5 M del 10-9-80

L-1807

WHEN DOES IT PAY TO BURN WOOD?

Charles L. Stayton*

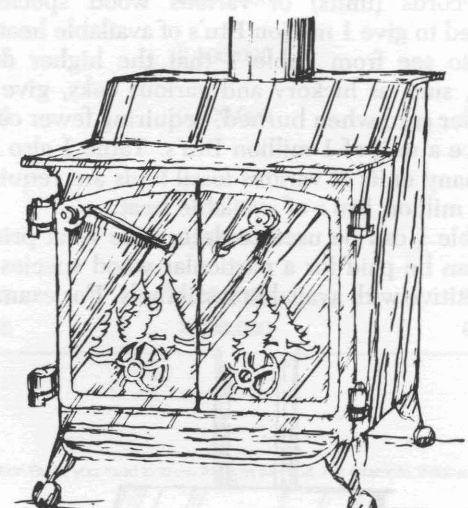
Wood-burning stoves help many Texans reduce home heating costs. Are wood-burning stoves the most economical heating system for everyone? The answer to this question depends on many factors: installation of an air-tight stove; alternative energy fuels available; availability of seasoned, high-density wood; and cost of a standard cord (128 cubic feet) of wood.

Choose Airtight Stoves

Airtight stoves must be used because they burn fuelwood slowly while producing a fairly steady Btu output. Normally, one fueling of wood in an airtight stove will last 8 to 12 hours. Stoves not airtight need refueling every hour or two, requiring much more wood and significantly increasing overall energy costs. Airtight stoves can be freestanding or inserts that fit into existing fireplaces. Some rely strictly on radiated heat and others, particularly inserts, have blower systems. Many Texans, whose homes have more than 2000 square feet living area, are discovering that two cords of wood burned in an airtight stove will supply their winter heating needs.

Seasoned wood provides more usable energy and reduces creosote buildup in the stovepipe. To evaporate one pound of moisture in wood requires 1,210 Btu's. At 20 percent moisture content, 750 Btu's are required to evaporate the available water, leaving around 6,400 Btu's available energy per wood pound. At 50 percent moisture content, there are only 4,927 Btu's of available energy per pound because increased water must be evaporated. Thus, it pays to dry fuelwood 9 to 12 months before use.

*Extension area forestry specialist — wood products, The Texas A&M University System.



Buy High Density Wood

Higher density woods weigh more per cubic foot since they contain more wood substance and fewer void areas. Therefore, they will produce more Btu's per cord than lower density woods at equal moisture content. At equal price per cord, it pays to buy the higher density woods such as hickory, white oak, cherrybark oak and post oak (Table 1). These species provide over a million Btu's per cord more available heat than red oak, willow oak and white ash. This is over 2 million Btu's per cord more than black walnut, red maple, hackberry, loblolly pine and shortleaf pine; over 3 million Btu's per cord more than sweetgum, American elm, sycamore, black ash, magnolia and eastern red cedar; and over 5 million Btu's per cord more than cottonwood and basswood (Table 1).

Texas Agricultural Extension Service

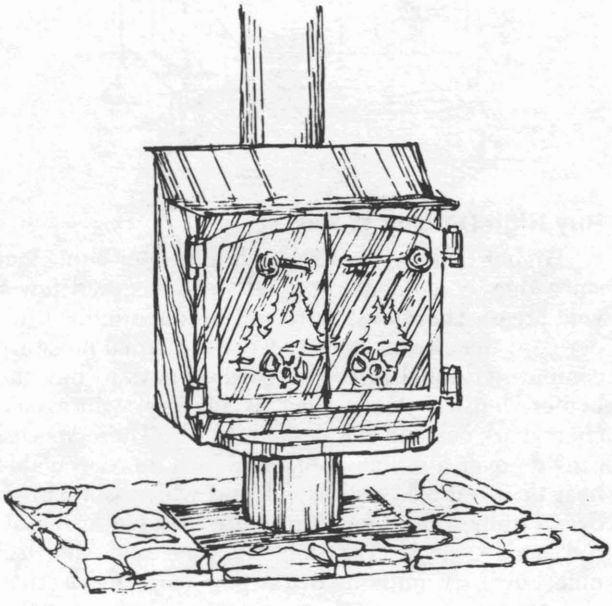
Daniel C. Pfannstiel, Director
College Station
The Texas A&M University System

High-density fuelwood, at 20 to 25 percent moisture content, is competitive with most fossil fuels available to Texans for heating. Natural gas is currently the most economic fossil fuel and only the most dense fuelwoods can compete with it. However, propane gas and electricity prices are high enough that even the lowest density species, cottonwood and basswood, are economically competitive in the East Texas area. In metropolitan areas where a cord of wood sells for $130, no fuelwood can economically compete with natural gas; only those species under Group I, Table 1, can compete with propane; and only those species under Groups I and II can compete with electricity.

Compare Fuel Prices

Fossil fuel and fuelwood prices will vary with time. Table 1 will permit one to compare fuelwood with fossil fuels if the current price per unit is known. Current prices can be obtained from the utility companies and other suppliers. Table 1 shows how many cords (units) of various wood species are required to give 1 million Btu's of available heat. One can also see from Table 1 that the higher density woods, such as hickory and various oaks, give more Btu's per cord when burned, requiring fewer cords to produce a unit of 1 million Btu's. Table 1 also shows how many units of various fossil fuels are required to give 1 million Btu's of available heat.

