Proposal Summary

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

2022 California Energy Code (Title 24, Part 6)

Multifamily Solar Thermal (Solar Water Heating)

Date last updated: Thursday, August 22, 2019

Prepared by: John Arent, NORESCO

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 October 3, 2019. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by October 17, 2019.

Measure Description

This submeasure will investigate ways to expand solar thermal water heating requirements for new high-rise and low-rise multifamily buildings for individual/central gas water heaters and individual/central heat pump water heaters. The Statewide CASE Team will evaluate energy savings and cost-effectiveness of the following solar water heating measures.

- Increase the prescriptive solar savings fraction (SSF) requirement of solar thermal water heating for central gas water heating systems.
- Add requirement of solar thermal water heating for individual gas water heaters, if feasible and cost-effective.
- Develop prescriptive solar water heating (SWH) requirement for central heat pump water heaters. Evaluate option for installing an energy-equivalent PV system if solar water heating is not cost effective for this system type.
- Evaluate an option to combine solar thermal system with individual heat pump water heater, if feasible and cost effective.
- Revise performance approach to include an hourly model of solar thermal energy production, for improved accuracy.

Draft Code Language

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.

Standards

SECTION 140.5 – PRESCRIPTIVE REQUIREMENTS FOR SERVICE WATER HEATING SYSTEMS

(a) **Nonresidential Occupancies.** A service water heating system installed in a nonresidential building complies with this section if it complies with the applicable requirements of Sections 110.1, 110.3 and 120.3.

(b) **High-Rise Residential and Hotel/Motel Occupancies.** A service water heating system installed in a high-rise residential or hotel/motel building complies with this section if it meets the requirements of Section 150.1(c)8.

EXCEPTION to Section 140.5(b): Buildings of ~~eight~~ TBD[1] stories or greater are not required to comply with the solar fraction requirement of Section 150.1(c)8Biii.

SECTION 150.1, Section 8(c)Biii:

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~~ **TBD*** in Climate Zones 1 through ~~9~~ 16 ~~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.~~

B. For systems serving multiple dwelling units, a central water-heating system that includes the following components shall be installed:

i. Gas or propane system, or a central heat pump water heating system, that meet the minimum efficiency requirements of Sections 110.1 and 110.3; and

[1] TBD indicates "to be determined": value depends on results of the study. For instance, the solar fraction exception could be increased to 10 or more stories; the required solar savings fraction could be increased to 0.5.

ii. A water heating recirculation loop 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

EXCEPTION to Section 150.1(c)8CBii: Buildings with eight or fewer dwelling units may use a single recirculation loop.

Reference Appendices

No significant changes are expected. The required inputs for compliance forms are not expected to change.

ACM Reference Manual (Performance Approach)

A new procedure to estimate annual energy production of solar water heating systems using EnergyPlus may be included, to improve accuracy in modeling. This should have minimal effect on the users of compliance software.

Proposal Summary

2022 California Energy Code (Title 24, Part 6)

Multifamily Hot Water Distribution

Updated: Wednesday, October 2, 2019

Prepared by: Gwelen Paliaga, TRC

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 October 3rd, 2019. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by October 17th, 2019.

Measure Description

The 2013 Multifamily Central DHW and Solar Water Heating CASE Report[1] estimated that 33 percent of hot water generated at the water heater is lost in the recirculation loop to ambient space. As a result of the 2013 CASE Report, currently Title 24 prescriptively requires demand control recirculation, as well as a minimum of two recirculation loops in multifamily buildings that have nine or more dwelling units.

The current requirement for 2 loop recirculation systems has faced adoption challenges including inconsistent interpretations of meaning of the requirement and challenges establishing appropriate baseline and proposed systems in the California Compliance Simulation Engine (CSE). In addition, the 2 loop requirement was developed based on research on low-rise multifamily that is not directly applicable across all multifamily buildings types (low-rise, mid-rise, and high-rise).

The 2022 multifamily hot water distribution CASE measure will replace the current 2 loop requirement while reducing the performance budget for multifamily DHW recirculation systems with the following prescriptive requirements.

1. Increased Insulation: This measure involves increasing pipe insulation requirements in Table 120.3-A for the temperature range of 105F-140F. The CASE team has identified three options to increase pipe insulation requirements: (a) increase insulation on all pipes including recirculation loop and runout pipes, (b) increase insulation only on recirculation loop pipes, (c) or increase insulation on specific portions of recirculation loop pipes such as large supply headers. Option (a), (b), or (c) will be chosen based on cost effectiveness, feasibility, and compliance enforcement considerations.

