

## The Evolution of Outdoor Wood-fired Boilers

Manufacturers are making significant progress in reducing emissions and increasing the efficiency of outdoor wood-burning devices. However, for wood to become a major source of residential home heating in both rural and more densely populated areas, manufacturers of these devices will need to commit to a program of continuing improvement in emissions quality and operating efficiency – with the ultimate goal of being as clean and efficient, if not cleaner and more efficient, than the units they would replace.

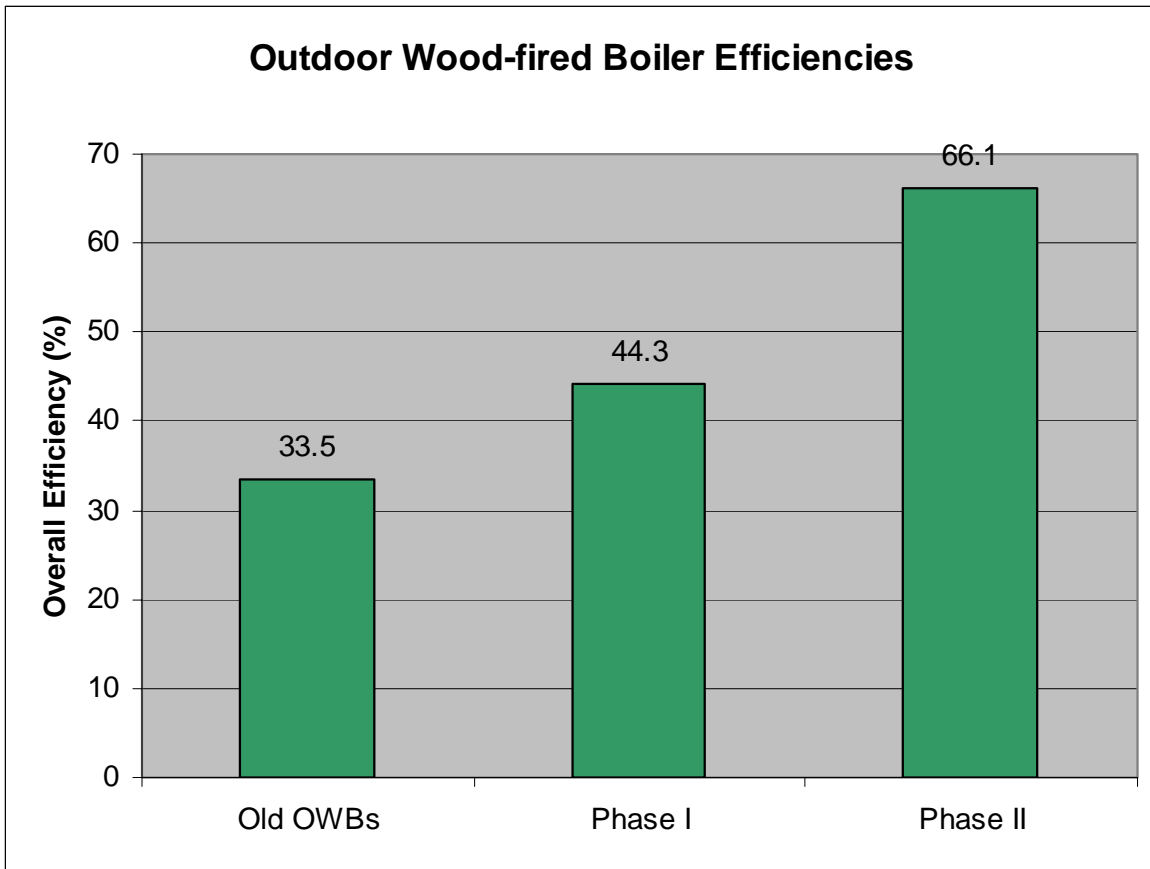
The US EPA, Vermont and other northern states are planning to implement a “Phase II” particulate standard for outdoor wood boilers (OWBs) in the spring of 2010. This standard of 0.32 lb/mmBTU of heat output is one more step in elevating wood to a clean burning status for residential heating. Several OWB manufacturers have developed chunk wood burning boilers that passed the test for Phase I or Phase II particulate emissions and have obtained Vermont certification. Other more advanced boilers are in the process of development, testing or test data review.

The graphs below were developed using the available certification test data and limited data from similar testing of old style OWBs. The efficiency graph compares the overall efficiencies of the three generations of OWBs. The overall efficiency is a measure of how much of the potential heat in the fuel is converted into useable heat. Based on this data, it is obvious that the new Phase I and especially the Phase II wood boilers are much more efficient than the original old style OWBs. Note that the test data does not measure heat lost in underground piping or from the boiler itself when exposed to outdoor air.

