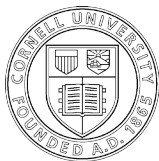


For more information, visit our web site  
**[ccetompkins.org/heatingwithwood](http://ccetompkins.org/heatingwithwood)**  
or call (607) 272-2292

*On our web site you'll find all the latest information on wood-burning technologies, health issues and emissions associated with burning wood, wood heating safety, woodlot management, invasive species, and much more to help you make the most of one our most precious resources.*

***Stay warm. And for your your family's and your community's sake, burn it right!***

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# LEARN TO BURN

## YOUR GUIDE TO HEATING WITH WOOD



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**I F PROPERLY USED**, wood is an excellent fuel source. From raw material to combustion, it's hard to beat seasoned split wood as a renewable, environmentally friendly, and inexpensive way to heat our homes and businesses. But if done improperly, heating with wood can put our health, our homes, and our environment at risk.

With the best management practices, forests can deliver heating fuel year after year—between half and one cord per acre—while at the same time being improved to encourage the growth of high-quality tree species, hold back the spread of invasive species, create optimal wildlife habitats, and decrease the likelihood of forest fires.

In most areas of New York State, wood is also a local resource. Responsible use of wood to heat buildings reduces our reliance on imported fossil fuels while strengthening our local economies. It also cuts down on transportation of fuels, which carries costs to our environment as well as our roads and bridges.

Another advantage cord wood has over many other fuels is that it can be stored for years with little or no degradation nor any risk of harming the environment. It's also preferable to fossil fuels when it comes to adding new car-

*As more people turn to wood for heating their homes and businesses, what we burn and what we burn it in are critical to ensuring we get the most out of this valuable resource without negatively impacting our health and environment.*

should be replaced with factory parts and new fasteners.

**Catalytic elements**, which became common in the 1990s, are used in wood stoves to more completely burn the combustion gases at lower temperatures. Fewer new stoves use them, in part because they have to be replaced periodically. Generally, they last 12,000 hours or about six years, provided they are cared for properly. Inspect the catalyst after a few years of use or if you see a change in stove performance. This can usually be done without removing it from the stove. Make sure it isn't chipped, cracked or crumbling, is uniform in color, and has no pieces missing. You can also gauge the condition of the catalyst by watching the smoke at the top of the chimney. There may be a little smoke as the stove heats up but it should disappear when the catalyst is engaged.

**Interior steel stove parts** may warp over time. Warped parts may allow exhaust to bypass the combustion system, producing a drop in efficiency. Warped interior stove parts should be replaced with components supplied by the manufacturer.

**Structural welded steel plates** that form the main body of some wood stoves can also warp. These parts are not replaceable so if they crack or badly distort it means the body is not suitable for continued use and should be recycled.

**Cast iron** may warp or crack over time, but it's usually a sign of severe stress caused by operating the stove too hot. Interior parts may be replaced with manufacturer-supplied parts. Exterior parts can only be replaced during a complete teardown and rebuilding.

This is just an overview of some of the main areas to look for wear and tear before every heating season, and a few things you can do to keep your wood stove firing as efficiently as possible. For more detailed information and a list of resources, visit [cctetompkins.org/heatingwithwood](http://cctetompkins.org/heatingwithwood) or contact your local wood stove retailer.

adjustment the bill pulls out easily in one or more places, you will probably have to replace the door gasket(s).

If your woodstove has a **glass** viewing window, it must also be sealed tightly to the door to prevent air leaks. This is usually done with a flat woven gasket with adhesive on one side. If you see brown streaks on the glass coming in from the door frame, this is a telltale sign the gasket needs replacing. Modern wood stoves use a clear ceramic material instead of the tempered glass of older units. Even though it can withstand very high temperatures without cracking, the ceramic glass can break if the fasteners are over-tightened or if it is struck with a poker or piece of wood. If your viewing window is cracked, replace it only with one that is factory-supplied.

**Firebrick** is used in many wood stoves to protect steel or cast iron from the higher firebox temperatures needed for better combustion. This brick can become cracked over time. When replacing firebrick, be sure to use the same brick type to maintain your stove's efficiency.

