Proposal Summary

2022 California Energy Code (Title 24, Part 6)

Nonresidential High Efficiency Boilers and High Capacity Service Water Heating Systems

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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 October 15, 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 29, 2019.

Measure Description

High Efficiency Boilers

This measure would update the boiler efficiency and service water heating system requirements to harmonize with the requirements proposed for Addendum BC to ASHRAE Standard 90.1-2016 and section 7.5.3 of ASHRAE Standard 90.1-2016 respectively. The ASHRAE proposal increases the minimum thermal efficiency for gas hot water boiler systems for space heating (1,000,000 – 10,000,000 Btu/h) to a weighted-thermal efficiency of 90 percent (90%E_t). while section 7.5.3 requires the same 90%E_t for gas service water heating systems.

Additionally, Addendum BC includes the following design requirements for the hot water distribution systems for large boiler systems:

- Hot water return entering the boiler(s) be 120°F or less,
- Establish flow rate requirements for supply hot water that recirculates directly into the return system to ensure flow rates are slow enough that condensing occurs. The tentative requirements are that flow rates be no greater than a) 20 percent of the design flow of the operating boiler.

The ASHRAE proposal includes an exception that boiler systems do not need to meet the equipment efficiency or hot water distribution system design requirements if 25 percent of the annual space heating requirement is provided by on site renewable energy, site-recovered energy, or heat recovery chillers or where half or more of the design heating load is served using perimeter convective heating, radiant ceiling panels, or both. Exceptions also exist for space heating boilers installed in individual dwelling. Furthermore, the ASHRAE proposal notes that individual gas boilers with input capacity less than 300,000 Btu/h should not be included in calculations of total system input or efficiency. The Statewide CASE Team will explore these exceptions and whether they would apply for California.

Oxygen Trim Control

The measure proposes that newly installed commercial and process boilers with an input capacity of 5 MMBtu/h (5,000,000 Btu/h) to 10 MMBtu/h (10,000,000 Btu/h) shall maintain excess (stack-gas) oxygen concentrations at less than or equal to 3 percent by volume on a dry basis over firing rates of 20 percent to 100 percent. Combustion air volume shall be controlled with respect to firing rate or measured flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited. Commercial boilers with steady state full-load thermal efficiency of 85 percent or higher are exempt from this requirement. The Statewide CASE Team will explore if it is feasible and cost-effective to lower the excess oxygen requirements below 5 percent and/or expanding the requirement to boilers with input capacity lower than 5 MMBtu/h.

Service Water Heating System Efficiency

This measure would update the gas service hot water heating requirements to harmonize with section 7.5.3 of ASHRAE Standard 90.1-2016. The ASHRAE proposal requires systems with 1,000,000 Btu/h or greater shall have a minimum thermal efficiency (E_t) of 90% or have a weighted E_t of 90%. Multiple units may meet this requirement if the water-heating input provided by the equipment with E_t above and below 90% provides an input capacity-weighted average E_t of at least 90%. This measure includes combination (integrated) systems that provide both service water-heating and space heating.

The ASHRAE proposal includes an exception that service hot water heating systems do not need to meet efficiency requirements if 25 percent of the annual service water-heating requirement is provided by site-solar energy or site-recovered energy, or if water heaters are installed in individual dwelling units, or if individual gas water heaters have an input capacity not greater than 100,000 Btu/h. The Statewide CASE Team will explore these exceptions and whether they would apply for California.

Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided 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.

Standards

Section 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

~~3.Newly installed process boilers with an input capacity of 5 MMBtu/h (5,000,000 Btu/h) to 10 MMBtu/h (10,000,000 Btu/h) shall maintain excess (stackgas) oxygen concentrations at less than or equal to 5.0 percent by volume on a dry basis over firing rates of 20 percent to 100 percent. Combustion air volume shall be controlled with respect to firing rate or measured flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.~~

3. Newly installed process boilers with an input capacity greater than 5 ~~10~~ MMBtu/h (5 ~~10~~,000,000 Btu/h) shall maintain excess (stack-gas) oxygen concentrations at less than or equal to 3.0 percent by volume on a dry basis over firing rates of 20 percent to 100 percent. Combustion air volume shall be controlled with respect to measured flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.

SECTION 120.9 – MANDATORY REQUIREMENTS FOR COMMERCIAL BOILERS.

(a) Newly installed boilers with an input capacity 5 MMBtu/h (5,000,000 Btu/h) and greater shall maintain excess (stackgas) oxygen concentration at less than or equal to 3.0 percent by volume on a dry basis over firing rates of 20 percent to 100 percent. Combustion air volume shall be controlled with respect to firing rate or flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shift is prohibited.

EXCEPTION to Section 120.9(c): Boilers with steady state full-load thermal efficiency 85 percent or higher.

Section 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

(K) Hydronic System Measures

(8) Hot Water Distribution System Design. The hot water distribution system for gas hot water boiler systems for space heating with a total system input of at least 1,000,000 Btu/h (290 kW) but not more than 10,000,000 Btu/h (2900 kW) shall be designed to meet all of the following:

1. Coils and other heat exchangers shall be selected so that at design conditions:
   A. The hot water return temperature entering the boilers is 120°F (49°C) or less, and
   B. Under all operating conditions, the water temperature entering the boiler is 120°F (49°C) or less or the flow rate of supply hot water that recirculates directly into the return system, such as by 3-way valves or minimum flow bypass controls, shall be no greater than 20% of the design flow of the operating boilers.

(P) Minimum High Capacity Gas-fired hot water boiler system efficiency. New buildings with gas hot water boiler systems for space heating with a total system input of at least 1,000,000 Btu/h but no more than 10,000,000 Btu/h must have a minimum thermal efficiency of 90 percent. Systems with multiple boilers can meet this requirement if the space-heating input provided by equipment with thermal efficiencies above and below 90 percent has an input capacity-weighted average thermal efficiency of at least 90 percent. For boilers rated only for combustion efficiency, the calculation for the input capacity-weighted average thermal efficiency shall use the combustion efficiency value.

Exceptions to 140.4(P) include the following:

1. Where 25% of the annual space heating requirement is provided by on-site renewable energy, site-recovered energy, or heat recovery chillers.
2. Space heating boilers installed in individual dwelling units.
3. Where 50 percent or more of the design heating load is served using perimeter convective heating, radiant ceiling panels or both.
4. Individual gas boilers with input capacity less than 300,000 Btu/h shall not be included in the calculations of the total system input or total system efficiency.

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 and 140.5(c) below.

(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 and 140.5(c) below.

(c) Nonresidential and High-Rise Residential Occupancies. Gas service water-heating systems in new buildings with a total installed gas water-heating input capacity of 1,000,000 Btu/h or greater must have gas service water-heating equipment with a minimum thermal efficiency of 90 percent. Multiple units are allowed to meet this requirement if the water-heating input provided by equipment with thermal efficiencies above and below 90 percent averages out to an input capacity-weighted average of at least 90 percent.

EXCEPTION 1 to Section 140.5(c): If 25 percent of the annual service water-heating requirement is provided by site-solar energy or site-recovered energy.

EXCEPTION 2 to Section 140.5(c): Water heaters installed in individual dwelling units.

EXCEPTION 3 to Section 140.5(c): Individual gas water heaters with input capacity at or below 100,000 Btu/h.