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Home Heating with Wood

To Cope With Inflation

One of the main causes of today's inflation is the price of energy, especially the fossil fuels used to heat many homes as well as to run our vehicles. The interest in alternative energy sources, mainly wood, to heat the home has grown significantly over the past years, largely by moderate-income families trying to reduce the bite of inflation but also by a sizeable segment of low-income families who simply cannot afford fossil-derived fuels.

The following compares economic considerations among energy sources for residential heating. Additional information may be found in Extension Circular 584, Home Heating with Wood.

SELECTING A WOOD STOVE/FURNACE/FIREPLACE

Before you select a wood heating unit, consider these questions: (1) Is a wood heater already in place and available for use? (2) Is the heater desired for supplemental heat or as the sole source of heat? (3) Where is the heat desired—in a localized area or a large area? (4) Is the heat required throughout the day or only in the evenings after family members are home? (5) How high do you want to keep room temperatures? (6) Are the quantitative factors (efficiency and economics) most important or are the qualitative factors (aesthetics, desire for radiant heat, etc.) also important?

If your house is already built and has a masonry fireplace, consider using the fireplace as efficiently as possible or add a stove to use the existing chimney. Depending on the house design and the desire to heat the entire house, you may need to add another stove at a different location in the house, add a wood or combi-furnace, or make some structural changes to allow a central location for a wood stove. If you plan to build a house with efficient wood heating in mind, make plans to allow for a central wood stove location so heat can radiate throughout, or plan for hot air ducting or hot water piping from a wood-fired furnace. The key is to PLAN AHEAD.

Base your judgments of the heating capacities of wood stoves or furnaces on experience rather than just the dealer's statements or manufacturer's claims. Evaluate the heater's capabilities, and also negative aspects, by seeing it in operation in homes and talking with others using one. Make sure you compare the differences in house design and the way it is located and used in the houses observed. Do they keep the temperature about like you desire it and, if not, will it fit your needs?

In the Southeast, most medium-to-large wood stoves (circulating or airtight radiant types) can heat 1,000 square feet of living area to most people's satisfaction and up to 2,000 square feet for those having the wood stove ideally located and desiring somewhat lower temperatures. Wood or combination wood and fossil-fuel-fired furnaces can be added to heat almost any house. Ducting hot air or distributing hot water may present problems if ducts or pipes are not already in place. Remember, wood stoves that are not airtight or that are inserted in a fireplace will not provide as much useful heat as an airtight stove placed where it can radiate or circulate heat in all directions. However, the fireplace insert performs satisfactorily for most people and has the advantage of requiring no additional floor space.

Heat distribution from wood stoves can be improved in some houses by operating the fan on the main heating unit, such as a heat pump, when the wood stove is being used.

You may also want to use a wood stove for cooking and for heating water, especially when the power is out. Some heating stoves provide a good cooking surface; others do not.

Circulating Versus Radiant Stoves: Some people simply like radiant heat rather than convective heat as distributed by the circulating stove. However, if young children are in the family, consider the circulating stove; its surface temperature is much cooler than that of the radiant stove and fewer burns would result.

When selecting a stove, also weigh the improved efficiency, and thereby lower wood requirement, of the airtight stove versus the nonairtight, which is lower priced. Efficiencies and airflow requirements are given in Circular 584. Airflow requirements are important as a certain airflow must be maintained to support adequate combustion; much lower flow is needed for the more tightly constructed stoves than the loosely constructed stoves or fireplaces. Because recently constructed and well-maintained houses are tighter than those built 25 or more years ago, problems sometimes occur when ventilation air is not adequate to operate a fireplace or open stove. Refer to Info. Leaflet No. 9, “Chimney Draft Problems,” for ways to solve these problems.

Be sure to evaluate dealer reliability and services before buying any type of heater. For many people, heater installation and service followup by the dealer is a necessity. If the heater is not installed correctly, it can be catastrophic. Refer to Info. Leaflet No. 8, “Wood Stove Installation,” for recommendations.

HOW MUCH WOOD

The following is called the Smithers method for estimating the number of cords of wood to heat a house. A standard cord is a well-stacked pile of wood 128 cubic feet in volume, a pile 4 feet by 4 feet by 8 feet. Most people have some way to arrive at the amount of conventional fuel it takes to heat the house for an average year.

