E-14. Limit Wood Burning Devices and Natural Gas/Propane Fireplaces in Residential Development

GHG Mitigation Potential

Large

Potentially large reduction in GHG emissions from wood burning devices

Co-Benefits (icon key on pg. 34)

Climate Resilience

Limiting wood burning and natural gas/propane fireplaces and replacing them with electric appliances can reduce sensitivity to fuel price shocks or scarcity; however, they may decrease resilience if they are the only option available during a power outage. This also offers more reliability if the grid has been adapted to climate change or less reliability if the grid has not been adapted.

Health and Equity Considerations

This may increase winter heating costs for some residents in colder climate zones. Eliminating wood burning and combustion of natural gas and propane in homes can help reduce indoor pollution and greatly reduce outdoor air pollution.

Measure Description

This measure requires committing to not installing any wood burning devices (i.e., woodstoves and fireplaces) or natural gas or propane fireplaces in proposed residential developments. This avoids the combustion of biomass, natural gas, and propane, thereby reducing associated biogenic and non-biogenic GHG emissions. The most efficient alternatives to wood burning devices or gas fireplaces are electric fireplace inserts and electric heat pumps.

Subsector

Building Decarbonization

Scale of Application

Project/Site and Plan/Community

Implementation Requirements

This measure may not be applicable in areas where wood burning devices in new development are already prohibited. In such areas, this measure could be applied for informational purposes, to determine the GHG and air quality benefits in new development achieved by restrictions on wood burning devices. However, users should exercise caution in taking credit for any emissions benefit from this measure in areas where the existing baseline already prohibits wood burning devices.

Cost Considerations

Wood, natural gas, and propane fireplaces use more energy and fuel to heat an area than centralized heating systems and have additional costs to purchase fuel for the fireplace. Electric imitation fireplaces meant for cosmetic purposes are less expensive to install and much more energy efficient. For heat production purposes, portable space heaters that run on electricity have the same benefits in cost reduction and allow the owner to use the same device in multiple locations, saving the cost of installing more units.

Expanded Mitigation Options

Consider electrifying all end uses (e.g., space heating, water heating) by implementing Measure E-15, *Require All-Electric Development*.

GHG Reduction Formula

$$A = -D \times \left[\left(\left(\left((E_1 \times K_1 + E_2 \times K_2 + E_3 \times K_3 + E_4 \times K_4) \times G\right) + F_1 \times L_1 \times H\right) \times N\right) + \left((F_2 \times L_2 + F_3 \times L_3) \times I \times J \times M\right)\right] \times O$$

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Reduction in GHG emissions from wood burning devices	[ ]	MT CO_2e per year	calculated
User Inputs				
B	Project location	[ ]	air basin, air district, county	user input
C	Housing type	[ ]	multi-family or single-family	user input
D	Number of du	[ ]	du	user input
Constants, Assumptions, and Available Defaults				
E_1	Percent of du with conventional woodstoves	Table E-14.1	%	CA Air Districts 2021
E_2	Percent of du with catalytic woodstoves	Table E-14.1	%	CA Air Districts 2021
E_3	Percent of du with non-catalytic woodstoves	Table E-14.1	%	CA Air Districts 2021
E_4	Percent of du with pellet woodstoves	Table E-14.1	%	CA Air Districts 2021
F_1	Percent of du with wood fireplaces	Table E-14.1	%	CA Air Districts 2021
F_2	Percent of du with natural gas fireplaces	Table E-14.1	%	CA Air Districts 2021
F_3	Percent of du with propane fireplaces	Table E-14.1	%	CA Air Districts 2021
G	Wood mass for stove	Table E-14.1	lb per year	CA Air Districts 2021
H	Wood mass for fireplace	Table E-14.1	lb per year	CA Air Districts 2021
I	Daily usage of fireplace	Table E-14.1	hour per day	CA Air Districts 2021
J	Annual usage of fireplace	Table E-14.1	day per year	CA Air Districts 2021

ID	Variable	Value	Unit	Source
K_1	Carbon intensity of conventional woodstove	Table E-14.2	lb biogenic CO_2e per ton wood burned	U.S. EPA 1996a
K_2	Carbon intensity of catalytic woodstove	Table E-14.2	lb biogenic CO_2e per ton wood burned	U.S. EPA 1996a
K_3	Carbon intensity of non-catalytic woodstove	Table E-14.2	lb biogenic CO_2e per ton wood burned	U.S. EPA 1996a
K_4	Carbon intensity of pellet woodstove	Table E-14.2	lb biogenic CO_2e per ton wood burned	U.S. EPA 1996a
L_1	Carbon intensity of wood fireplace	Table E-14.2	lb biogenic CO_2e per ton wood burned	U.S. EPA 1996b
L_2	Carbon intensity of natural gas	Table E-14.2	lb non-biogenic CO_2e per MMBtu	U.S. EPA 2020
L_3	Carbon intensity of propane	Table E-14.2	lb non-biogenic CO_2e per MMBtu	U.S. EPA 2020
M	Heating rate of natural gas and propane	0.06	MMBtu per hour	SCAQMD 2008
N	Conversion from lb to ton	0.0005	ton per lb	conversion
O	Conversion from lb to MT	0.000454	MT per lb	conversion

