

Keeping Up With Technology: Developing Regulations for New Innovations in Alternative Energy Heating Products

Produced by Pro-Fab Industries Inc., Nov. 2009. Based on EPA test data and regulations.

Cleaner Wood Heat: Believe It!

If this is what you see when you think of outdoor wood furnaces, you might have been right twenty years ago. Many people are drawn to wood heat for its homey feel and natural heat, but assume that it is an inefficient and environmentally unfriendly option. While many traditional or home-built wood furnaces and fireplaces still have high emissions, wood furnaces today are leading the way in high efficiency and renewable energy technology.

Outdoor Wood Furnaces

An outdoor wood furnace can be generally classified as a free standing wood burning unit located outside the main building, which is used to heat the main and/or accessory buildings on the property. The furnace heats water through combustion of solid fuel (wood). This hot water is then piped to the building(s) to be heated.

In 1998, the United States Environmental Protection Agency (EPA) conducted a study of two conventional outdoor wood furnaces representing two major designs available on the market at the time. These tests rated them at approximately 50% fuel efficiency (see Graph 2), with emissions ranging from 2.78-5.63 pounds per million BTU heat output for regular heating season operation (Graph 1).

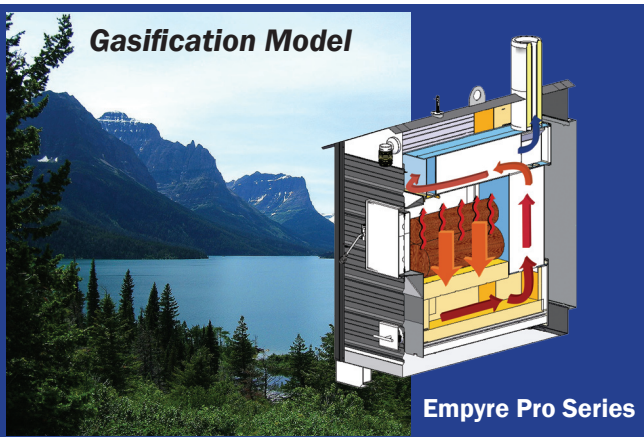
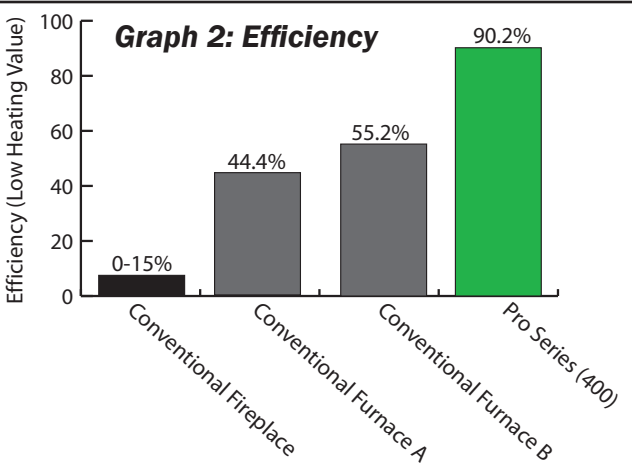
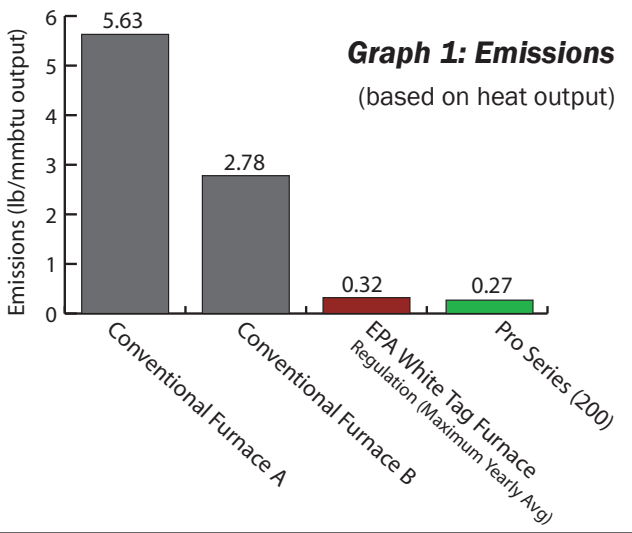
New EPA Wood Furnace Standards