**Baffles** reflect heat toward the fire, increase the length of the flame path, and create a chamber for secondary combustion, all of which are essential for clean burning and high efficiency. They may be steel, cast iron, firebrick, ceramic fiber board, or a combination of these materials. Since they are exposed to flames on both sides, baffles get very hot and may fail over time. Removal and replacement of baffles is detailed in your owner's manual. Some stoves use special refractory material, which is usually made of firebrick or ceramic fiber. Replace this when necessary with factory-supplied components.

Many EPA-certified stoves use stainless steel **air tubes** at the top of the firebox just below the horizontal baffle. These help with air circulation and ensure more complete combustion. The intense heat in this location can cause the air tubes to sag or disintegrate over time. They are removable by undoing the fastener or turning to unlock the keyed ends. They

bon into the atmosphere: the carbon released when wood is burned is carbon that is already in the carbon cycle, as opposed to fossil fuels, whose carbon was sequestered until the fuel was brought into production.

The main concern with wood combustion is particulate matter and carbon monoxide. These can be serious health hazards, but if burned properly, in a modern, high-quality unit, wood can be a very clean fuel—and the technology is improving all the time.

The biggest problems arise from outdated or poorly maintained wood stoves, open fireplaces, and outdoor wood boilers or furnaces. Wood stoves made after 1991, when Environmental Protection Agency (EPA) Phase II-certified wood stove standards went into effect, incorporate several technologies that improve the stoves' efficiencies and result in lower emissions. It's estimated, however, that more than 70% of wood stoves currently in operation in the United States were made before 1991. Some see that as a testament to their quality construction, but, more accurately, others see that as a significant source of air pollution. The EPA is working on developing performance standards for all wood heating equipment; but, again, they may not achieve much unless older, inefficient units are phased out.

Outdoor wood boilers (OWBs) are undergoing improvements as well, and there are now voluntary standards that many manufacturers adhere to, but these units continue to be almost universally highly inefficient and significant polluters. The New York State Attorney General's Office published a report in 2005 that found that "OWBs



may be among the dirtiest and least economical modes of heating.” Note that not only do they emit high levels of dangerous particulates and smoke, but because they’re so inefficient, they give you far less heat value for your wood than other types of heaters. They have become such a public health concern that many municipalities have banned them outright, and New York is currently working on regulations.

Two-stage gasification wood-fired boilers, which maximize efficiency and minimize emissions by pumping air into a secondary burn chamber for a more complete combustion, are a much cleaner option, especially when coupled with secondary water storage tanks that minimize on-off cycling. These types of boilers can be found at prices competitive with OWBs, and have the added benefit of being able to be installed indoors or out. Wood-fired boilers with this type of technology, pellet stoves, and masonry heaters have the highest efficiency and lowest emissions of the wood-burning appliances. EPA Phase II-certified wood stoves—which all units currently sold are required to be—are the next best. In the next couple of years, we expect to see even more advances in wood stove technology hitting the mainstream home-heating market, as well as, in all likelihood, tighter EPA standards.

As more people turn to wood for heating their homes and businesses, what we burn and what we burn it in are critical to ensuring we get the most out of this valuable resource without negatively impacting our health and environment. This booklet will get you started on heating with wood safely and efficiently. For all the latest information, including more on health effects and emissions, wood heating safety, a comprehensive list of resources, and more, visit our web site at [ccetompkins.org/heatingwithwood](http://ccetompkins.org/heatingwithwood).

## WOOD STOVE MAINTENANCE

**Y**ou’re nearly ready to put some of that nice, dry wood in your wood stove, but first, there’s one more important thing you need to do: make sure everything is in proper working order. It is not always possible to generalize about service and maintenance of wood stoves because of the differences between them. But there are some important areas to look for wear or damage before every heating season in order to keep your wood stove working the way it was intended to.

Less a performance issue than a safety one, check your **stovepipe** for creosote buildup—better yet, have a certified chimney sweep check it for you. Remember, a hot fire can ignite the creosote and create a chimney fire. Also look for leaks in the stovepipe. Make sure all connections are tight and the pipe itself is in good condition.

In order to work at maximum efficiency, wood stoves need to retain their air tightness as well, allowing air only through controlled points. EPA-certified Phase II wood stoves have various features that draw in air for a more complete combustion of the gases that are created as the wood is heated up. But if not properly maintained, these stoves can form leaks and other problems that can drop their efficiency considerably.

