

Fuel Efficiency & Conservation



From the Colville National Forest

Firewood

Selecting the Right Firewood

Firewood heat output is measured in “British Thermal Units” or BTUs. One BTU is the amount of heat needed to raise the temperature of one pound of water one degree Fahrenheit.

Tree species with dense wood provide the best firewood, releasing more BTUs per volume of wood than species with less dense or lighter-weight wood. The dense wood of eastern hardwoods -- such as hickory and oak -- rivals coal in heat values.

One ton of anthracite coal produces 26 million BTUs of heat. Hickory produces 28 million BTUs of heat per cord. One cord equals 128 cubic feet of wood (4'x4'x8' stack).

The figures below represent the potential heat values from dry wood of common Western tree species (the moisture content of firewood and the efficiency of woodstoves or fireplaces will reduce actual heat values). Many modern wood stoves reach efficiencies over 70% — while typical fireplaces have efficiencies in the 5 - 15% range.



Western larch and Douglas-fir provide the best heat value of all tree species in northeast Washington.

Equivalence
in BTU's to
Million
a Ton of
Coal

Tree	BTU's/Cord	Equivalence in BTU's to Million a Ton of Coal
Western Larch (Tamarack)	22.3	86%
Douglas-Fir (Red Fir)	20.6	79%
Lodgepole Pine	17.5	68%
Ponderosa Pine (Yellow Pine)	17.1	66%
Grand Fir (White Fir)	16.7	65%
Spruce	15.0	58%
Subalpine Fir	13.6	53%

Economics of Wood Heat

The economics of heating your home with wood are difficult to determine because of the variable nature of home heating. The problem becomes one of comparing the costs of heat obtained from various fuels.

Fuel cost comparisons can be easily computed. For example, suppose you are interested in comparing the cost of the heat value from a cord of firewood to the other fuels listed below. For comparison to natural gas, this calculation is as follows:



$$\frac{80/\text{Therm}}{85,000 \text{ BTU/Therm}} = \frac{?/\text{Cord} [\text{\$}89.98]}{11,247,500 \text{ BTU/Cord}}$$

Heat values and costs per unit for common fuels, adjusted for heater efficiency is presented below.

Fuel/Heater	Unit Heat	Btu/Heat Unit	Cost(\$/unit)	Heater Efficiency (%)	Actual Heat Value (Btu Unit)
Natural Gas/Furnace	therm	100,000	0.80	85	85,000 BTU/Therm
No.2 Fuel Oil/Furnace	gal	141,075	1.53	80	112,860 BTU/gal
Baseboard Electric	kwh	3,413	0.05	100	3,413 BTU/kwh
Propane/Furnace	gal	91,000	1.29	85	77,350 BTU/gal
Standard Heat Pump	kwh	3,413	0.05	220	7,509 BTU/kwh
Airtight Wood Stove	cord	20,450,000	90.0	55	11,247,500 BTU/cord

*Fuel prices may vary by location and should be considered as averages only.

Fuel/Heater Cost Equivalent to Cord of Firewood

Natural Gas/Furnace	\$ 89.98
No. 2 Fuel Oil/Furnace	\$152.48
Baseboard Electric	\$164.77
Propane/Furnace	\$187.58
Standard Heat Pump	\$ 74.89

If you pay more than the amounts shown here for a cord of firewood, you would be better off heating with the other fuel listed.

Stove Standards & Emissions

How You Can Reduce Emissions

The most effective means to reduce air pollution from wood-burning appliances is to buy a new, efficient, EPA-certified woodstove, or to install a catalytic combustor on your existing stove. Catalytic combustors are honeycomb-shaped devices that improve combustion efficiency by burning particulate matter and other gases before they escape up the stove pipe. Efficient stoves use less wood to produce the same amount of heat. Burning fuel cleanly reduces the amount of creosote buildup.

Tips for Cleaner Burning

- Burn only dry, seasoned wood. Be sure your firewood has been split and dried for at least one year.
- Never burn wet, painted, stained or treated wood, color newsprint, plastic, garbage, diapers or magazines. Items such as these produce high amounts of odor, smoke and toxic fumes.
- Store your firewood under cover. A shed or shelter is best. If you use a plastic tarp, allow ventilation to prevent condensation.
- Burn small, hot fires. This helps the wood burn completely and cleanly.
- Never allow the fire to smolder. Smoldering fires are the worst polluters because they burn at a temperature too low for efficient combustion. The result is more smoke -- unburned wood going up the chimney, wasted.