Further explanation of key variables:

- (B and C) – The project location and housing type are needed to lookup the percent of du with various types of woodstoves and fireplaces (E_1 through E_4 and F_1 through F_3).
- (E_1 through J) – The percent of du with various types of woodstoves and fireplaces, amount of wood burned by woodstoves and fireplaces, and fireplace usage is based on data supplied by local air districts and state defaults (CA Air Districts 2021). Table E-14.1 in Appendix C presents this information by housing type for each county, air basin, and air district.
- (K_1 through L_3) – The carbon intensity of the various woodstoves and fireplace fuels were calculated in terms of CO_2e by multiplying the emission factors for CO_2, CH_4, and N_2O (U.S. EPA 1996a, 1996b, 2020) by the corresponding 100-year GWP values from the IPCC's Fourth Assessment Report (IPCC 2007). See Table E-14.2 in Appendix C for these emission factors.
- (K_1 through L_1) – GHG emissions from the combustion of wood or biomass are considered biogenic emissions, meaning they are derived from living cells, as opposed to fossil fuels that have been transformed by geological processes. Some protocols do not consider these emissions to be part of an emission inventory. In these instances, users should take care to keep them distinct from non-biogenic emissions caused by natural gas and propane fireplaces (L_2 and L_3).

- (M) – The heating rate of natural gas and propane is based on the upper range provided in the South Coast Air Quality Management District's environmental assessment for Rule 445, Wood Burning Devices (SCAQMD 2008).

GHG Calculation Caps or Maximums

None.

Example GHG Reduction Quantification

The user avoids emission from wood burning devices by eliminating woodstoves and fireplaces from the proposed residential development. In this example, the proposed project would be a 100-unit (D) multi-family housing development (C) located in the Great Basin Valley Air Basin (B). Based on this information, Table E-14.1 can be used to determine the percent of du with various types of woodstoves and fireplaces, the amount of wood burned by woodstoves and fireplaces, and the fireplace usage (E_1 through J). The mitigated emissions would be reduced by -151 MT CO_2e per year.

$$A = \text{-100 units} \times \left[\left(\left(\left(\left(0\% \times \frac{3{,}792 \text{ lb } CO_2e}{\text{ton wood}} + 5\% \times \frac{3{,}277 \text{ lb } CO_2e}{\text{ton wood}} + 5\% \times \frac{3{,}400 \text{ lb } CO_2e}{\text{ton wood}} + 0\% \times \frac{3{,}400 \text{ lb } CO_2e}{\text{ton wood}}\right) \times \frac{3{,}019.2 \text{ lb wood}}{\text{yr}}\right) + 35\% \times \frac{3{,}480 \text{ lb } CO_2e}{\text{ton wood}} \times \frac{3{,}078.4 \text{ lb wood}}{\text{yr}}\right) \times \frac{0.005 \text{ ton}}{\text{lb}}\right) + \left(\left(55\% \times \frac{117 \text{ lb } CO_2e}{\text{MMBtu}} + 0\% \times \frac{141.3 \text{ lb } CO_2e}{\text{MMBtu}}\right) \times \frac{3 \text{ hours}}{\text{day}} \times \frac{82.0 \text{ days}}{\text{yr}} \times \frac{0.06 \text{ MMBtu}}{\text{hour}}\right)\right] \times \frac{0.000454 \text{ MT}}{\text{lb}} = \frac{\text{-151 MT } CO_2e}{\text{yr}}$$

Quantified Co-Benefits

Improved Air Quality

The reduction in wood, natural gas, and propane combustion from this measure would result in local improvements in air quality because the combustion occurs on site of the project. The reduction in criteria pollutant emissions (Q) achieved by the measure would be calculated the same way as the GHG reduction equation, except for the following differences.

- (K_1 through L_3) – Use the criteria pollutant emission factors in Table E-14.2 in Appendix C instead of the GHG emission factors (U.S. EPA 1996a, 1996b, 2015; CARB 2011).
- (N) – Replace (O) with (N) because criteria pollutant emissions are reported as tons of pollutant per year, whereas GHG emissions are reported in units of metric tons.

Energy and Fuel Savings

The reduction in natural gas and propane fuel consumption (P) achieved by this measure, in units of MMBtu per year, can be calculated as follows.

Fuel Reduction Formula

$$P = -D \times (F_2 + F_3) \times I \times J \times M$$

Sources

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- California Air Districts. 2021. Excel database of hearth usage and inventory statistics, provided to the Sacramento Metropolitan Air Quality Management District and ICF. April 1, 2021.
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