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Alternative energy

Evaluating wood fuel for greenhouse heat

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HAVE A QUESTION?

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Wood is truly a renewable resource. Forest stands in many areas have been increasing over the past few years. In many states, forested area is more than 50 percent of the total land area. Management and improvement of this resource can improve the quality of the lumber harvested and supplement our energy needs.

Cordwood, pellets and chips are sources of biomass that are most readily available. When considering using these as a heat source, availability, cost, storage and handling need to be evaluated. A good starting point is to consider how much heat it will take to keep the greenhouse warm.

A modern, well-constructed, energy-efficient greenhouse located in the central to northern part of the nation will require about 75,000 Btu/square foot of floor area if heated to 60°F all winter. A 10,000-square-foot greenhouse will require about 750 million Btu (MBtu). Table 1 gives the fuel quantities and approximate cost for heating this greenhouse and provides formulas so that you can compare the cost of the different fuels based on the price in your area. Biomass fuels are comparable to natural gas but much less expensive than propane or fuel oil.

Cordwood: A cord of wood is a pile 4 feet by 4 feet by 8 feet, or 128 cubic feet. Hardwoods (oak, hickory, maple, ash) are preferred and contain about twice the heat value of softwoods (pine, spruce, hemlock). Green or fresh-cut hardwood weighs about two tons per cord and contains 16 to 24 million Btu's. If allowed to air dry for six months, it will lose about 150 gallons of moisture.

Growers with a woodlot usually cut wood in the off season to keep employees busy. Some growers contract with logging crews to purchase the tops of trees that have been cut for lumber. These are usually handled in log lengths with about six to seven cords/truck load. In some areas, utility tree trimming crews and arborists have large quantities of wood that they provide to growers at minimal cost.

Considerable work is involved in getting this wood into a form that will fit into the firebox of the heating system. On cold nights, the boiler usually has to be loaded in late evening and then again early in the morning.

Wood chips: To reduce the labor involved with burning wood, chips may be a good alternative. Chips are usually sold by the cubic year or ton. They are produced in the woods as whole tree chips, at the sawmill or woodworking shop as mill chips, or by arborists, utility companies and recycling centers as waste wood chips. Whole tree and mill chips are usually fairly uniform in size (about 1 inch by 2 inches by .5 inch). These feed well in chip-handling equipment. Waste wood chips may contain twigs, branches, lumber and odd size pieces that tend to plug boiler feed conveyors. Some growers that get free waste wood chips run them through a sizing grinder to get them to a uniform size.

Table 1. Approximate fuel needs and estimated fuel cost for heating a 10,000-square-foot greenhouse*

Fuel	Quantity of fuel needed	Unit price	Cost	Formula for estimating cost/MBtu**
Natural gas	16,120 ccf	$1.10/ccf	$17,132	MBtu = $/ccf x 13.3
Propane	17,950 gal.	$2.25/gal	$40,388	MBtu = $/gal x 14.4
Fuel oil	11,860 gal	$3.50/gal	$41,510	MBtu = $/gal x 9.6
Cord wood	83 cords	$125/cord	$10,375	MBtu = $/cord ÷ 12
Wood chips	593 cu yds	$15/cu yd***	$ 8,895	MBtu = $/cu yd ÷ 1.5
Wood pellets	101 tons	$200/ton	$20,200	MBtu = $/ton ÷ 12.8

*for a greenhouse located in the central to northern part of the U.S. and heated to 60°F night temperature
**based on 75 percent heating system efficiency
***equivalent to $55.50/ton

Wood pellets: These are formed from ground-up biomass, dried and compressed into .25-inch diameter by 1-foot-long wood pellets and provide a convenient material that feeds easily into the burner. At 8,200 Btu/pound, wood pellets have a heat value more than double that of chips. Their moisture content is less than 10 percent and ash content less than 0.5 percent. In recent years, supply has been ramped up to meet demand and many new companies have come on line. GM