

## Wood Heating Case Study

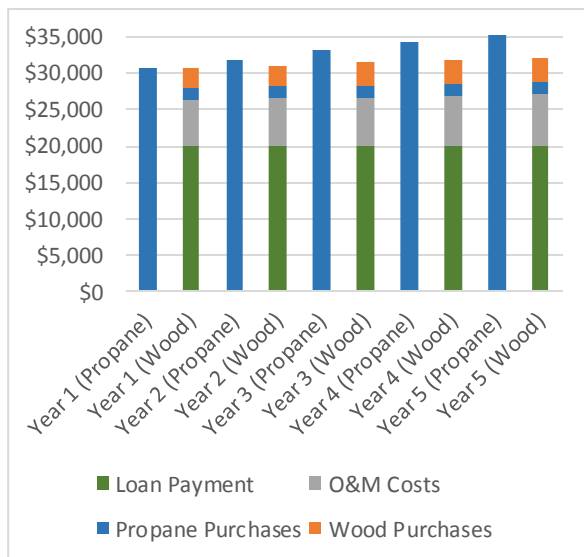
**Scenario:** A greenhouse operation currently heats with propane using a central boiler and a number of stand alone propane heaters to heat several greenhouses.

**Goal:** Utilize community waste wood to heat all greenhouses with a central, wood chip boiler (maintaining the propane system as a backup).

**Heating Needs:** The current growing space is approximately 70,000 square feet of enclosed greenhouse area (requiring 16,500 gallons of propane to meet the desired heating needs).

**Outcomes:** The feasibility study concluded that the facility could meet its heating needs using only 200 tons of wood chips each year (reducing fuel costs by \$25,000 in the first year).

**Financing Wood System:** It was estimated that the cost of converting to wood heating was \$800,000. With grant funding, the operation would only need to finance \$250,000 of the total cost. The graph below shows the first five years of heating costs of wood (including loan payments) versus propane. This facility would have slightly higher heating costs in the first year (\$161) after the switch to wood heat, with each subsequent year providing increasingly lower heating costs (saving more than \$100,000 during the 15-year loan period).



## Financial Assistance Programs\*

\*This is not a complete listing of available programs.

### TREES Heat Nebraska Nebraska Forest Service (NFS)

- 100% grants for the completion of initial feasibility studies (up to \$20,000)
- 50% of project cost, grants for the purchase, construction and installation of wood energy systems (up to \$350,000)

### Rural Energy for America Program (REAP) USDA-Rural Development (USDA)

- Assistance for the purchase, installation and construction of renewable energy systems (including biomass)
  - 25% of project cost, grants (up to \$500,000)
  - 75% of project cost, loan guarantees (up to 85% loan guaranteed, up to \$25 million)

### Dollar and Energy Savings Program Nebraska Energy Office (NEO)

- Assistance for projects reducing costs by improving energy efficiency or renewable energy projects
  - 2.5-5% low interest loans (up to \$750,000)
  - Loans provided by Nebraska banks

**For more information about woody biomass heating or the TREES Heat Nebraska program, contact Adam Smith, Forest Products Utilization Team Leader, 102 Forestry Hall, Lincoln, NE 68583-0815(402) 472-1276, [asmith11@unl.edu](mailto:asmith11@unl.edu)**



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Nebraska Forest Service

## Heating Greenhouses With Woody Biomass



Nebraska is home to a large horticulture nursery and greenhouse industry that produces a variety of products including aquatic plants, fruits, vegetables, flowers and trees. With over 325 nursery and greenhouse operations growing material "under glass" or some other type of protection, these growers often experience high and seasonally unpredictable heating costs related to fossil fuel use.

An eco-friendly and cost-effective alternative to fossil fuel heating is woody biomass heating. Woody biomass heating—heating facilities with wood chips or other woody material—lowers operating costs, utilizes locally available wood material as fuel and stimulates local economic growth and job development. The Nebraska Forest Service (NFS) offers technical and financial assistance to assist facilities interested in woody biomass heating.