Virtually all modern wood stoves use **gasket material** around the loading doors to seal them, and some ash pan doors also have gaskets. Look for obvious wear or areas where the gasket has come loose. Then, when the stove is cold, test the seal on the loading door by opening the door and placing a dollar bill across the gasketed area and closing and latching the door. If there is an area where the bill slips out easily, the door seal needs attention. Some stoves have a mechanism to adjust the door. Check your wood stove manual and, if possible, try this first. If the door is not adjustable, or if after

Once delivered, stack the wood as soon as possible. Always stack firewood off the ground—pallets are a good first layer. Then, loosely stack the wood no more than two layers deep (see Figure 4). End caps built up with alternately stacked firewood or using 2 x 4s will keep the pile together. In the Northeast, it's important to keep your wood pile covered—you'll gain more from protecting it from rain and snow than you would from exposing it to the sun. Metal roofing sheets or plastic tarps make good covers. Just be sure to cover only the top, leaving the sides exposed so that air can flow through. Our web site will have some more suggestions for stacking firewood, including photos.

It's a good idea to buy your wood at least one whole season ahead. That way, you'll be burning firewood that's been fully seasoned and you will always have dry wood at your fingertips. Think of it as an investment in your heating. The more wood you're able to have properly drying on your property, the better. Finally, try to buy your wood in the spring, when it's cheaper and dealers aren't as busy, so you'll get it quicker.

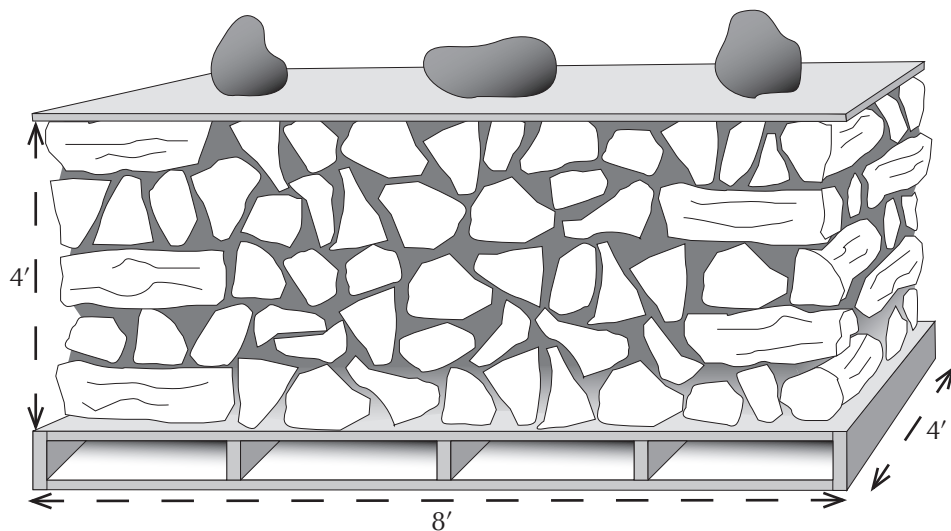


Figure 4. A nicely stacked full cord of firewood.

**B**efore striking the first match or even setting the first piece of firewood in your wood stove, be sure to read your owner's manual. In most cases, your wood stove manual will provide excellent guidelines for the best way to get—and keep—a fire going, along with how to operate your wood stove optimally and what practices to avoid. And be sure to install a carbon monoxide (CO) detector in addition to smoke detectors—each year CO from household appliances, including wood stoves and other types of heaters, kills roughly 500 people and sends another 15,000 to emergency rooms in the United States alone.

### SELECT THE BEST FUEL

Burn only fully seasoned wood: wood that has been properly dried for at least six months and has reached a moisture content of about 20% or less. Seasoned wood burns much more efficiently, resulting in less wood consumption and far less particulate matter emissions. Basically, burning fresh or wet wood pollutes more and is a waste of money because it takes energy—in the form of burning wood—to boil off the excess water. See “Buying and Drying Firewood” on page 9 for some tips on getting your wood to 20% moisture.

Burning wet or green wood also results in more creosote buildup in your stovepipe. Creosote is a tar-like substance consisting of oils that didn't completely burn in the wood stove. These oils can condense on the pipe and become a serious fire hazard. As the creosote builds up it's likely to ignite, creating a chimney fire.

You may hear a lot about burning the right kinds of wood. Hardwoods such as oak, hickory, and black locust provide the most heat per weight, but as long as the wood is dry, a small amount of soft woods is okay. Soft woods such as poplar, aspen,

and spruce are also good for milder spring and fall weather because they burn quickly and light easily.

