a single recirculation loop.
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Residential with eight or more floors above grade	System TBD
Retail building 2 floors or fewer	System 7 - SZVAV*
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System 13 – KITCH	Kitchen HVAC System	Dedicated single-zone makeup air unit (MAU) with dedicated exhaust fan. If the building is VAVS per Table 3, the cooling source is chilled water and the heating source is hot water. Otherwise, cooling source is DX and heating source is a gas furnace.

Residential Alternative Calculation Method Reference Manual

2.9.3 Multiple Dwelling Units

When the proposed design is a central water heating system, the standard design consists of the water heating devices, a recirculation system, and solar systems as follows:

Water-heating device. The standard design consists of the same number of water-heating devices as the proposed design using the efficiencies required in the Appliance Efficiency Standards. The standard design is **heat pump water heater system (language TBD)** ~~is natural gas when the proposed device is natural gas. The standard design is propane if the proposed device is propane. Each water-heating device in the proposed system is examined separately. If the proposed water-heating device is gas or propane, the standard design is set to the same type and characteristics as the proposed design.~~

~~If the proposed water-heating device is electric resistance or heat pump with no recirculating loops (fewer than eight dwelling units), then the standard design is a heat pump water heater with 2.0 UEF. If~~

~~the proposed central water heating device is electric resistance or heat pump with recirculating loops, the standard design is natural gas or propane.~~

Standards

Reference Appendices

Draft Code Language – Plug load and MELs

Residential Alternative Calculation Method Reference Manual Appendix E – Plug loads and lighting modeling

Table 1: User Inputs Affecting Estimated Plug Load and Lighting Energy Use

End Use	User Inputs that Determine Estimated Energy Use	Notes
Primary Refrigerator/ Freezer	<ul style="list-style-type: none"> - BRperUnit - Optional: rated annual kWh usage from the Energy Guide label of the installed device 	<ul style="list-style-type: none"> - Default kWh can be overridden with the rated annual kWh usage input on the Energy Guide label; however, there is a maximum allowable kWh credit dependent on BRperUnit. - Energy use adjusted on an hourly basis depending on the indoor temperature in the kitchen simulated in the software.
Non-Primary Refrigerators and Separate Freezers	<ul style="list-style-type: none"> - BRperUnit - Single-family or multi-family housing 	<ul style="list-style-type: none"> - Assumed to be installed in the garage in new, single-family homes. - Assumed to be absent in multi-family dwelling units.
Dishwasher	<ul style="list-style-type: none"> - BRperUnit - Presence of device - Single-family or multi-family 	<ul style="list-style-type: none"> - Ruleset estimates machine energy use only. - Energy use is only included if user indicates the device will be present. - Assumed different usage patterns in single family and multi-family when developing algorithms.
Clothes Washer	<ul style="list-style-type: none"> - BRperUnit - Presence of device - Single-family or multi-family - <u>In-unit or communal</u> - Optional: whether installed device will comply with the 2015 	<ul style="list-style-type: none"> - Ruleset estimates machine energy use only. - Energy use is only included if user indicates the device will be present. - Assumed different usage patterns in single family and multi-family when developing algorithms. - Default energy use can be reduced if the user specifies the device will meet the 2015 federal standard, which can be determined by looking up

	federal efficiency standards (credit for installing new or nearly-new device)	the model on the California Appliance Efficiency Database.
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End Use	User Inputs that Determine Estimated Energy Use	Notes
Clothes Dryer	<ul style="list-style-type: none"> - BRperUnit - Presence of device - <u>In-unit or communal</u> - Fuel type (natural gas, propane, or electric) - Single-family or multi-family - Optional: percent remaining moisture content (RMC) of the clothes washer 	<ul style="list-style-type: none"> - Energy use is only included if user indicates the device will be present. - User can select fuel type. If user indicates natural gas is available at the site (see Section 2.2.10 of RACM), then the default fuel type is natural gas. If user indicates that natural gas is not available at the site then the default fuel type is electric. User cannot select natural gas as the fuel type if natural gas is not available at the site. - Default energy use can be reduced if the user specifies that the installed clothes washer has a rated RMC of less than 50 percent.
Oven	<ul style="list-style-type: none"> - BRperUnit - Presence of device - Fuel type (natural gas, propane, or electric) 	<ul style="list-style-type: none"> - Energy use is only included if user indicates the device will be present. - User can select fuel type, but default assumption is natural gas if user indicates that natural gas is available on-site and electric if user indicates natural gas is not available on-site
Cooktop		
Televisions Set-Top Boxes Computers and Monitors Residual MELs	<ul style="list-style-type: none"> - BRperUnit 	
Interior Lighting Exterior Lighting	<ul style="list-style-type: none"> - CFAperUnit 	
Garage Lighting	<ul style="list-style-type: none"> - CFAperUnit - Presence of garage 	<ul style="list-style-type: none"> - Energy use is only included if user indicates there is a garage present. - Garage lighting is assigned to multi-family buildings if there is at least once garage present. - Carport lighting is covered under the exterior lighting ruleset.

Table 2: Algorithms for Plug Load and Lighting Annual Energy Use

End Use	Standard Design Fuel Type	kWh or therms	Intercept	Slope	Per-Unit BR or CFA
Primary Refrigerator/Freezer	Electricity	kWh	454	37.0	BR
Non-Primary Refrigerators and Separate Freezers (Single-Family only)	Electricity	kWh	0	71.0	BR
Oven	Electricity	kWh	138	16	BR
Oven	Gas	therms	6.0	0.95	BR
Oven	Gas	kWh	41	4.79	BR
Cooktop - <u>Resistance</u>	Electricity	kWh	84	5.68	BR
<u>Cooktop- Induction</u>	<u>Electricity</u>	<u>kWh</u>	<u>TBD</u>	<u>TBD</u>	<u>BR</u>
Cooktop	Gas	therms	5.0	0.30	BR
Cooktop	Gas	kWh	0	0	BR
Televisions	Electricity	kWh	265	31.8	BR
Set-Top Boxes	Electricity	kWh	76	59.4	BR
Computers and Monitors	Electricity	kWh	79	55.4	BR
Residual MELs	Electricity	kWh	672	235	BR
Interior Lighting	Electricity	kWh	100	0.1775	CFA
Exterior Lighting	Electricity	kWh	8.0	0.0532	CFA
Garage Lighting	Electricity	kWh	20	0.0063	CFA

Table 3: Multi-Family Dwelling Unit Algorithms for Dishwasher, Clothes Washer, and Clothes Dryer Annual Energy Use

BRperUnit	Dishwashers (kWh/yr)	Clothes Washers (kWh/yr)	Electric Clothes Dryer		Gas Clothes Dryers	
			Electric resistance (kWh/yr)	Heat pump (kWh/yr)	Natural Gas Usage (therms/yr)	Electricity Usage (kWh/yr)
0	56	66	496	TBD	17	25
1	68	70	527	TBD	19	26
2	96	99	745	TBD	26	37
3	94	97	733	TBD	26	37
4	121	118	885	TBD	31	44
5+	114	107	805	TBD	28	40