

# Proposal Summary

## Process Boiler #1 Stack Economizer

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## Measure Description

A process boiler is a type of boiler with a capacity (rated maximum input) of 300,000 Btu per hour (Btu/h) or more that serves loads other than space conditioning and service water heating related to human occupancy. A boiler stack economizer is a heat exchanger that recovers heat from boiler flue gas and transfers it to boiler feedwater or a combination of boiler feedwater and make-up water.

This proposed code change would require boiler stack (non-condensing) economizers on process boilers with capacities at or above 10 million British Thermal Units per hour (MMBtu/h). The requirement would apply to all new process boilers, including replacement boilers and boilers in additions to existing facilities, with the following exceptions:

- Boilers with stack temperatures below 340°F at their lowest firing rate without an economizer.
- Boiler systems designed to burn biomass<sup>1</sup> from facility processes or biomass produced from waste material produced at the facility, such as woody biomass, digester gas, landfill gas, and animal fat.
- Boilers employing stack heat recovery, such as a heat exchanger that serves an industrial heat pump or process drying application.
- Indoor replacement boilers at existing facilities with roof clearances (distance between the boiler outlet connection to the stack and the ceiling) less than 88 inches for boilers with an input capacity at or below 25 MMBtu/h; and less than 116 inches for boilers with an input capacity above 25 MMBtu/h.

The Statewide CASE Team is considering an additional exception for low-use boilers. Boilers used in oilfield production and municipal power generation are often not in buildings and therefore not expected to be within the scope of Title 24, Part 6.

Table 1 summarizes the scope of the proposed code change.

Table 1: Scope of Proposed Code Change

An “X” indicates the proposed code change is relevant.

<b>Building Type(s)</b>		single family	<b>Construction Type(s)</b>	X	new construction
		multifamily		X	additions
	X	nonresidential		X	alterations
<b>Type of Change</b>	X	mandatory	<b>Updates to Compliance Software</b>	X	no updates
		prescriptive			update existing feature
		performance			add new feature
<b>Third Party Verification</b>	X	no changes to third party verification			
		update existing verification requirements			
		add new verification requirements			

## Justification for Proposed Change

Most steam boilers lose 20% or more of their input fuel energy in the form of combustion exhaust. A stack economizer, which is a heat exchanger that recovers heat from boiler flue gas, can recover a significant fraction of this waste heat by preheating the boiler feedwater with heat from the hot boiler flue gas. This reduces load and thermal stress on the boiler, lowers fuel consumption, and extends boiler useful life.

The use of boiler stack economizers has been listed in Department of Energy literature as a best practice since at least the early 2000s. Despite its cost-effectiveness, this measure often goes unimplemented because of its first cost and the general lack of owner and operator awareness of the energy benefits. In general, boiler system vendors and contractors are highly familiar with this technology, and it is widely available. Stack economizers can be installed in various configurations, including roof boxes, making them feasible in most facilities.

The use of a stack economizer is typically the highest-impact action that sites can take to reduce their boiler natural gas usage, saving 2-3% of fuel energy by preheating boiler feedwater. Preliminary savings calculations and assumptions can be found in the stack economizer savings calculations document.

Additional benefits of this proposed code change include job creation in the manufacturing and installation of stack economizers, as well as improved local air quality. Many industrial facilities are located near Low- and Moderate-Income (LMI) housing, which is disproportionately exposed to lower air quality. This proposal would reduce photochemical smog in these communities.

## Data Needs / Information Requests

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The Statewide CASE Team is seeking the following information to inform the code change proposal. Data may be provided anonymously. To participate or provide information, please email Emma Conroy, [emmaconroy@2050partners.com](mailto:emmaconroy@2050partners.com) directly and copy [info@title24stakeholders.com](mailto:info@title24stakeholders.com).