[1] http://title24stakeholders.com/wp-content/uploads/2017/10/2013_CASE-Report_Multifamily-Central-DHW-and-Solar-Water-Heating.pdf

2. Pipe Insulation Verification: This measure involves adding a requirement for field verification of pipe insulation quality. Field verification would confirm installation of code minimum pipe insulation meeting California Plumbing Code (CPC) and Title 24 Part 6, including insulation on all fittings and valves, and thermal isolation at pipe hangers. This measure builds on the current low-rise pipe insulation credit (PIC-H) and extends it to become a prescriptive baseline for all multifamily buildings.

The 2022 multifamily hot water distribution CASE measure will also add the following alternative compliance options or alternate prescriptive paths:

3. CPC Appendix M pipe sizing: This measure will add at least one alterative prescriptive compliance path that includes pipe sizing based on CPC Appendix M (CPC 2019, UPC 2018). CPC appendix M is a performance-based pipe sizing calculation procedure that typically results in smaller pipe sizes than standard practice sizing that reduce first costs and distribution system heat loss. An alternative prescriptive compliance path would include a requirement for Appendix M sizing instead of other DHW requirements such as solar hot water, drain water heat recovery, or increased pipe insulation, and would result in similar or lower TDV energy use compared to the primary prescriptive baseline. The primary prescriptive baseline model assumes standard practice pipe sizing based on CPC (fixture units, hunters curve, etc.).
4. Clustered Design without Recirculation: This measure will support use of clustered design without recirculation as a compliance option in the performance approach. The CASE team has identified through interviews and CASE research that distributed water heaters serving multiple dwelling units (clusters) without recirculation loops is growing in popularity. CSE currently has the capability of modeling clustered systems without recirculation, but there is no mention of the option in Title 24 Part 6 and limited guidance in the Alternative Calculation Method (ACM) Reference Manual. This measure will add code language and clarify and align code and ACM requirements for clustered design without recirculation.

The measure includes modifying the prescriptive baseline, adding alternative prescriptive pathways, refining field inspection procedures, and updating the Alternative Calculation Method (ACM) Reference Manual and Reference Appendices.

Because there is limited data readily available on these sub measures, the CASE Team will first assess the potential magnitude of savings of each of these measures through spreadsheet calculations or other modeling, in coordination with subject matter experts.

Draft Code Language

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.

Title 24 Part 6

SECTION 150.1(c)8

8. Domestic Water-Heating Systems. Water-heating systems shall meet the requirements of either A B ~~or~~ C, or D. 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 U-factor 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.

v. 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 s~~ Systems serving multiple dwelling units, a central water-heating system ~~that includes the following components~~ shall be installed that meets all applicable requirements of i or ii below:

i. Recirculation controls and solar water-heating.

a. Gas or propane water heating system; and

~~ii~~ b. 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.~~

~~iii~~ c. 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.

ii. Recirculation system sized to California Plumbing Code Appendix M

a. …

b. …

C. For Systems serving multiple dwelling units without recirculation, the system shall meet all applicable requirements below:

i. System serves less than ? dwelling units.

ii. …

iii. …

D~~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.

Expected changes to new multifamily code sections

Option 1

Service water heating mandatory pipe insulation shall use table A which supersedes table 120.3-A for pipes with fluid operating temperature from 105-140°F.

Option 2

Service water heating madatory recirculation loop pipe insulation shall use table A which supersedes table 120.3-A for pipes with fluid operating temperature from 105-140°F.

Table A

Fluid Operating Temperature Range (°F)	Insulation Conductivity			Nominal Pipe Diameter (in inches)				
	Conductivity (in Btu·in/h·ft²-°F)	Mean Rating Temperature (°F)		< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Service Water Heating Systems				Minimum Pipe Insulation Required (Thickness in inches or R-value)				
105-140	0.22-0.28	100	Inches	~~1.0~~ 1.5	~~1.5~~2	~~1.5~~2	~~1.5~~2	~~1.5~~2
			R-value	~~R 7.7~~R?	~~R 12.5~~ R?	~~R 11~~ R?	~~R 9~~ R?	~~R 8~~ R?

