

PIR-18-005 Improving the Performance of Wall Furnaces in California
Final Technical and Economic Benefits Calculation, March 13, 2023

Estimated Number of California Wall Furnaces

New estimates of the number of existing wall furnaces in California were made. These estimates were based on information collected in the 2020 American Community Survey, <https://www.census.gov/programs-surveys/acs>. The total number of wall furnaces in single and multi-family homes is estimated to be 1.4 million.

Table 1: Estimated Number of California Wall Furnaces

	Single Family	Multi-Family	Total
Homes in CA	9,898,841	4,594,291	
% Occupied	92.5%	92.5%	
% with Floor or Wall Furnace	7.6%	15.2%	
% Floor Furnaces	7.0%	3.0%	
% with Two Wall Furnaces	13.1%	6.6%	
# Wall Furnaces	732,000	668,000	1,400,000

Advanced Wall Furnace Retrofit per Unit Benefits

Table 2 shows the rated characteristics of the two retrofit wall furnace options studied in this project. Baseline values reflect average characteristics of existing furnaces that were replaced. The advanced drop-in retrofit characteristics reflect an amalgamation of the three drop-in furnaces tested. The condensing direct-vent retrofit characteristics are for a single furnace of this type that was tested during this project.

Although one of the tested advanced drop-in furnaces was self-powered, it is assumed that the retrofit drop-in furnaces is not self-powered but draws 12.5 W of AC power when actively heating, as measured in this project. The retrofit direct vent furnace is also not self-powered and is assumed to draw 100 W of AC power when heating, as measured

Table 2: Baseline and Retrofit Wall Furnace Characteristics

	Existing Baseline before Drop-In Retrofit	Existing Baseline before Condensing Direct-Vent Retrofit
Rated Input Capacity, Btu/hr	35,625	25,000
Rated Thermal Efficiency, %	66.3%	70%
Rated AFUE, %	Not rated	Not rated
Pilot Gas Use, Btu/hr	740	520
Age, years	32	35
	Drop-In Retrofit	Condensing Direct-Vent Retrofit
Rated Input Capacity, Btu/hr	31,250	17,500
Rated Thermal Efficiency, %	83.6%	94%
Rated AFUE, %	81.0%	93%
Active AC Power, W	12.5	100

Table 3 lists annual site-level savings found from this project when replacing an existing gravity wall furnace with one of the retrofit options, either a drop-in wall furnace or a condensing direct-vent furnace. Savings are based on the measured differences between the existing gravity wall furnaces and the advanced drop-in or direct vent wall furnaces that replaced them.

Table 3: Annual Wall Furnace Retrofit per Unit Benefits

	Drop-In Retrofit	Condensing Direct-Vent Retrofit
Natural Gas Savings, therms	79.4	58.3
Electricity Savings, kWh	1.7	9.5
Utility Bill Savings, \$	\$150	\$108
CO2e Avoided, lbs	927	581
NOx Avoided, lbs	0.620	0.555

Assumptions Made to Calculate Cumulative Benefits of Advanced Wall Furnace Retrofits

Although the effective useful life of wall furnaces is usually assumed to be 20 years, the average age of the ten existing wall furnaces in this project was over 32 years, so a 30-year life is assumed. It is expected that 1/30 or 3.33% of existing wall furnaces are replaced each year.

The proposed drop-in replacement technology was assumed to immediately gain 20% of this annual replacement market in year one, ramping to 60% of replacements over 10 years. More conservative estimates were made for the direct vent solution. It is assumed that direct vent wall furnaces would be installed in an additional 5% of the wall furnace replacements, ramping up to an additional 15% of all replacement units over ten years. After ten years under this scheme, 14% of existing units would be replaced with an advanced drop-in furnace and an additional 3.5% of existing units would have been replaced with a condensing/direct-vent furnace.

Avoided equivalent carbon dioxide emissions (CO2e) are based on avoided natural gas use, where 0.053 metric tons of CO2e is avoided for each 1 MMBtu or 10 therms of natural gas savings. Utility cost savings are based on a natural gas price of \$19.00 per MMBtu, or \$1.90 per therm, and an electricity price of \$0.25 per kWh.

Cumulative Benefits of Advanced Wall Furnace Retrofits

Table 4 shows cumulative statewide benefits after 10 years for each retrofit solutions, which GTI Energy believes would coexist in the marketplace. These figures include the cumulative natural gas, electricity, and utility cost savings, plus and avoided CO2e and NOx over ten years. These estimates include benefits from wall furnace retrofits in single family and multi-family buildings.

Table 4: 10-Year Cumulative Ratepayer Benefits

	Drop-In Retrofit	Condensing Direct-Vent Retrofit	Total
Natural Gas Savings, therms	7,110,350	1,306,360	8,416,710
Electricity Savings, kWh	(1,053,950)	(2,218,000)	(3,181,950)
Utility Bill Savings, \$	\$134,833,190	\$24,288,7780	\$159,121,970
CO2e Avoided, metric tons	376,850	69,240	446,090
NOx Avoided, metric tons	265	60	325