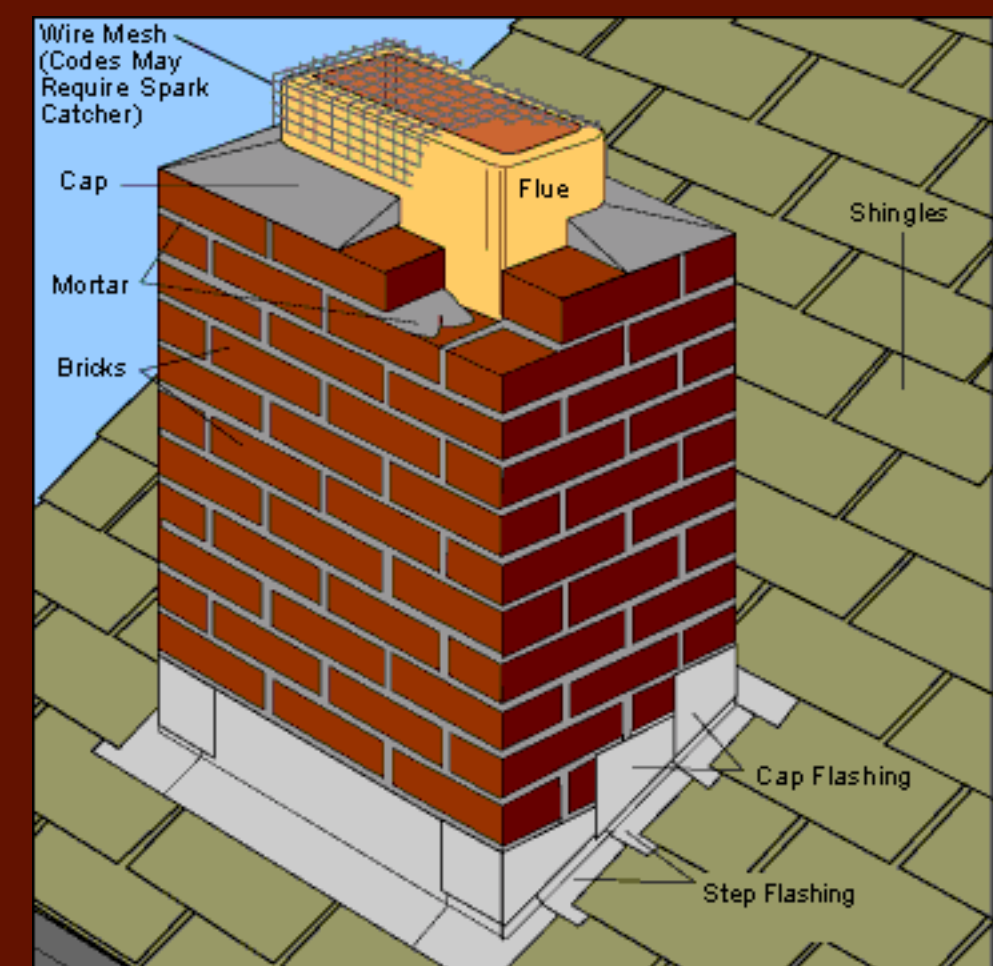
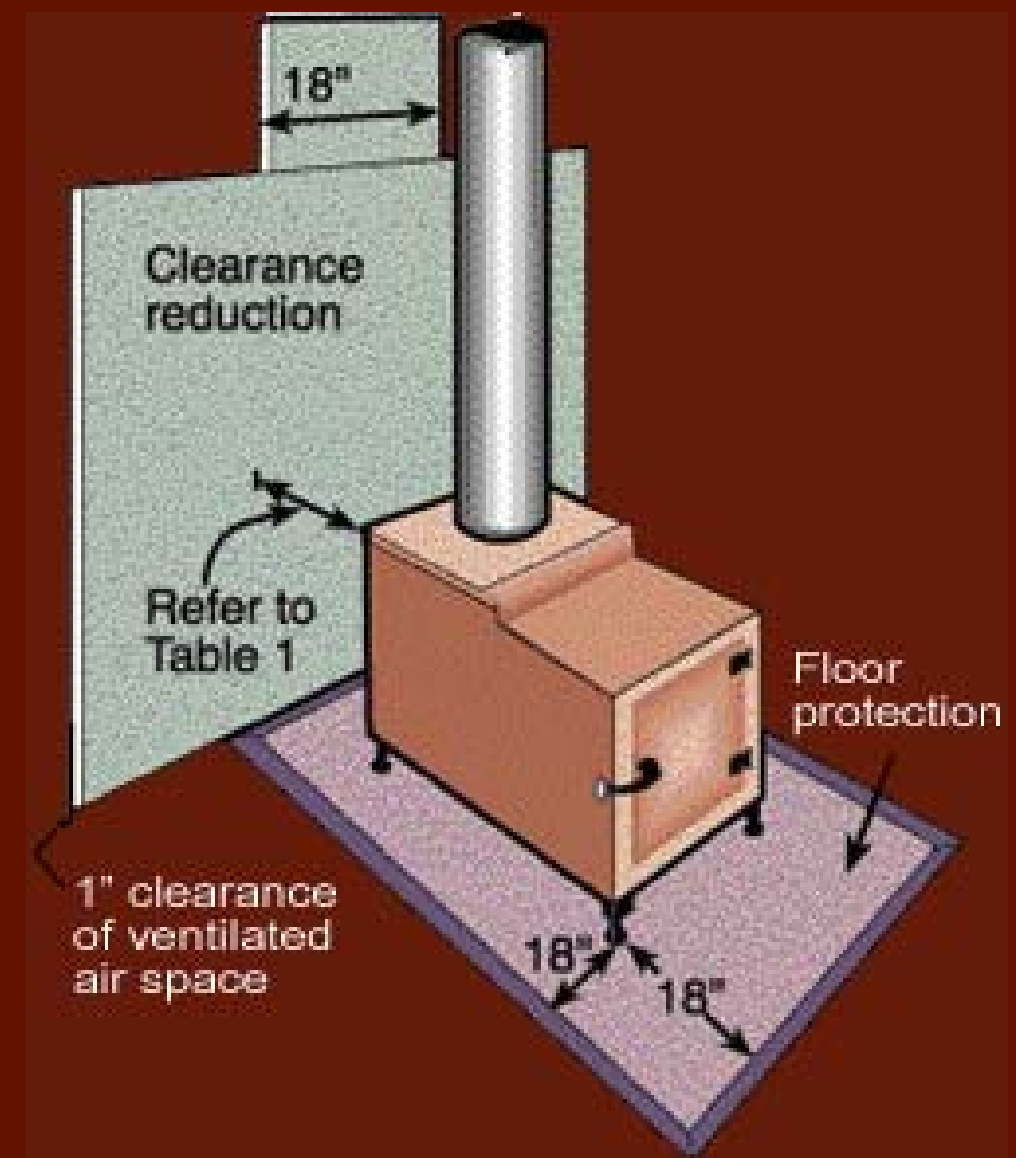
- Purchase a fuel-efficient woodstove that provides sufficient airflow for complete combustion of your firewood.
- Step outside and look at the plume from your chimney. You should see only heat waves. If you can see smoke, your wood is not burning completely. Increase the air supply to your fire.
- Size your wood stove properly. A stove that is too large for the space to be heated will have to be damped down, causing much smoke and wasting wood.
- Do not burn in moderate temperatures. Your stove will tend to overheat your house. You will want to close the dampers to cut back on the heat, which cuts oxygen to the fire, wastes wood and increases pollution.
- Install your stove properly -- make sure the installation meets the specifications for your model. Install only certified stoves.
- Don't install a wood stove until you've considered all of the other ways to cut heating costs such as weatherizing your home.

