Wood Heat, an Alternative Fuel for Homes

Conservation First

High home heating costs might send you searching for alternative fuels. Before altering or replacing your present heating system, reduce your home's heat loss as much as possible. Adding weather-stripping and insulation, and performing furnace maintenance can cut a home's energy usage by 20 to 50% and make it more comfortable in winter and summer. To reduce costs even more, consider wood heat.

What Type of Wood?

Cordwood, which is readily available in New England, is either hardwood or softwood. A cord of wood is a stacked pile 4' x 4' x 8' or 128 cubic feet. When sold at $180/cord, it is about 3/4 the price of natural gas at $1.50/therm and 2/3 the price of fuel oil at $2.50/gallon. If you have a woodlot or permission to use one, you can save by cutting your own.

Hardwoods, such as oak, hickory, sugar maple, and white ash, are preferred and contain about twice the heat value of softwoods.

Softwoods, such as pine, spruce, and hemlock, lack good heating qualities. Less desirable woods have lower heat values, are difficult to split, can cause a creosote problem, and generate more smoke and sparks because of resins and trapped moisture.

A popular, but more expensive, alternative to cordwood is wood pellets. Sawdust and other biomass products are processed into pellets about ¼ inches in diameter and 1 inch long and sold in 40-pound bags. This fuel, which must be burned in a specially-designed stove, has a low moisture and ash content and a high heat value.

If your home uses 800 gallons of fuel oil, 1200 gallons of propane, or 1100 therms of natural gas, you will probably burn 5 to 6 cords of wood or 6 to 7 tons of pellets to heat your home with an efficient stove.

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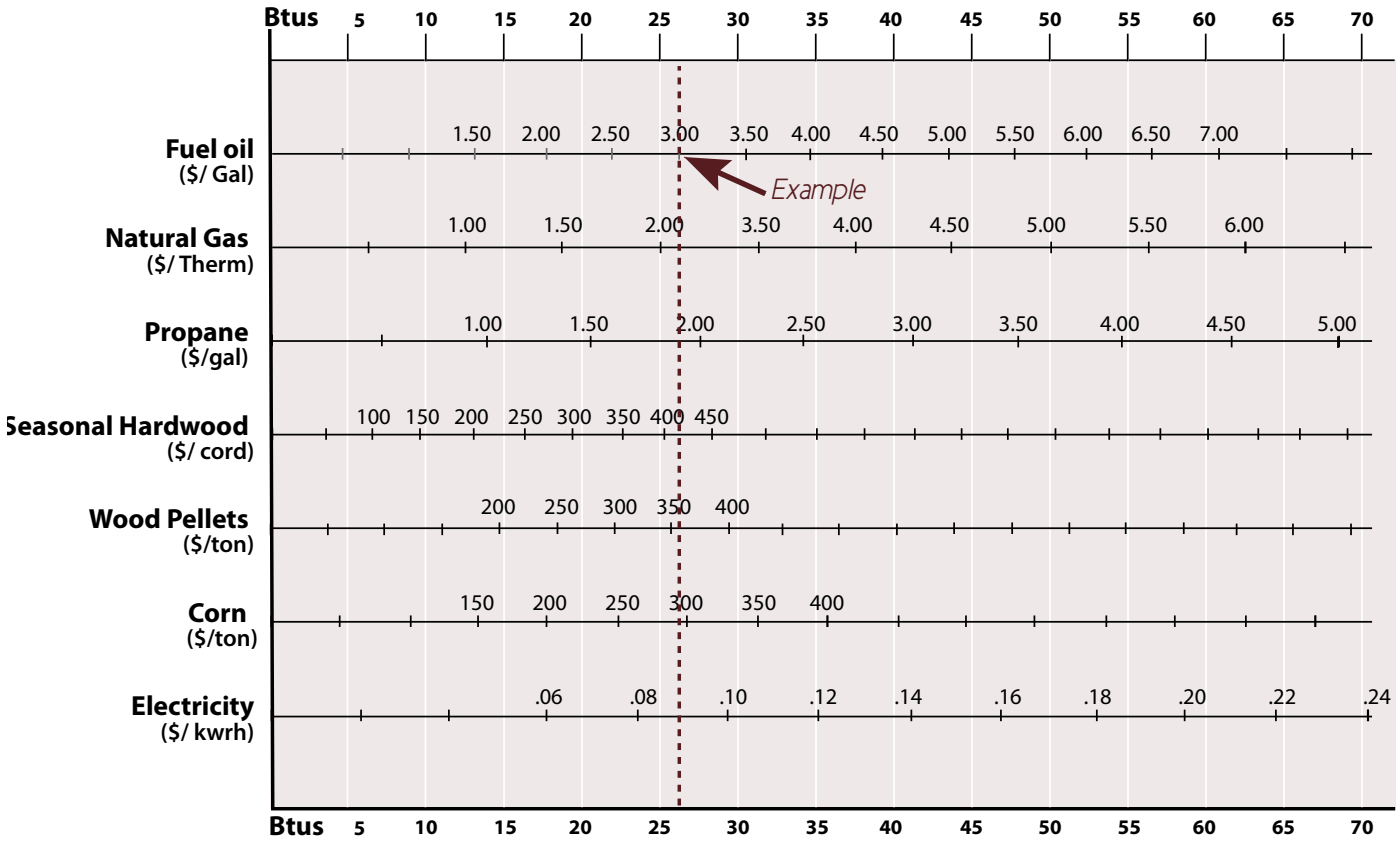
Comparing Heating Fuel Costs