Reference Appendices for Residential and Nonresidential Buildings

SECTION RA2.2

Table RA2-1 – Summary of Measures Requiring Field Verification and Diagnostic Testing

	Multi Family Domestic Hot Water Heating Measures	
Multiple Recirculation Loop Design for DHW Systems Serving Multiple Dwelling Units	Inspection that a central DHW system serving a building with more than eight dwelling units has at least two recirculation loops, each serving roughly the same number of dwelling units. These recirculation loops may the same water heating equipment or be connected to independent water heating equipment.	RA3.6.8
Verified Drain Water Heat Recovery System (DWHR-H)	Inspection to verify that the DWHR unit(s) and installation configuration match the compliance document and the DWHR(s) is certified to the Commission to have met the requirements.	RA3.6.9
Pipe Insulation Verification	Inspection to verify that all hot water piping systems are insulated including pipes, fittings, and valves. Metallic piping should be thermally isolated from pipe hangers. No piping should be visible due to insulation voids except piping specifically exempted in the California Plumbing Code.	RA3.6.10

Proposal Summary

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

2022 California Energy Code (Title 24, Part 6)

Multifamily Central Heat Pump Water Heater

Thursday, August 22, 2019

Prepared by: Jingjuan Dove Feng, TRC

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 October 3, 2019. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by October 17, 2019.

Measure Description

This measure will develop a prescriptive compliance pathway for central domestic water heating systems with heat pump technology serving multiple dwelling units by leveraging existing software algorithm development, lab testing, and design guide development. The Statewide CASE Team will perform additional market readiness research across a broad group of stakeholders and develop code and compliance manual language.

Central heat pump water heating (HPWH) is a key design strategy to decarbonize domestic water heating. Several successful designs have been implemented and are operational in Washington and California in field demonstrations. However, energy savings are highly dependent on design and not guaranteed. Heat pump water heaters require low entering water temperature to operate at high efficiencies. Design variables that must be considered include hot water draw schedules and volume throughout a multifamily building, and stratification strategies including tank sizing and piping configuration. Multiple water heaters can be designed to operate in parallel to increase overall capacity, and each heat pump water heater model has different performance characteristics.

Central HPWH is a relatively new design approach and no design guidelines exist to ensure appropriate design. This measure would integrate best practices into the code language for central HPWH design and operation to ensure energy savings. The Statewide CASE Team will gather the following information from various on-going research efforts:

- Heat pump water heater sizing and model selection in different climates
- Tank sizing and piping configurations that lead to beneficial stratification
- Control methods to maintain supply water temperature, reduce cycling, and optimize defrosting
- Location within the building and distribution piping, including impact on space heating and cooling loads.

The goal of this measure is to develop a prescriptive compliance pathway for central HPWH to encourage implementation in multifamily buildings. The Statewide CASE Team will collaborate and build upon the PG&E funded lab testing effort that include:

- Conduct performance testing of central HPWH systems and develop central HPWH model to be included in CBECC-Res and CBECC-Com
- Develop installation criteria for multifamily HPWH systems

There are several overlapping issues with accurately modeling central HPWH, which the Statewide CASE Team needs to coordinate with other domestic hot water (DHW) CASE topics and on-going research efforts:

- Recirculation loop modeling accounting for multiple loops or length of loops, solar thermal, or solar PV designs.
- Updating CBECC-Res to allow for central HPWH modeling in all multifamily buildings

Based on the outcome of the research, the Statewide CASE Team may recommend several alternate compliance pathways depending on the location, number of loops, and/or number of dwelling units being served by the central HPWH system.

Draft Code Language

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 water heating system, ~~or~~ 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.

Proposal Summary

CALIFORNIA ENERGY CODES & STANDARDS
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2022 California Energy Code (Title 24, Part 6)

Multifamily Drain Water Heat Recovery

Updated: Wednesday, August 22, 2019

Prepared by: Jingjuan Dove Feng, TRC

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 October 3, 2019. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by October 17, 2019

Measure Description

This measure would prescriptively require drain water heat recovery (DWHR) in all multifamily buildings for all hot water system types. This CASE topic builds on a DWHR measure for low-rise residential in 2019-Title 24 as a compliance credit and a prescriptive alternative path for gas storage water heaters, heat pump water heaters, and solar water-heating systems.[1]

DWHR is an energy-saving technology used to reduce the amount of energy needed by a water heater or fixture to heat incoming water to the required temperature. The technology utilizes a heat exchanger in the drain line to pre-heat cold water supplied to the cold-water side of a water heater and/or fixture. The device can be installed in either an equal flow configuration (with preheated water being routed to both the water heater and the shower) or an unequal flow configuration (with preheated water directed to either the water heater or shower). DWHR comes in horizontal and vertical configurations, and both are included in this measure.