As part of a push for cleaner renewable energy heating, the EPA implemented a new standard for outdoor wood furnaces. Phase 1 of this 2-Phase standard was implemented in 2008, requiring furnace manufacturers to maintain emissions under 0.60 lb/mmBTU heat input. Phase 2, the 2010 standard, forces emissions down even further to 0.32 lb/mmBTU output.

This emissions standard is based on year-round furnace use. When a furnace operates on a very low heat load in the summer, it is like an idling car, producing more emissions per BTU of heat than a furnace operating at full load. New EPA standards include these higher summer emission levels, while the 1998 test only indicated heating season emissions, meaning that the data for conventional furnaces would be even higher if calculated at the new EPA standard. EPA rates Orange Tag (Phase 1) approved furnaces as 70% cleaner than conventional wood furnaces and White Tag (Phase 2) approved furnaces as 90% cleaner than conventional wood furnaces.

How it Works: Gasification

A new standard requires new technology, and wood furnace manufacturers set to work immediately to upgrade their furnace design. Gasification is a revolution in wood heating technology. In a gasification furnace, the wood is burned in the primary firebox, but gases and ash are forced into a secondary burn chamber. The secondary burn chamber reaches heat levels over 2,000°F, enough to burn off almost 100% of emissions and ash, dropping emission levels well below EPA standards. Almost complete fuel combustion and higher heat result in greater efficiency (Graph 2), which can reduce fuel requirements by as much as 50%.



New Efficiency Standard Calls for New Regulations

With these new emissions standards, current zoning and insurance regulations for wood furnaces are as obsolete as old wood heating methods. Furnace location and stack height regulations have been formulated based on emissions and safety requirements for traditional outdoor wood furnace models. As demonstrated by the graphs at right, EPA approved gasification furnaces are clearly in their own category for high efficiency and low emissions.

Gasification furnaces should also be evaluated within the greater context of wood burning appliances. The majority of wood burning appliances are unregulated, including more than 16 million fireplaces, 8 million uncertified indoor wood furnaces, and many more indoor and outdoor wood burning appliances used for primary heating or for comfort.

While conventional fireplaces operate at 0-15% efficiency (Graph 2), contributing little to the home heating requirements, their emissions far exceed those of EPA approved wood furnaces in both grams per hour of operation or grams per kilogram of fuel input. EPA White Tag approved outdoor wood furnaces should not be required to compensate for inefficient operation of unregulated indoor wood burning appliances.

Empyre Pro Series Models 200 and 400 are leading the way in alternative energy heating. Not only are they EPA White Tag approved, but they are also UL/CSA tested and approved for indoor use. Producing only a fraction of the emissions of a conventional indoor

“...gasification furnaces are clearly in their own category for high efficiency and low emissions”

fireplace and less than half the maximum limit for EPA’s White Tag regulations for fireplaces (see Graphs 3 and 4), stacks more correctly operate as air vents than as smoke chimneys.

Similarly, gasification furnaces, used as the primary heat source, reduce household environmental impact by replacing non-renewable fuel - processed often at great cost to the environment - with renewable local fuel.

These differences should be reflected in local bylaws and insurance policies.