## **BURN ONLY WOOD**

Among the most important things not to do is put anything in your wood stove that shouldn't be burned. It can not be stressed enough, so we'll say it again: except for a small amount of newspaper (no colored, slick inserts!) to start the fire, never burn anything other than seasoned firewood in a wood stove. Junk mail, bills, glossy magazine pages, and wet or rotting wood may seem like reasonably good fuel, but they all burn poorly and release high levels of particulate matter, which contains dangerous particles that can enter your lungs but can't escape. This can cause a host of health problems, including asthma and other respiratory diseases and cardiac issues and they can even damage your immune system.

Other items commonly burned in wood stoves are even worse.

### ***Never burn any of the following:***

**household trash**

**plastics**

**cardboard**

**Styrofoam**

**driftwood (especially from salt water)**

**pressure-treated or painted wood (including varnishes, sealants, and wood sprayed with pesticides)**

**plywood or particleboard**

In New York State, as of October 2009, "burning household trash, whether in an open pit, burn barrel or a wood stove is illegal." That includes any of the items listed above. (For more information, go to the Department of Environmental Conservation's [DEC] web site: [www.dec.ny.gov](http://www.dec.ny.gov).) There's a good reason

that they'll be delivering or make available for pickup. If they brush you off or won't let you out to their site, you may want to try someone else. Due to liability concerns, they probably won't let you wander around by yourself or climb on the woodpiles, but they should be open about their operations. Note that many firewood dealers cut wood as a second job, so allow them ample time to respond.

In many areas, it's illegal to move firewood from one area to another, because of the threat of spreading invasive insects that are destroying certain types of trees. In New York State, the limit is 50 miles. So, make sure your firewood dealer is getting his wood from less than 50 miles away and never transport the wood further yourself, not even for camping trips. We will have more information about invasive insects on our web site; in the meantime, you can visit the DEC's web site. In New York State, when advertising firewood, dealers are also legally required to adhere to certain definitions (see table, below).

In New York State, when advertising firewood, dealers are legally required to adhere to the following definitions:

A **full cord** is a stack of firewood measuring 4ft x 8ft x 4ft

A **half cord** = 4ft x 8ft x 2ft

A **third of a cord** = 4ft x 8ft x 16in

A **face cord** = 4ft x 8ft x 16 or 18in

A **rack** = 4ft x 8ft x 18in

A **truckload** = 9ft x 9ft x 3ft

If the word "seasoned" is used in advertising firewood, the dealer must specify how long it has been seasoned and whether it was air or kiln dried.

meter. You can buy a basic one for under \$30. Most wood moisture meters have two short probes that are inserted about a quarter inch into the wood. This will obviously only give you the moisture level at that depth—it could be higher deeper in. To get a more accurate reading, you could split a few pieces and test the moisture inside, as well.

Freshly cut wood will have bound and unbound moisture. The latter is released fairly easily, and can get the wood down to 25% to 30% moisture content. Bound moisture, on the other hand, takes much longer to evaporate. Depending on your location—if your woodpile is in a shady spot or near a stream or lake—it may take significantly longer than six months for your firewood to get to 20% moisture content. Certain types of hardwoods also take longer to fully season. For some tips for accelerated drying, go to our web site, [csetompkins.org](http://csetompkins.org), and type in “Accelerated Seasoning of Firewood” in the search window.

Before purchasing firewood, it’s a good idea to do some background research. Ask other people who burn wood where they’ve been getting their firewood and if they’ve been happy with it. Then, call around to different dealers and ask them some questions, including how long ago the wood was split and how it was stored before it was split, what kind of wood it is, where the trees were taken from, what kinds of forest management practices the loggers practiced, and find out if it’s competitively priced for your area. Finally, ask them if you can go see where the wood is stored

*Because of the threat of spreading invasive insects that are destroying certain types of trees, ... make sure your firewood dealer is getting his wood from less than 50 miles away and never transport the wood further yourself, not even for camping trips.*

it’s illegal: the number of toxic chemicals these materials release into the air when burned could make your head spin—and literally could land you in the hospital. They include:

- dioxins**
- volatile organic compounds (VOCs) (such as benzene, toluene and methyl chloroform)**
- furans**
- halogenated hydrocarbons**
- chlorinated fluorocarbons**
- carbon monoxide**
- carbon dioxide**
- sulfur dioxide**
- heavy metals (including lead, barium, chromium, cadmium, arsenic and mercury)**

### **BUILD THE BEST FIRE**

When you bought your wood stove, you probably noted its efficiency. That number was reached through tests conducted in a controlled laboratory environment. Real-world efficiencies are very dependent on the operator—how you use your wood stove could greatly affect both its efficiency and emissions.