The 2019 CASE Report introducing DWHR as a compliance credit and prescriptive alternative path found that DWHR was cost-effective for low-rise multifamily buildings in all climate zones, assuming four residential units share one DWHR unit (and not accounting for access panels or water meters), and would likely be cost-effective for high-rise multifamily buildings with a similar configuration. The

[1] http://title24stakeholders.com/wp-content/uploads/2017/09/2019-T24-CASE-Report_DWHR_Final_September-2017.pdf

unequal flow configuration is more common in multifamily buildings with central water heaters to reduce pipe lengths.

Key costs that were not considered in the 2019 CASE measure include:

- Access panels that comply with California Plumbing Code (CPC) Appendix L and facilitate alterations.
- Additional water meters necessary per Senate Bill (SB) 7[2] which subsequently led to 2019 CPC 601.2.1.

Prescriptive requirements for DWHR may be dependent on hot water distribution type (central or by unit), heat recovery installation (equal or unequal flow), and DWHR location (in drain line serving multiple dwelling units or in drain line serving one dwelling unit). The measure may allow for exceptions for dwelling units that are slab-on-grade and may also allow for tradeoffs with other hot water compliance credits, such as compact hot water distribution.

Draft Code Language

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.

Standards

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 U-factor no greater than 0.24, and in addition one of the following shall be installed:

[2] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB7.

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.

v. 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; 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.

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.

Reference Appendices

RA 3.6.9 HERS-Verified Drain Water Heat Recovery System (DWHR-H)

A HERS inspection is required to obtain this credit. All DWHR unit(s) shall be certified to the Energy Commission according to the following requirements:

(a) Vertical DWHR unit(s) shall be compliant with CSA B55.2, and tested and labeled in accordance with CSA B55.1 or IAPMO IGC 346-2017. Sloped DWHR unit(s) shall be compliant with IAPMO PS 92, and tested and labeled with IAPMO IGC 346-2017.

(b) The DWHR unit(s) shall have a minimum rated effectiveness of 42 percent.

The HERS inspector shall verify that:

(a) The make, model, and CSA B55.1 or IAPMO IGC 346-2017 rated effectiveness of the DWHR unit(s) shall match the compliance documents. The DWHR unit(s) shall also be verified as a model certified to the Energy Commission as qualified for credit as a DWHR unit(s).

(b) The installation configuration (e.g. equal flow, unequal flow to the water heater, or unequal flow to the showers) and the percent of served shower fixtures shall match the compliance documents.

(c) For water heating system serving a single dwelling, the DWHR system shall, at the minimum, recover heat from the master bathroom shower and must at least transfer that heat either back to all the respective showers or the water heater.

(d) For central water heating system serving multiple dwellings, the DWHR system shall, at the minimum, recover heat from half the showers located above the first floor and must at least transfer that heat either back to all the respective showers or the water heater.

(e) The DWHR unit(s) shall be installed within 1 degrees of the rated slope. Sloped DWHR shall have a minimum lengthwise slope of 1 degree. The lateral level tolerance shall be within plus or minus 1 degree.

(f) The installation shall comply with any applicable California Plumbing Code requirements.

RA4.4.21 HERS-Verified Drain Water Heat Recovery System (DWHR-H)

A HERS inspection is required to obtain this credit. All DWHR unit(s) shall be certified to the Energy Commission according to the following requirements:

(a) Vertical DWHR unit(s) shall be compliant with CSA B55.2, and tested and labeled in accordance with CSA B55.1 or IAPMO IGC 346-2017. Sloped DWHR unit(s) shall be compliant with IAPMO PS 92, and tested and labeled with IAPMO IGC 346-2017.

(b) The DWHR unit(s) shall have a minimum rated effectiveness of 42 percent.

The HERS inspector shall verify that:

(a) The make, model, and CSA B55.1 or IAPMO IGC 346-2017 rated effectiveness of the DWHR unit(s) shall match the compliance documents. The DWHR unit(s) shall also be verified as a model certified to the Energy Commission as qualified for credit as a DWHR unit(s).

(b) The installation configuration (e.g. equal flow, unequal flow to the water heater, or unequal flow to the showers) and the percent of served shower fixtures shall match the compliance documents.

(c) For water heating system serving a single dwelling, the DWHR system shall, at the minimum, recover heat from the master bathroom shower and must at least transfer that heat either back to all the respective showers or the water heater.

(d) For central water heating system serving multiple dwellings, the DWHR system shall, at the minimum, recover heat from half the showers located above the first floor and must at least transfer that heat either back to all the respective showers or the water heater.

(e) The DWHR unit(s) shall be installed within 1 degrees of the rated slope. Sloped DWHR shall have a minimum lengthwise slope of 1 degree. The lateral level tolerance shall be within plus or minus 1 degree.

(f) The installation shall comply with any applicable California Plumbing Code requirements.