

# E-3-A. Require Energy Efficient Residential Boilers



## GHG Mitigation Potential



Up to 14.0 % of GHG emissions from boiler fuel consumption

## Co-Benefits (icon key on pg. 34)



## Climate Resilience

If the boilers are electric, increased energy efficiency can reduce the strain on the overall grid, particularly the risk of power outages during peak loads. Increased efficiency can also reduce energy costs.

## Health and Equity Considerations

If the boilers use natural gas, propane, or home heat oil, a more efficient model can directly reduce fuel combustion in the home and thus help reduce indoor air pollution, supporting improvements to public health.

## Measure Description

This measure requires installation of a residential boiler with a higher energy efficiency than what is required by regulation. Improving boiler efficiency decreases fuel consumption for the same amount of energy output, thereby reducing associated GHG emissions.

## Subsector

Energy Efficiency Improvements

## Scale of Application

Project/Site

## Implementation Requirements

This measure is only appropriate for residential boilers. A *residential boiler*, as defined in the Code of Federal Regulations (C.F.R.), means a product that utilizes only single-phase electric current, or single-phase electric current or DC current in conjunction with natural gas, propane, or home heating oil and that (1) is designed to be the principal heating source for the living space of residence; and (2) has a heat input rate of less than 300,000 British Thermal Units (Btus) per hour.

## Cost Considerations

More energy-efficient boilers are typically more expensive than less efficient ones, leading to greater upfront costs. However, the use of more efficient models reduces energy consumption and thereby reduces long-term energy costs. Boilers with improved insulation—a metric in improved energy efficiency—are also less likely to freeze and burst, potentially avoiding cold weather repair costs and water damage.

## Expanded Mitigation Options

Pair with Measure E-12, *Install Alternative Type of Water Heater in Place of Gas Storage Tank Heater in Residences*, to reduce energy use from both space heating and water heating to yield increased GHG reductions.





## GHG Reduction Formula

$$A = D$$

## GHG Calculation Variables

ID	Variable	Value	Unit	Source
<b>Output</b>				
A	Percent reduction in GHG emissions from boiler fuel consumption	1.2–14.0	%	calculated
<b>User Inputs</b>				
B	Boiler type	[ ]	text	user input
C	Annual fuel utilization efficiency of boiler with measure	83–96	%	user input
<b>Constants, Assumptions, and Available Defaults</b>				
D	Boiler fuel savings with measure compared to minimum requirement	Table E-3-A.1	%	U.S. DOE 2015

Further explanation of key variables:

- (C) – The U.S. Department of Energy’s (U.S. DOE) 2016 Conservation Standards for Residential Boilers (10 C.F.R. 430) set increased energy efficiency requirements for residential boilers, effective January 2021. The annual fuel utilization efficiency (AFUE) is a common metric for determining residential boiler efficiency as it represents the ratio of the total useful heat delivered to the heat value from the annual amount of fuel consumed. The project boiler AFUE must exceed the minimum AFUE required by the standards to result in GHG emission reductions. Boiler efficiency should be obtainable from manufacturer specifications.
- (D) – The U.S. DOE calculated the average annual fuel use and savings of boilers at various AFUEs above the minimum requirement of the standards based on historical consumption data. This information is summarized in Table E-3-A.1 in Appendix C.

## GHG Calculation Caps or Maximums

### Measure Maximum

( $C_{\max}$ ) The annual fuel utilization efficiency of the proposed boiler is capped at the “Max Tech” percentage for each boiler type, which is presented in Table E-3-A.1 in Appendix C.

### Mutually Exclusive Measures

If the user selects Measure E-15, *Require All-Electric Development*, the user cannot also select this measure, given that it calls for use of gas- and oil-fired boilers.



## Example GHG Reduction Quantification

The user reduces boiler fuel use by requiring installation of a boiler with a higher AFUE than what is required by the 2016 Conservation Standards for Residential Boilers. If the boiler is a gas-fired hot water boiler (B) with an AFUE of 96 percent (C), the user would reduce GHG emissions from boiler fuel consumption by 14 percent based on Table E-3-A.1 in Appendix C.

$$A = -14\%$$

## Quantified Co-Benefits



### *Improved Air Quality*

The reduction in fuel consumption (i.e., natural gas or oil) from this measure would result in local improvements in air quality because pollutants from fuel consumption would be reduced at the project site. The percent reduction in GHG emissions (A) is the same as the percent reduction in criteria pollutant emissions achieved by the measure.



### *Energy and Fuel Savings*

The percent reduction in fuel consumption achieved by the measure is the same as the percent reduction in GHG emissions (A).

## Sources

- U.S. Department of Energy (U.S. DOE). 2015. *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Boilers*. March. Available: <https://www.regulations.gov/docketBrowser?rpp=25&so=DESC&sb=commentDueDate&po=0&dct=SR%2BO&D=EERE-2012-BT-STD-0047>. Accessed: January 2021.