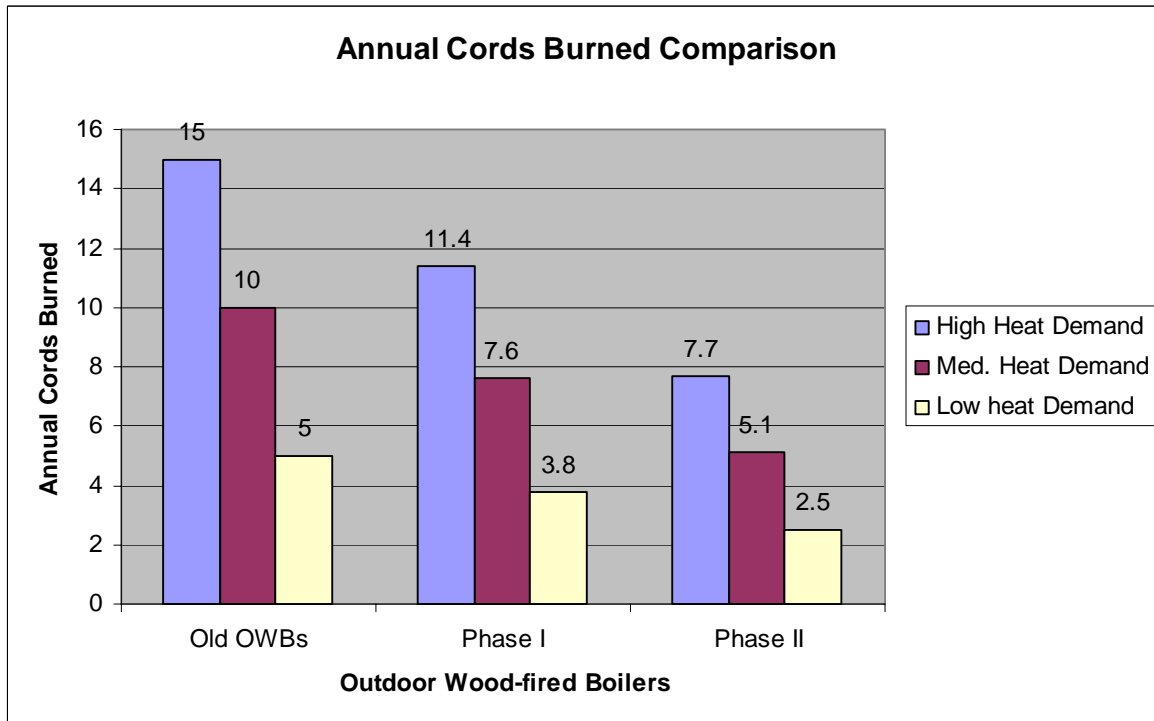
The second graph shows the reduction in the number of cords of wood required to be burned by each of the three generations of OWBs to satisfy three different heating loads. This graph was developed from the efficiency data to give consumers some idea how much wood could be saved by having one of the newer more efficient units. Obviously, the new units require far less wood to produce the same amount of heat.

What does this mean to consumers? Consumers of wood burning boilers should choose the most efficient model that meets their needs and that they can afford. The benefits of high efficiency wood combustion are numerous.

- Less expensive heat due to reduced wood use
- Less wood to haul and store
- Reduced health impacts on owners and neighbors
- Fewer zoning or regulatory restrictions on cleaner units
- Reduced impacts on forest resources
- Less greenhouse gases emitted



Overall thermal efficiency comparison of outdoor wood-fired boilers based on testing of older wood boilers and the tests of Phase I and II units certified by Vermont as of 10/1/08.



Comparison showing potential reduction of cords burned based on efficiencies.

## **Be Smart, Burn Smart**

Choosing a clean and efficient wood burning device is only part of the story. Good operation is also critical. Many homeowners have burned wood for years and know the right way to do it. But other homeowners and consumers may be new to wood heating and need to learn safe and proper wood burning techniques. How you operate your wood boiler or other wood burning device makes an enormous difference in efficiency, emissions and ultimately costs. Here are some guidelines:

- **Burn only seasoned wood:** Burning green wood or any wood with a high moisture content produces less heat and may severely affect the operation of the wood heater. Combustion efficiency is reduced due to cooler temperatures in the firebox and the poor combustion increases the hazardous nature of the emissions.
- **Burn Hardwood:** Due to its higher density, hardwood provides a slower more controlled burn. Softwoods, particularly with high surface area such as slabwood, may burn too fast for the unit to heat efficiently. Dry softwood makes good kindling to start fires. If you must burn softwood, mix it with seasoned hardwood.
- **Burn Only Natural Wood:** Do not burn painted, stained, pressure treated or any type of treated wood, artificial wood products or trash or garbage. All these materials may produce highly toxic emissions or ash when burned. The resulting gases may be highly corrosive to the metals in your wood heater. Burning these materials may also void your heater's warranty.
- **Follow Instructions:** Follow the manufacturer's operating instructions. The manufacturers know best how to operate the heater for peak efficiency and longevity.
- **Be Stingy:** Match the wood load to the heating need. Burn only the amount of wood you need for the heat demand conditions so the device can burn hot and efficiently. During those marginal heat demand days in the spring and fall, load just enough wood to allow the load to keep burning hot without shutting down and smoldering. Consider not burning during those marginal heat demand days or during the summer when wood burning is likely to be less efficient and people want to open their windows without wood smoke in the air.
- **Consider installing a heat accumulation or "mass storage" system.** This generally consists of a water tank several hundred gallons in size that can store all the excess heat from burning a full load of wood. This allows you to burn the entire load of wood at one time, without the boiler shutting down, which means the wood heater will burn constantly at high fire - the most efficient burn rate. Mass storage is especially useful during warm periods when you can use the stored heat over a period of days before starting another fire.