- Size of installed stack economizers
- Labor and material costs of stack economizers across different boiler sizes
- Maintenance costs, the frequency of maintenance on stack economizers, lifetimes of stack economizers, and economizer retube costs
- Prevalence of boilers that have stack temperatures below 340°F
- Prevalence of inadequate overhead space, when a roof box cannot be added to accommodate a stack economizer in a boiler replacement
- Barriers to implementing non-condensing stack economizers on boilers
- Market prevalence of stack economizers by boiler capacity
- New construction and additions rate for process boilers

## Draft Code Language

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### 1.1 Guide to Marked Up Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2025 documents are marked with [blue underlining](#) (new language) and ~~strikethroughs~~ (deletions).

### 1.2 Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

### 1.3 Title 24, Part 6

## SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

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**Section 100.1(b) – Definitions: Recommends new or revised definitions for the following terms:**

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**BOILER STACK ECONOMIZER** (also known as a flue gas heat recovery unit) is a heat exchanger that recovers heat from boiler flue gas and transfers it to boiler feedwater or a combination of boiler feedwater and make-up water.

**MESH BURNER** is a type of burner constructed from fine metal mesh. In this system, combustion air is premixed with fuel before entering the burner. The premixed air-fuel mixture is directed through a steel tube into the mesh burner, where it passes through the fine mesh and enters the combustion chamber. Combustion occurs at the mesh surface, which acts as a flame arrestor, stabilizing and maintaining the flame.

**SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM** is a system used to reduce nitrogen oxide (NO<sub>x</sub>) emissions. In this system, aqueous ammonia is injected into the boiler stack, where it mixes with the combustion exhaust gases. This ammonia (NH<sub>3</sub>) and exhaust gas mixture then passes through a catalyst. Within the catalyst, the ammonia reacts with the NO<sub>x</sub> to produce nitrogen (N<sub>2</sub>) and water (H<sub>2</sub>O). Urea can also be used as an alternative to ammonia; it is converted into ammonia in the hot stack before entering the catalyst.

**BIOMASS** is non-fossilized and biodegradable organic material originating from plants, animals or micro-organisms, including products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material.

## **SUBCHAPTER 3 – NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES-- MANDATORY REQUIREMENTS**

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### **SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES**

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#### **120.6(d) Mandatory requirements for process boilers.**

1. Combustion air positive shut-off shall be provided on all newly installed process boilers as follows:

- A. All process boilers with an input capacity of 2.5 MMBtu/h (2,500,000 Btu/h) and above, in which the boiler is designed to operate with a nonpositive vent static pressure.

B. All process boilers where one stack serves two or more boilers with a total combined input capacity per stack of 2.5 MMBtu/h (2,500,000 Btu/h).

2. Process boiler combustion air fans with motors 10 horsepower or larger shall meet one of the following for newly installed boilers:

A. The fan motor shall be driven by a variable speed drive; or

B. The fan motor shall include controls that limit the fan motor demand to no more than 30 percent of the total design wattage at 50 percent of design air volume.

3. Newly installed process boilers with an input capacity greater than 5 MMBtu/h (5,000,000 Btu/h) shall maintain stack-gas oxygen concentrations at less than or equal to 3.0 percent by volume on a dry basis over firing rates of 20 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.

Exception to Section 120.6(d)3: Boilers with steady state full-load combustion efficiency 90 percent or higher.

4. Stack economizer. Newly installed process boilers with an input capacity equal to or greater than 10 MMBtu/h (10,000,000 Btu/h) shall have a boiler stack economizer.

Exception 1 to Section 120.6(d)4: Boilers where the stack temperature measured at their lowest firing rate is below 340°F as documented in manufacturer performance data.

Exception 2 to Section 120.6(d)4: Boiler systems designed to burn biomass<sup>6</sup> from facility processes or biomass produced from waste material produced at the facility, such as woody biomass, digester gas, landfill gas, and animal fat.

Exception 3 to Section 120.6(d)4: Boilers employing other methods of stack heat recovery, such as a heat exchanger serving a load other than boiler feedwater.

Exception 4 to Section 120.6(d)4: Indoor replacement boilers at existing facilities with roof clearance (distance between boiler stack outlet to the ceiling) less than 88 inches for boilers with an input capacity at or below 25 MMBtu/h and less than 116 inches for boilers with an input capacity above 25 MMBtu/h.

## 1.4 Reference Appendices

No changes are proposed to the Reference Appendices.