Understanding the chart:

Select a fuel you wish to compare from the left column.

Follow the horizontal line to its right until you find your current cost per unit.

Look vertically up and down the column to see approximate costs for other fuels.

Example:

To compare fuel costs find "fuel oil" in the left hand column. Follow the line to what it costs to buy a gallon in your area, in the example $3.00 a gallon. The dotted vertical intersects the equivalent cost of other fuels on the chart for the same amount of heat.

In the example, fuel oil for $3.00 a gallon is selected. Following the dotted verticle line, we find that cordwood would have to cost $403.00 a cord before it is more expensive than oil.

Assumptions on Fuel Efficiency

Fuel oil	138,000 Btu/gallon	83% efficiency
Natural gas	100,000 Btu/therm	80% efficiency
Propane	92,500 Btu/gallon	79% efficiency
Seasoned hardwood	20,000,000 Btu/cord	77% efficiency
Wood pellets	8,000 Btu/pound	83% efficiency
Shell corn	7,000 Btu/pound	80% efficiency
Electricity	3413 Btu/kilowatt-hour	100% efficiency

What Type of Stove?

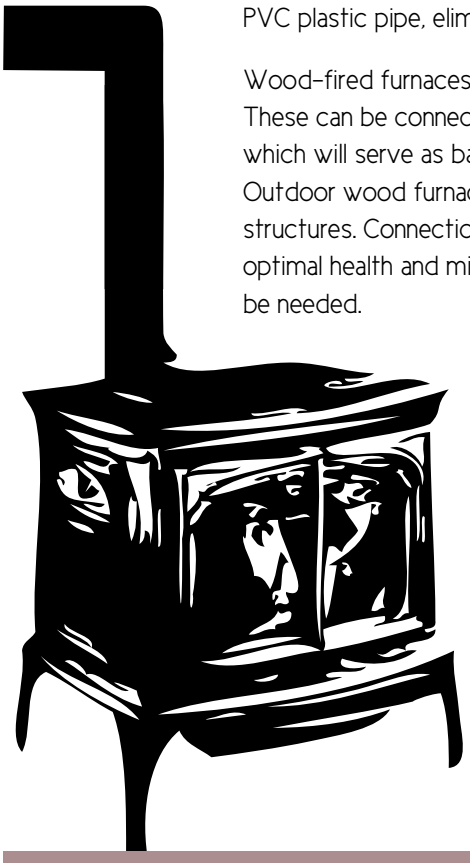
An experienced stove dealer can suggest a unit for the number of rooms or cubic feet you want to heat.

Radiant stoves use wave energy to heat objects and people the way the sun does. The closer you are, the warmer you are. Circulating stoves have a metal enclosure about two inches from a firebox. They circulate room air naturally or with a blower and heat the whole room. Their surface is cooler and, therefore, safer around children.

The most common materials, plate steel and cast-iron, hold up well to the heat generated by fire. A firebrick liner can protect the metal and retain a higher temperature in the firebox. By decreasing the smoke generated and increasing heat recovery from the wood, manufacturer-added baffles or catalytic combustors help meet Environmental Protection Association emission standards.

Placement and connection depend on the unit. A regular wood stove, which can go in a fireplace, corner of the room, or basement, uses an existing or new masonry chimney flue or an approved stainless steel factory-built one. Some pellet stoves are vented outside with common PVC plastic pipe, eliminating the need for a chimney.