The Smithers method assumes the following equivalents to one cord of average dry hardwood* (W):

150 gallon No. 2 fuel oil
230 gallon LP gas
21,000 cubic feet natural gas
6,158 kwh electricity

*Dry hardwood is not as commonly sold as green hardwood, which requires about 20 percent more volume to yield equivalent energy to the air-dry hardwood.

Use the following Energy Efficiency values:

E_b	Heater	E_w	Wood Heater
0.65	Oil Furnace	0.10	Fireplace
0.70	Gas Furnace	0.25	Improved Fireplace
1.00	Electric	0.30	Nonairtight Stove
0.65	LP Gas	0.50	Airtight Stove
		0.60	Wood Furnace
		0.65	Airtight Stove with Catalytic Combustor

The Smithers method equation is:

$$\text{Cords} = \frac{B \times E_b}{W \times E_w}$$

Where B = units of conventional fuel consumed per year.

Example 1: Assume you are considering purchase of a wood furnace and your use of No. 2 fuel oil has averaged 500 gallons per year in recent years. How much wood is needed to produce the same quantity of heat if a wood furnace is used?

$$\text{Cords} = \frac{500 \text{ gal} \times .65}{150 \text{ gal} \times .60} = 3.6 \text{ cords}$$

Example 2: Assume you are considering purchase of an airtight stove with catalytic combustor and your use of natural gas has averaged 60,000 cubic feet per year in recent years. How much wood is needed to produce the same quantity of heat if an airtight stove with catalytic combustor is used?

$$\text{Cords} = \frac{60{,}000 \text{ cu ft} \times .70}{21{,}000 \text{ cu ft} \times .65} = 3.1 \text{ cords}$$

FUEL COST COMPARISONS

Before considering the following examples, refer to Circular 584 for certain definitions, such as **cord, efficiency, BTU**, and **energy equivalents.** Also check for wood characteristics, including weight and heating value per cord of wood species common to South Carolina.

I. First, let’s compare wood with other fuels, being concerned only with wood that is split and delivered to the house at a specific price.

A. *Cost per Million Btu’s (MBtu) Useful Heat Into the Room:*

1) Fuel oil at $1.00 per gallon: There are 140,000 Btus per gallon of fuel oil and oil furnace efficiency equals 0.65:

$$\frac{1{,}000{,}000 \text{ Btu} \times \$1.00/\text{gal}}{140{,}000 \text{ Btu/gal} \times .65} = \$10.99/\text{MBtu}$$

Note 1: Fuel oil at any other price is a multiple of this. For example, with fuel oil at $1.50 per gallon, the cost per MBtu = ($10.99/MBtu) x 1.5 = $16.48/MBtu since $1.50 per gallon is 1.5 times the $1.00 per gallon price.

(2) Electricity at $.10/kwh, 3,414 Btu/kwh, and effi ciency
equals 1.0:

$$\frac{1{,}000{,}000 \text{ Btu x } \$.10/\text{kwh}}{3{,}414 \text{ Btu/kwh x } 1.0} = \$29.29/\text{MBtu}$$

Note 2: Electricity at any other price is a multiple of this. For example, with electricity at $.08 per kwh, the cost per MBtu = ($29.29/MBtu) x 0.8 = $23.43/MBtu since $.08/ kwh is 0.8 of the $.10/kwh price.

(3) Natural gas at $1.00/100 cu ft, 1000 Btu/cu ft, and efficiency equals 0.70:

$$\frac{1{,}000{,}000 \text{ Btu x } \$1.00/100 \text{ cu ft}}{1{,}000 \text{ Btu/cu ft x } .70} = \$14.29/\text{MBtu}$$

Note 3: Natural gas at any other price is a multiple of this. For example, with natural gas at $.70 per 100 cu ft, cost per MBtu = (14.29/MBtu) x 0.7 = $10.00/MBtu since $.70/ 100 cu ft is 0.7 of the $1.00/100 cu ft price.

(4) Wood (between green and air-dry red oak) at $120/ cord, 19.6 MBtu/cord, and efficiency of airtight stove equals 0.50:

$$\frac{1{,}000{,}000 \text{ Btu x } \$120/\text{cord}}{19{,}600{,}000 \text{ Btu/cord x } .50} = \$12.24 \text{ /MB+u}$$

Note 4: Wood prices will vary considerable across the state.