To build an efficient fire, first, always make sure the dampers are completely open. Then, pile up a small amount of kindling in a crisscross or pyramid pattern (see Figures 1 and 2). Use smaller pieces on the bottom, working up to pieces 2” to 3” in diameter at the top. Stacking the

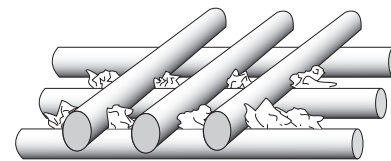


Figure 1. Crisscross pattern

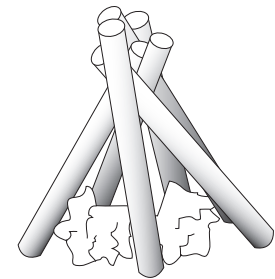


Figure 2. Pyramid pattern



kindling on a small amount of crumpled-up newspaper will make things easier, but remember, no glossy inserts, magazine pages or junk mail.

One of the most common fears of any wood stove owner is not getting the draft going on first firing up the wood stove, leading to a billow of smoke in the house. To get a strong draft started, try twisting up a piece of newspaper so it's a couple of feet long and light the end. Hold it high inside the wood stove firebox and, after a few seconds, carefully light as much of the rest of the newspaper as you can. Then, place the twisted-up piece on top of the kindling pile and gently close the door.

Another problem that is sometimes hard to avoid is catching a backdraft, which occurs when it's windy outside. While it's no guarantee, if you feel a draft coming down the stovepipe when you go to light the fire, try keeping a door or window near the wood stove open for a couple of minutes while you start the fire.

### **KEEP THE FIRE GOING**

Once the kindling has caught and the fire is burning brightly, you can load more wood. Always open the wood stove door slowly, to prevent a sudden backdraft of smoke into the house. It's important to allow for plenty of air circulation and to never let the fire smolder—maintain a bright, strong fire. An inexpensive stovepipe thermometer is a good way to ensure the fire is staying in the right temperature range. The wood stove should be allowed to burn the wood as completely as possible. If the fire is damped down too far it can't get enough air and it will burn inefficiently and produce a lot more smoke.

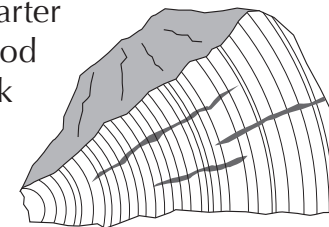
Remember, if you see smoke, you're not getting the most heat value from your wood, creosote is likely condensing on your stovepipe, and you and your neighbors are breathing potentially toxic pollutants.

## BUYING AND DRYING FIREWOOD

If you've ever heated your house with wood you know there are some trade-offs to the many benefits. In addition to the health concerns, using wood as a fuel takes quite a bit more work than heating with something like oil. Of course, firewood won't ever result in an Exxon-Valdez-sized disaster, but it does require some proper handling, mainly in the way it's seasoned, or dried. And in most cases, that requires some planning.

The start of the heating season is not the time to buy firewood. Most firewood dealers sell green, or freshly cut, wood, which could have a moisture content of 100% or more (100% moisture content means half the weight of the wood is water). In many areas, you can buy seasoned or kiln-dried wood, but you'll pay a premium for it. It's important to burn only wood with a moisture content below 20%. Remember, burning wet wood creates more smoke, which contains harmful chemicals and particulates and forms creosote on your chimney. It also gives you less heat, because it takes energy to boil off the excess water. That means wasted money.

The simplest way to make sure your wood is dry is to look for checks in the end grain. As wood dries the ends will usually split open up to a quarter inch (see Figure 3). Seasoned wood also has a distinct sound—knock two pieces together and you'll get a crisp, solid sound. Green wood will make a duller, muffled sound. Over time, you'll gain a feel for telling dry from green wood.



*Figure 3. The end grain of seasoned firewood will usually show checking.*

If you're unsure about the moisture content of your wood or want something more accurate, try using a moisture