Wood Heat Safety

As with any heating system, it is critical that a wood burning system be installed properly so that it is completely safe. If you are considering adding a wood heat system, you should check with your local fire department for information on installation and maintenance of your system.

Your insurance company should be notified, and they can provide you with a checklist of safety considerations. Most insurance companies have strict requirements for keeping a wood stove a set distance from a combustible surface, having safe venting systems and chimneys, and installing smoke detectors. Some companies will also require an on-site inspection by a fire department or company official. These strict standards are not designed to be deterrents to the use of firewood, but should be considered as safety features for your benefit.

By far the most dangerous wood stove installations are those done in a makeshift way by untrained people. While installing a wood stove may seem a simple matter, a safe installation calls for a lot of specialized knowledge. Seek professional help to install your wood stove.



Tips for Safe Operation

- Make sure your battery-operated smoke detector is functioning.
- Check combustible materials around the stove or fireplace and all exposed parts of the chimney, including in the attic, for signs of overheating; wood starts to darken as it overheats.
 - Burn small, bright fires to make the most effective use of the fuel, while avoiding the overheating that results from burning large, intense fires. Don't try to heat the whole house, but concentrate all your activities in the room where the heater is and let the rest go cold.
- Shovel ashes into a metal container, take it outside immediately and empty it in the yard away from trees and shrubs; never put a bucket full of ashes in the basement or on a wooden porch floor, and never put ashes in a wood or cardboard box.
 - If you can't keep the wood stove from smoking, stop using it because you and your family could suffer carbon monoxide poisoning.
 - Never leave your wood stove unattended.

Caring for your Firewood

Allow your firewood to dry completely before use. Drying (seasoning) fresh green wood may take several summer months. Drying time can be shortened if the wood is cut to firewood length and split. Splitting is easiest when wood is frozen or green and should be done before the wood is stacked.

Firewood should be stacked outside and away (more than 25 feet) from your home. It should be protected from rain and snow. Firewood must be properly stacked for satisfactory drying. The greater the surface area exposed to air, the more rapid the drying. Wood should be stacked loosely and kept off moist ground.

Keep the area around your wood pile clear of weeds, leaves and debris. Discourage rodents, snakes and insects and other unwanted pests from making their homes in the stacked wood.

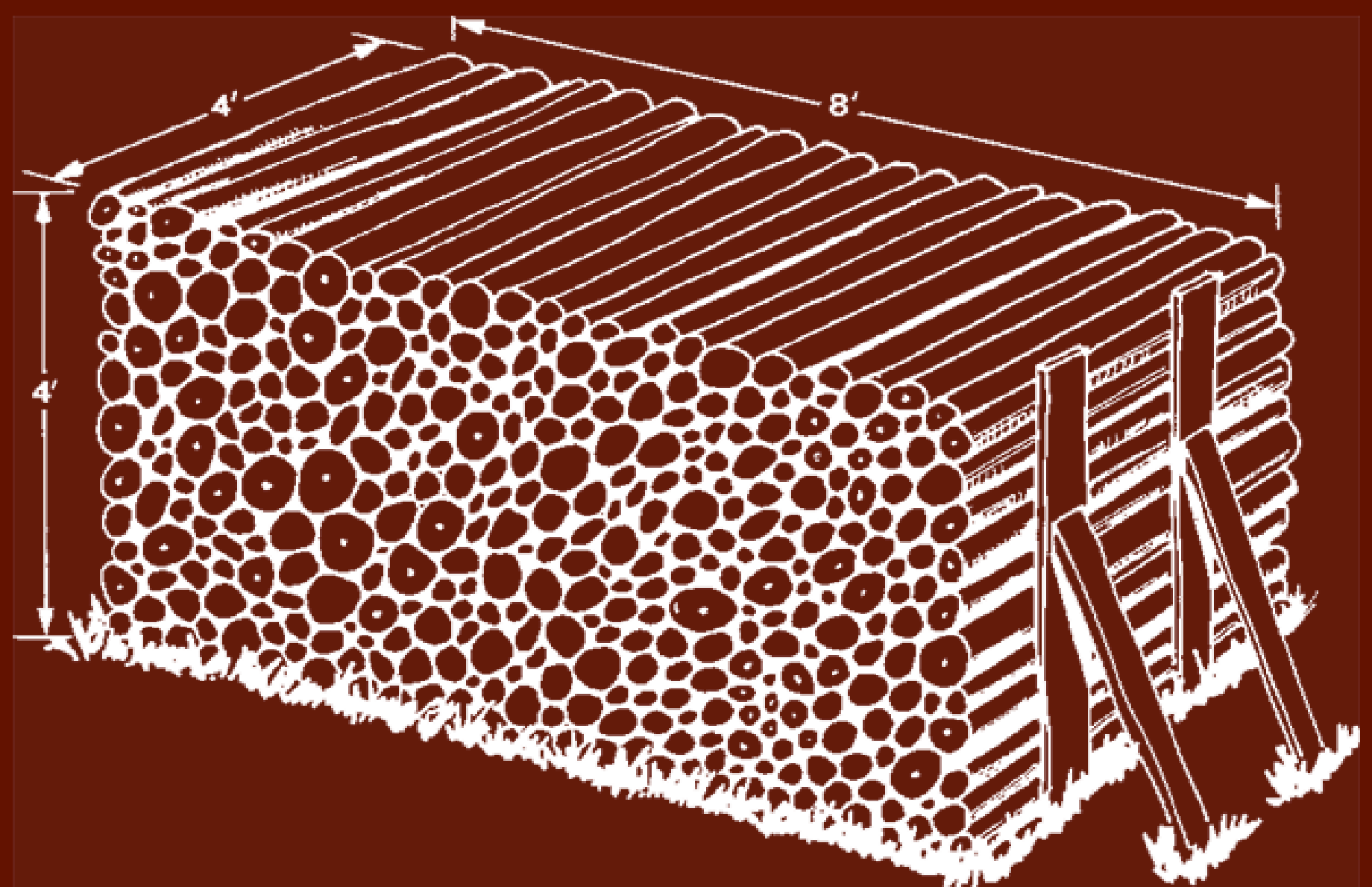
It is possible for bark beetles to overwinter in your firewood. If you have ponderosa pine growing on your property, these insects can emerge in the spring and infect live trees. If insects are present in your wood pile, cover the wood with clear plastic, in full sunlight. Properly “solarized”, any live insects will not survive the high temperatures generated under the clear plastic. The plastic should be sealed at the ground to hold in the “greenhouse-generated” solar heat, which can reach temperatures up to 160 degrees F.