B. *Fuel Quantity /Cost Comparison:*

A homeowner is using 700 gallons fuel oil per year and wants to switch to wood heat using an airtight stove and half-dry red oak at the above prices. Compare these:

(1) 700 gal fuel oil x 140,000 Btu/gal x .65 efficiency = 63.7 MBtu
Annual cost = 700 gal x $1.50/gal = $1,050

(2) Wood required =

$$\frac{63.7 \text{ MBtu useful heat/season}}{19.6 \text{ MBtu/cord x } .50 \text{ eff.}} = 6.5 \text{ cords}$$

Annual cost = 6.5 cords x $120/cord = $780

(3) Savings by using wood = $1,050 - $780 = $270/ season

(4) Wood/fuel oil energy equivalence for these conditions:

700 gal fuel oil = 6.5 cords red oak
or
1 cord red oak = 108 gallons fuel oil

C. How Much Can You Afford to Pay for Wood Compared to Conventional Fuels When Using an Airtight Stove?

(1) Cost/MBtu ÷ cords wood to give MBtu (useful heat into room)

(2) From A.1 above, fuel oil at $1.50/gal $16.48/MBtu; cords/MBtu useful heat =

$$\frac{1 \text{ MBtu}}{19.6 \text{ MBtu/cord x } .50 \text{ eff.}} = .102 \text{ cord}$$

$$\frac{16.48/\text{MBtu}}{.102 \text{ cord/MBtu}} = \$161.57/\text{cord}$$

(3) Electricity at $.08/kwh = $23.43/MBtu

$$\frac{\$23.43/\text{MBtu}}{.102 \text{ cords/MBtu}} = \$229.70/\text{cord}$$

(4) Natural gas at $.70/100 cu ft = $10.00/MBtu

$$\frac{\$10.00/\text{MBtu}}{.102 \text{ cord/MBtu}} = \$98.04/\text{cord}$$

II. Consider the case where you have your own tools for cutting wood and you have a pickup truck to haul it. You have located a good place to cut wood 4 miles from your home at a $25/cord charge for what is taken. The pickup will haul 1/ 2 cord of wood when it is well-stacked. You figure you can cut, load, and haul a load in 3 hours and split and stack a load in 2 hours. You plan to cut the season's requirement mentioned above (6.5 cords).

Let's figure the annual wood cost:

Permit Charge: $25/cord x 6.5 cords	=	$162.50
Transportation: 8 miles/trip x 13 trips 35 x $.40/mi. (est.)	=	41.60
Chain Saw: $35 F.C. + $30 O.C.	=	65.00
Other Tools, Personal Protective Equipment:	=	25.00
Labor Costs: Cut/haul 3 hr x 11 loads x $5/hr	=	65.00
Split/stack 2 hr x 11 loads x $5/hr	=	10.00
Total	=	$569.10
		or $65.67/cord

Good points can be made as to why some of these charges should be higher or lower than indicated. For example, some people say they enjoy that type of work and do not feel a labor charge is necessary; on the other hand, some who perform hard physical work during the normal work day would say the labor charge is too low. Also, many people may have wood on their own land or have free access to wood, eliminating that charge. Cost comparisons must be tailored to fit each specific case.

III. Another major economic consideration is that of the fixed cost for the wood heater as compared to that for the conventional fuel heater. A simplified comparison is given.

Consider the fixed cost for buying and installing an airtight stove to be $2,100. The same heating capacity oil furnace could be purchased and installed for $1,700 at a difference of $400 in investment.

Assume the lifetime for each of the heaters to be 15 years when maintained properly. If current interest rates are used and the loss of this interest on the $400 investment difference is added to the $400 difference, the annual saving in fuel cost by using wood would have to exceed about $111 to economically justify the wood stove over the oil furnace. Reference to I.B.(3) indicates the annual savings for using wood to be $270 without considering the investment.

If the oil furnace initial cost were more or the wood stove were less, the annual savings by using wood would not have to be as great. On the other hand, if the difference in investment costs between the two furnaces were greater than the $400 illustrated, the annual savings would have to be even greater to economically justify the wood stove.

MY FUEL USE COMPARISONS:

Current Fuel Type ____________________________

Annual Fuel Usage ___________________________

Wood Equivalent to This:

$$\text{Cords} = \frac{\text{Annual fuel quantity} \times E_{\text{heater}}}{\text{One cord wood equivalent} \times E_{\text{wood heater}}}$$

= ____________________________________

USEFUL REFERENCES

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