Basic High-Efficiency Wood Stove

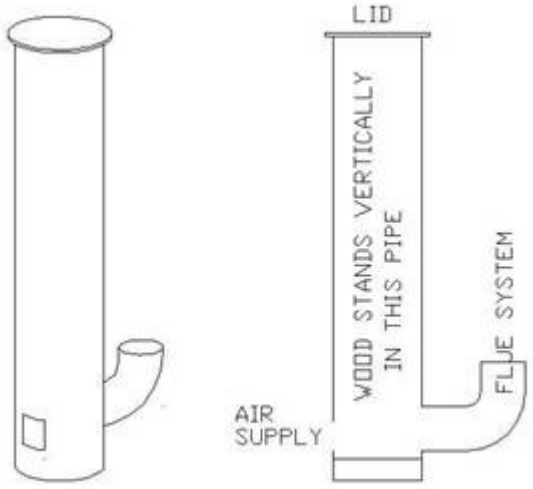
Over forty percent of the energy available in wood begins as smoke. If this smoke is not properly burned it either clings to the inside of your chimney as creosote, or goes off into the air looking for a lung to pollute.

A bright orange fire and plenty of oxygen are required to burn smoke – conditions not always found in wood stoves. Indeed, when you close the doors and cut down the air supply on your wood stove so that it will burn all night, most stoves lose this energy.

On the other hand, when you give it plenty of air, you often have too much heat, and a fire that doesn't last very long, so what do you to do? You build a version of this stove.

The stove consists of a vertical tube with a lid on top, an opening for air at the bottom, and a flue also connected at the bottom – just opposite the air inlet.

Firewood stands vertically in the tube, and gravity-feeds into a small hot fire between the air supply and the flue. Any smoke rendered in the wood farther up in the tube must pass through this intense oxygen-rich fire in order to get to the flue. The result is a long, efficient burn with no smoke and very little ash.



I made my first version of this from a 5" diameter piece of sheet-metal pipe, about 30" long. I used 3" pipe for the flue. Use at least 10’ of flue to develop a satisfactory draft

If you attempt to build this one, connect the ELL to tabs bent outward from the flue hole in the base. This is so the wood descending vertically will have nothing to hang up on.

The first time I used it I fed it a couple of 2x4's, and it burned for over two hours. Usually, you'd want a higher rate of heat, so I thereafter would split them lengthwise for a quicker burn. This is a great little thing for miscellaneous sticks, pallet wood, and scraps normally considered junk.

Inasmuch as the small fire is more intense in this stove, there is remarkably little ash to deal with. You may also notice that the ash that does remain is a lighter shade of gray than that dug out of other stoves. This too is because the burn has been more efficient, and less carbon remains behind in the ash.

The fire can be a little tricky to start, because the smoke wants to travel up the larger pipe until the draw up the flue becomes convincing. Sometimes I’ve made a small (1/2”) hole near the base of the flue to insert a burning scrap of paper to initiate the draft.

Another thing to be careful of is that if the fire drops to a smolder, sometimes the draft can be lost and smoke begins to come up the wood storage magazine and into the room – rarely, but I’ve seen it happen with a minimal stack height.

The stove is an excellent, compact, high-efficiency concept though, and a more serious version using 8" diameter pipe and a larger base area lined with fire-brick warmed our house through several winters

in Colorado.

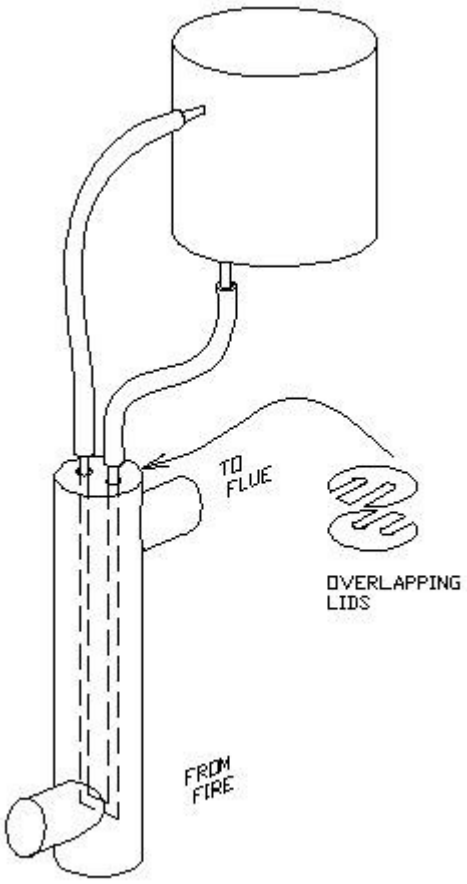
I have found that 6” pipe with a 4” flue is about optimum for a minimal stove. Use a 1-1/2” square opening about 2” above the bottom for the air input. This is to allow for a layer of gravel to protect the bottom sheet metal cap, and for a limited amount of ash storage. Have the bottom of the flue opening at least as high as the middle of the air opening.