Table 1 can be used to determine what price per cord can be paid for a particular wood species to be competitive with available fossil fuels. For example, if natural gas is available to you, then you need to call the gas company and find the current cost. This cost, as of January 1980, to homeowners in East Texas is $3.41 per thousand cubic feet. Table 1 shows that it requires 1.43 units (thousand cubic feet) to produce 1 million Btu's. Thus, multiplying the number of required units (1.43) times the cost per unit ($3.41), gives a cost of $4.88 per one million Btu's.



To find how much you can pay for a cord of post oak, for example, to compete with natural gas, you need to know how many cords of post oak are required to produce 1 million Btu's of available heat. Table 1 shows that only 0.075 cord is required. Dividing the cost of natural gas ($4.88) to produce 1 million Btu's by the cords (0.075) of post oak required to produce 1 million Btu's gives the amount ($65.07) you can pay per cord to equal the cost of natural gas. Thus, one would have to pay less than $65 per cord for post oak to compete with natural gas, $136 per cord to compete with propane at 65 cents per gallon and $158 per cord to compete with electricity at $0.0405 per KWH. If you purchase a lower density wood, such as sweetgum (0.099 cord produces 1 million Btu's available heat), then you could only pay $49 per cord to compete with natural gas, $103 per cord to compete with propane and $119 per cord to compete with electricity.

Determine Best Buy

Table 1 can also be used to determine how many cords of wood will be required to replace your current fuel. For example, if you used 500 gallons of propane to heat your home last season, your heat load per season is 500 gallons ÷ 15.7 units (from Table 1) = 31.8 million Btu's per season. If you want to switch to red oak, you will need 31.8 million Btu's ÷ 12.2 million Btu's per cord (Table 1) = 2.6 cords. Cost comparison would be 500 gallons times 65 cents per gallon = $325 per heating season for propane and 2.6 cords times $65 per cord (current price per cord in East Texas rural areas) = $169 per heating season for red oak, or a savings of $156 to burn wood.

The data in Table 1 can help you make sound decisions when comparing wood to other fuels to find the most economic fuel to heat with. By calculating heating cost savings, you can also determine how long it will take to pay back your wood-burning stove investment. The data in this table will not change; only the cost of the fuel choices will change. If you update these costs, you can quickly calculate the most economic heating fuel for your situation each year. If fossil fuels continue as expected to rise in cost, wood will play an increasingly important role in providing homeowners with economic heating.

TABLE 1. FUEL UNITS REQUIRED TO OBTAIN ONE MILLION BTU'S OF AVAILABLE HEAT

Fuel	Density[1] (lbs/cu ft)	Unit	Heating Efficiency (%)	Available Heat[2] Per Unit (Btu's)	Units Required for 1 Million Btu's Available Heat[5]
Natural Gas	—	mcf[3]	70	700,000	1.430
Propane Gas	—	gallon	70	63,700	15.700
Electricity	—	KWH[4]	100	3,413	293.000
Lignite Coal	—	ton	60	8,280,000	0.121
Group I					
Hickory	50.9	cord[6]	55[7]	14,300,000	0.070
White Oak Cherrybark Oak Post Oak	47.7	cord	55	13,400,000	0.075
Group II					
Red Oak Willow Oak Water Oak White Ash	43.3	cord	55	12,200,000	0.082
Group III					
Black Walnut	39.7	cord	55	11,200,000	0.089
Red Maple Hackberry	38.2	cord	55	10,800,000	0.093
Loblolly Pine Shortleaf Pine	36.7	cord	55	10,300,000	0.097
Sweetgum American Elm Sycamore	35.7	cord	55	10,100,000	0.099
Group IV					
Magnolia Eastern Red Cedar	34.4	cord	55	9,700,000	0.103
Cottonwood	28.4	cord	55	8,000,000	0.125
Basswood	24.7	cord	55	7,000,000	0.143

[1]Based on wood oven-dry weight and volume at 20% moisture content.

[2]Total heat multiplied by heating efficiency.

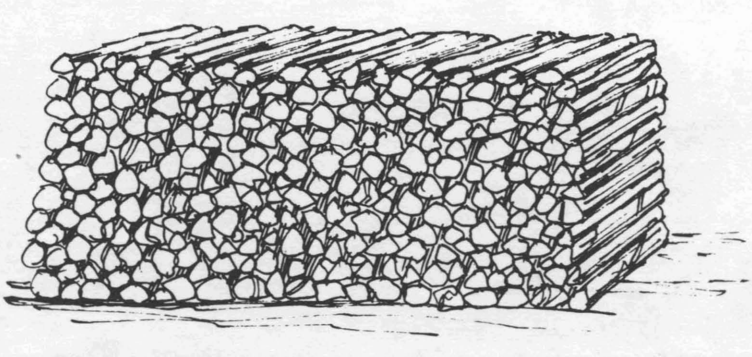
[3]Thousand cubic feet

[4]Kilowatt hours

[5]Units required for 1 million Btu's = 1 million Btu's ÷ available heat per unit. To calculate cost per million Btu's, you need to know the cost per unit. For example, if natural gas costs \$3.41 per mcf, then the cost is \$3.41 × 1.43 = \$4.88 per million Btu's.

[6]Cord of wood = 128 cubic feet (4′ × 4′ × 8′); assume 80 cubic feet of solid wood.

[7]55 percent is based on the average air-tight stove.



Educational programs conducted by the Texas Agricultural Extension Service serve people of all ages regardless of socioeconomic level, race, color, sex, religion or national origin.

Cooperative Extension Work in Agriculture and Home Economics, The Texas A&M University System and the United States Department of Agriculture cooperating. Distributed in furtherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
5M—9-80 **FOR 2**