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Example of a small-scale wood chip boiler system

## Woody Biomass Heating Systems

Woody biomass heating systems use heat produced from the combustion of wood fuel in a boiler to produce steam or hot water. The steam or hot water then moves through insulated piping to structures equipped with blower fans or other heat transfer equipment to provide space heating. In-floor or bench-top hydronics can also be utilized.

## Wood Fuel Options

When evaluating wood fuels, local availability, fuel cost and the amount of fuel handling required should all be considered.

### Wood Chips

Wood chips are the most common fuel used in commercial wood energy systems. Measuring about the size of a book of matches, wood chips are fed to the boiler through an automated fuel handling system using conveyors or augers. Wood chips are often regularly available in most areas. However, because of the automated fuel handling equipment, wood chip systems can be expensive.

### Cordwood (Firewood)

Cordwood is a traditional fuel option still used for small facilities. New technology has improved the efficiency and reduced the emissions from cordwood boilers. Even though these systems require high-quality wood fuel—dry, hardwood material—it is commonly available. While availability may not limit cordwood use, fuel handling is an issue. Cordwood must be loaded into the boiler firebox by hand, making cordwood a less attractive heating option in some cases.

## Wood Pellets

In recent decades, wood pellet heating has become increasingly common in the northeast United States and in the Great Lakes region. Wood pellets are created by compressing small particle wood material—such as saw dust—into a die or mold at very high pressures to form the small cylinders. This fuel has a very high heat content, as pellets traditionally have a moisture content of less than 10 percent. Automated fuel handling is also a benefit when using wood pellets, as the operator simply must keep a large hopper full of pellets and the system operates on its own. However, wood pellets are the most expensive wood fuel and may not be available in some areas.



## Wood Heating Economics

Wood heating systems provide savings as a result of lower fuel costs compared to fossil fuels, such as propane. All heating fuels possess a specific amount of potential heat. This heat content is expressed in British thermal unit (Btu). It is difficult to compare one fuel to another as some fuels are sold by the gallon and others sold by the ton. To compare actual fuel costs between fuel options we compare the cost of fuel per million Btu (MMBtu). Table 1 provides information regarding wood fuel costs versus traditional greenhouse heating fuel options.

### Financing Wood System

As a renewable energy heating option, wood heating systems qualify for grants and low-interest loans to assist with financing their construction and installation (see back panel). Using available assistance to lower the initial capital costs, coupled with lower fuel costs, operations can see lower heating expenses within the first or second year.

Table 1. Heating Fuel Prices

Fuel	Fuel \$/Unit	Fuel \$/MMBtu
Propane	\$1.30/gallon	\$18.00
Fuel Oil	\$3.25/gallon	\$27.50
Cordwood	\$250/cord	\$11.00
Wood Chips	\$60/ton	\$8.00
Wood Pellets	\$190/ton	\$13.50

## Calculating Potential Savings

When calculating the potential savings as a result of a facility converting to wood energy, we must consider all expenses related to wood heating, not simply the cost of wood fuel versus propane. These expenses include:

- Wood fuel costs - Facilities must have an idea of how much wood fuel they will require in order to offset their current propane use.
- Backup heating fuel costs - Amount of propane fuel needed as a backup heating option.
- Increased operation and maintenance costs - Wood systems require slightly more attention than fossil fuel heating systems. Wood fuel must occasionally be moved from the storage area to the hopper or “chip pit”—which stores fuel before going to the boiler.
- Annual loan payments - Wood energy systems require significant initial capital for equipment purchase, construction and installation. While grants are often available to assist with these costs, loans are often used to finance a portion of the initial costs. Annual debt payments of loans should be included when calculating the amount of savings provided by wood energy heating.

Understanding these costs will help provide a clearer picture of the potential savings. When the annual total costs of wood heating (above) are less than the annual cost of propane, the facility will begin seeing annual savings. As propane prices are known to increase more rapidly over time than wood fuel prices, even if wood heating is not estimated to provide savings during the first year, projections should be made to understand when heating expenses can be expected to decrease.