Avoid storing large quantities of firewood in the house, warm garage or basement because the heat will activate insect and fungi or spore activity and bring about hatching of any insect eggs in or on the wood.

How much firewood is in a cord?

Firewood is measured in cords. A standard cord is a pile of 4-foot-long pieces of wood, 4 feet high, and 8 feet long, occupying 128 cubic feet of space.

Often, however, pieces shorter than or longer than 4 feet are cut, piled and measured in cords. When pieces are less than 4 feet long, a stack 4 feet high and 8 feet long is called a short or face cord; when pieces are longer than 4 feet, a similar stack is called a long cord.



Environmental Quality

Because wood stoves are a romantic and cost-efficient way to heat a home, the sale of wood-burning appliances has increased 112 percent since 1992. Along with this increase has come a decrease in air quality in populated areas from the incomplete or incorrect burning of firewood. Low-energy materials like wood and charcoal release more pollution by volume than high-energy fuels like propane and natural gas.

Residential fireplaces and stoves, like fires, release wood smoke pollution. On the East Coast, wood smoke pollution is a regional concern. In the West, wood smoke becomes a local issue because the mountain topography and cold weather inversions inhibit its dispersal.

Wood smoke pollution has been linked to a variety of lung ailments and other health complaints. People think that because wood smoke is all natural, it can't be bad for them. Tobacco is all natural too, but the Environmental Protection Agency (EPA) estimates the cancer risk from wood smoke to be 12 times greater than from an equal amount of tobacco smoke.



Smoke goes Everywhere

Many of the particles produced by incinerated wood are smaller than 2.5 microns (one-fourth the diameter of a human hair). These tiny particulates seep through the smallest cracks and crevices, and once inhaled, can elude the body's natural purification mechanisms.

Particulate pollution is a serious health risk -- when particle levels in the air go up, people die. A number of studies show that there are changes in electrocardiogram patterns, which are risk factors for arrhythmia. There are also changes in inflammatory markers in the blood, which are risk factors for heart attack.

Health consequences people commonly experience after being exposed to wood smoke include eye, nose, mouth, and throat tenderness; coughing; trouble breathing; tightness of the chest; or symptoms related to preexisting respiratory ailments like emphysema.

Besides particulates, wood smoke contains nitrogen dioxide, carbon monoxide, and many organic compounds such as aldehydes. Some of these substances are suspected carcinogens while others are known to cause cancer, irritate the nose and eyes, or damage lung tissue.

To reduce pollution, consumers can install highly efficient stoves and fireplaces. These fireplaces burn wood more completely and release fewer pollutants.