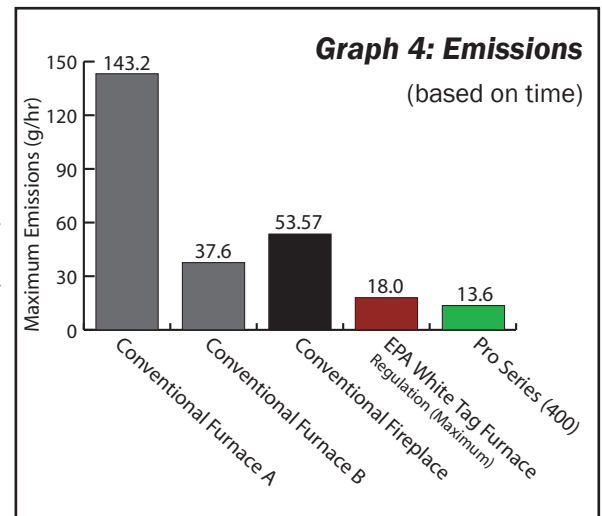
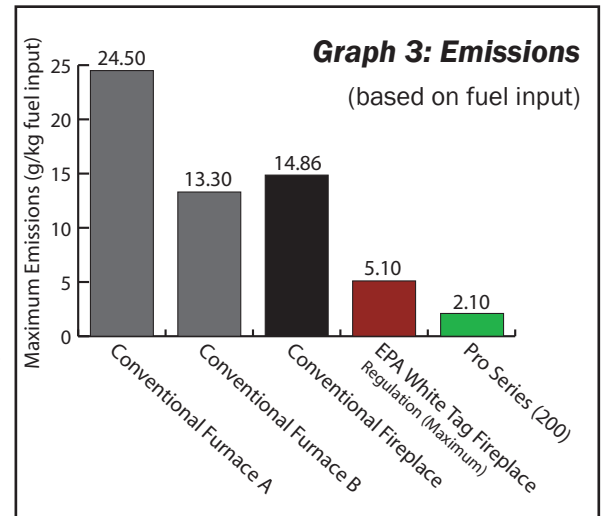
Developing New Regulations

Many regions have already adopted separate regulations for gasification furnaces. One example is a bylaw in the town of Kirkland Lake, Ontario, Canada, which offers the following clarification in their bylaw regulating outdoor wood burning appliances:

“(ii) ‘Appliance’ means an outdoor wood-burning appliance situated outside of the main building, which is intended to heat the main or accessory buildings using solid fuel for combustion. *It does not include a wood-fired hydronic furnace designed to burn wood completely through a process called wood gasification reaching temperatures of 2000 degrees Fahrenheit. The wood-fired hydronic furnace shall be UL/CSA approved and be installed, operated and maintained exactly to the manufacturers*

instructions” (emphasis added).

As seen above, regulations should differentiate between old and new furnace technology and recognize safety testing, efficiency and low emissions in comparison to unregulated or noncertified wood burning appliances. They should also outline a process for pre-approval and appeals to accommodate an ever changing industry at the forefront of alternative and renewable energy development.



Furnace	Efficiency (Low Heating Value)	Emissions g/Kg (Input/Maximum)	Emissions g/hr (Maximum)	Emissions lb/mmbtu (output)
	GRAPH 2	GRAPH 3	GRAPH 4	GRAPH 1
Conventional Wood Furnace*	(A) 44.4% (B) 55.2%	(A) 24.5 (B) 13.3	(A) 143.2 (B) 37.6	(A) 5.63 ^a (B) 2.78 ^a
Conventional Fireplace**	0%-15% ^b	14.86	53.57	no data
EPA-White Tag Fireplace Standard	no standard	5.10	no standard	no standard
EPA-White Tag Furnace Standard	no standard	no standard	18.0	0.32 ^c
Empyre Pro Series 400	90.2%	2.33	13.6	0.31 ^c

*Data based on EPA lab test 1998 of single and double pass wood furnaces; High and Low Heating Values based on “average winter” and “extreme cold winter” output expectations, not yearly average. **Data based on conventional fireplaces tested in 2000 EPA Test Purvis, Carol R. and Robert C. McCrillis. “Fine Particulate Matter (PM) and Organic Speciation of Fireplace Emissions” Environ. Sci. Technol. 2000, 34, 1653-1658. a) based on high heating value (winter use); no yearly value available, Empyre Pro Series 400 high heating value 0.11 lb/mmbtu. b) based on home heating value, Hayden, A. C. S. “Fireplaces: Studies in Contrasts,” Home Energy Magazine. Sept/Oct 1994. c) yearly average by EPA White Tag formulas and standards.