Wood-fired furnaces and boilers go in the basement. These can be connected to an existing fossil fuel system, which will serve as backup when the fire goes out. Outdoor wood furnaces are installed outside away from structures. Connecticut regulates their placement for optimal health and minimal nuisance. A zoning permit may be needed.



Installing the Stove

Avoid fire hazards with safe and proper installation and operation. A building permit and inspection are required, and, usually, the insurance company requires notification.

All new stoves and furnaces must meet Underwriters Laboratories, Inc. (UL) standards. Follow the operating manual for safe installation procedures and wall and floor clearance particulars. National Fire Protection Association (NFPA) standards apply to units without a UL listing. The local building inspector has this information.

Combustibles, such as the wood supply, furniture, and draperies, should be kept at least 36 inches away. Protect combustible floors and walls. Install smoke detectors just outside bedrooms and above the stove. Place a fire extinguisher near the entrance to the room with the stove.

Before connecting a stove or furnace, hire a chimney sweep to do the difficult and hazardous job of chimney cleaning and inspection. The sweep should check for a cracked lining and make sure the chimney's mortar joints are solid.

Consult the installation manual for chimney flue size requirements. If the flue is too small, it restricts combustion gas venting and causes smoke. A flue that is too large, such as a fireplace flue, reduces the draft and cools the combustion gases to create creosote. Install a stainless steel liner to make the flue smaller. Building codes forbid connecting a solid-fuel heater to a flue serving appliances burning other fuels.

Operating the Stove

Depending on the size of the firebox and the amount of heat needed, you may need to add fuel every couple of hours or only once or twice a day. Refuel automatic fuel feed pellet stoves once every day or two.

Before starting a fire, open the draft control and bypass dampers and lay a large piece of dry wood along each side of the firebox. Place crumpled newspaper and dry kindling wood between these pieces. Add a couple of smaller dry wood pieces to the top and light the newspaper. Once the kindling is burning, larger pieces can be added. Refuel with larger pieces as the fire burns down. Adjust the damper to control the fire intensity.

All cordwood needs to be seasoned (dried) before use; stored under cover and off the ground (e.g., a tarp on top and pallets underneath), and easily accessible during the heating season.

Wood combustion stops if fuel, air, or heat is removed. A lack of air causes wood to smolder and produce pollutants. Too much air cools the fire and wastes heat. Burning wood goes through three stages, which can be present in the firebox at the same time.

First stage – the wood is heated to evaporate and drive off moisture. This heat does not warm the stove or room.

Second stage (500°F – 1100°F) – The wood starts to break down chemically at 500°F and volatile matter is vaporized. The vapors contain between 50% and 60% of the heat value of the wood. The vapors burn at about 11 OO°F. This high temperature and adequate oxygen are required for maximum combustion efficiency.

Third stage (over 11 OO°F) – After the volatile gases are driven off, the remaining material (charcoal) burns with little or no flame and only ash is left. All three stages usually take place at the same time in a fire.

A smoky fire is an indication of incomplete combustion. There are six main causes of a smoky fire:

- Wet wood – green or wet wood where much of the heat of the fire is needed to dry the wood.
- Flue too large – The flue gases are cooled too much in the chimney. Install a stainless steel stove pipe through the center of the chimney.
- Obstructed flue – a heavy layer of soot or creosote in the flue can reduce the opening and restricts the flow of flue gases.
- Down drafts – Nearby trees, buildings or roof projections can cause downdrafts during windy periods. The height of the chimney or the addition of a cap may correct this problem.
- Lack of oxygen – In modem, tight homes, air infiltration is limited. Air for the fire may be restricted. A source of make up air, such as cracking a window or a PVC pipe through an exterior wall may be needed.
- Too much ash in the firebox may restrict airflow.

A low or smoldering fire causes creosote, which is unburnt carbon and other impurities that forms a black, sticky coating on the stovepipe and chimney. A very hot fire can ignite accumulated creosote, crack the flue lining, and cause a chimney or house fire.

Put ashes in a steel pail away from combustibles when they build up deeper than two inches in the firebox. You may apply ash residue, high in potash, to your lawn and garden at the rate of 10 pounds/100 square feet per year. This lime substitute enhances the soil's pH.

For more information, see Heating with Wood and Coal (NRAES 23), which is available for $12 from the Communications & Information Technology Resource Center Store, 860.486.3336, store@uconn.edu, or Room 2 in the W.B. Young Building.