Water Heater for Woodstove

A simple water heater can be made by having the flue gasses pass through a two-foot section of 4" diameter pipe.

A U-shaped piece of 1/2" copper pipe is suspended in this section. Even though this pipe is exposed to orange-hot flue gasses, any solder joints will not melt, because it will be filled with water.

I connected the ends to a five-gallon can suspended from the rafters in my shop, with 5/8" automotive heater hose. The connections to the can were made to pieces of 1/2" copper pipe – one soldered into the bottom, and the other soldered about half-way up the side.



I messed around with a version of this that was connected to more fire and a 55-gallon drum, but never got around to completing the project; I did get far enough however, to say with certainty that it can be done.

To really be practical of course, any such container would have to be insulated, and have a spigot for removing hot water.

Wood Chipper Replacement

Speaking of “more serious”, I made a 5’-tall version of this 10” diameter stove for a farmer who grows fruit trees (the one shown 4’ tall). By using a 6” diameter stack about 15’ tall there was enough draft to run it with the lid off, without having smoke run backwards up the 10” pipe.

It is very important to use a spark arrestor on all wood stoves. I believe the forest service requires 3/8” mesh, but I always make a capped tube of ¼” hardware cloth that extends about a foot above the end of the flue.

The air inlet is at the bottom on the left, and the 6” flue connection is at the lower right. The capped pipe at the bottom right has a mate on the other side. This option allows extra air right at the exit point, to help keep the flue entrance free of ash.

With pollution restrictions it is increasingly difficult to burn the tons of sash (branches and twigs), so they must be ground in a chipper and shipped off to a biomass disposal site. The chipper of course consumes petroleum and does its own share of polluting.

This stove was able to consume sash almost as fast as the chipper, used no gasoline or oil, and produced no visible emissions (by burning all the visible smoke).

There are agricultural processes where incredible amounts of propane and other fuels are consumed as heat. It would make a lot of sense to use agricultural waste as a source of heat – consider:

- It would spare the eco-damage of mining, refining, transporting, and burning vast amounts of fossil fuels.
- The fossil fuels would be replaced by renewable fuel, resulting in no net increase of greenhouse gasses
- Transportation costs would be greatly reduced since the fuel would be produced within agricultural areas near where they would be used.

Reflected Radiant Heating

By placing a parabolic reflector behind the stove, you can feel significant radiant heat from a dozen feet away. This is ideal for breaking the chill under a patio roof with a stove placed just outside.

A flue pipe may be conveniently wired to 10' length of ¾" metal electrical conduit for support.

Small Forced Air System

I was able to heat a small shed by enclosing the base of a stove and a portion of the flue pipe in a sheet metal shroud, and drive air through it via flexible metal tubing. A blower mounted in the shed forced air through the system. It worked OK, but would have been more efficient if I had insulated the ducting and the shroud.

A word of caution here: There is no regulating the temperature of this air, and it could get hot enough to light things on fire. The upper tube joined the shed through a metal shield to prevent it making contact with wood. All fires are dangerous, and as I am merely sharing my experiences, I can't be responsible for what anybody else may do.

I must confess that I initially mounted a muffin fan directly on the shroud, and even with air flowing through it, the radiant heat was enough to burn it up. If you aren't making any mistakes, it's because you aren't doing anything.

Insert Retrofit

Under the best of conditions, burning wood in a conventional masonry fireplace only gets about 20% of the energy available in firewood it into the living space. Typically, the percentage is much smaller. If the flue is left open between fires, a great deal of heat is then siphoned out of the house.

I blocked off my chimney at the top of the fireplace with sheet metal. I then cut a hole in it to accommodate the flue of a free-standing wood stove.