NRAES

Comparing Heating Fuel Costs

The costs of various forms of energy are evaluated in different ways, making comparisons difficult. The following chart will enable you to compare the cost of various heating fuels on the basis of their heating equivalent as expressed in dollars per million British thermal units[1] ($/MBtu). To use the chart, read across the fuel price columns to the Heating Equivalent column to determine the price per MBtu.

For example, if a source of mixed hardwood is available at $100/cord, the equivalent fuel cost is approximately $8.30/MBtu. Fuel oil at $1.20/gallon has an equivalent fuel cost of $13.40/MBtu. In this case, it may pay to switch to wood because wood costs less per MBtu than oil.

Remember the cost of the heater when switching fuels. A good quality wood stove and new chimney costs a thousand dollars or more. Heat pumps cost several thousand dollars. It may require many years of fuel savings to pay for a new installation.

[1]One Btu = The amount of energy required to raise a pound of water 1° Fahrenheit.

Fuel Cost Comparison

ASSUMPTIONS

Natural Gas - *Therm = 100,000 Btu = 100 cu ft*
65% Efficiency
$/MBtu = 15.38 × $/Therm

Fuel Oil - *138,000 Btu/gallon*
65% Efficiency
$/MBtu = 11.15 × $/gallon

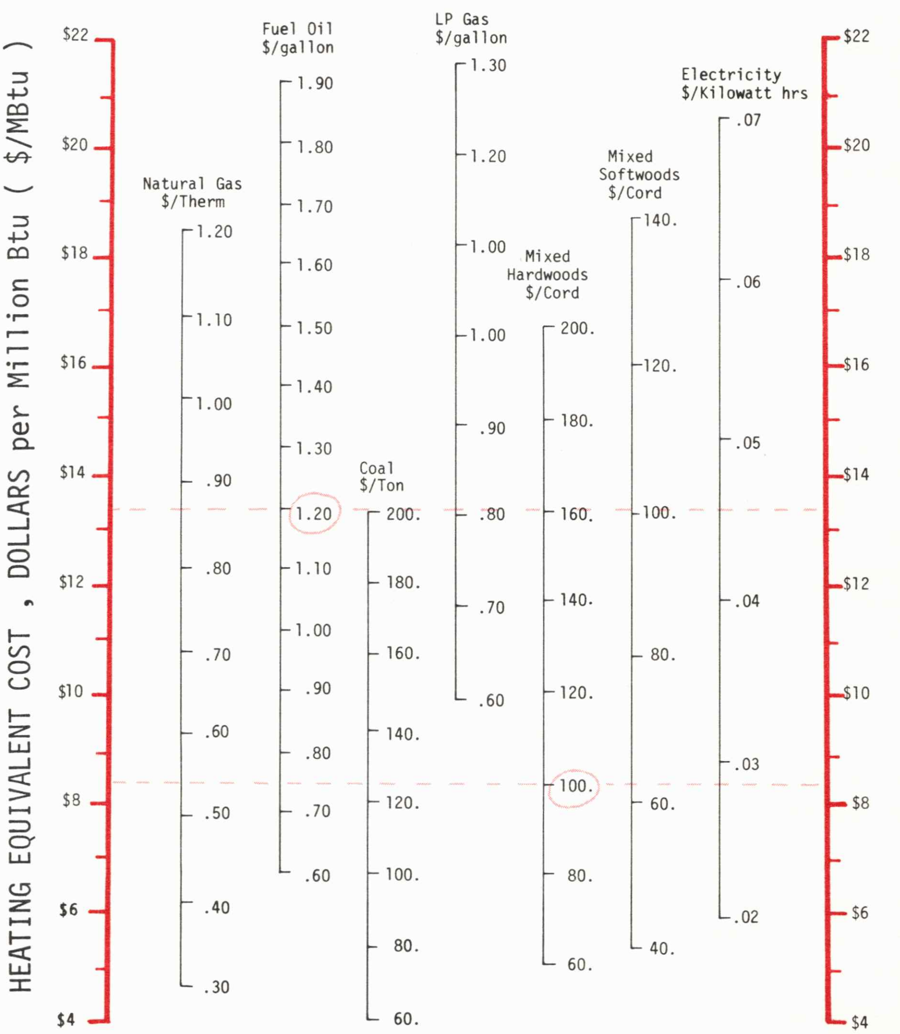
LP Gas - *93,000 Btu/gallon*
65% Efficiency
$/MBtu = 16.54 × $/gallon

Electricity - *3412 Btu/kwh*
100% Efficiency
$/MBtu = 293 × $/kwh

Mixed Hardwoods - *24 MBtu/cord*
50% Efficiency
$/MBtu = $/cord ÷ 12

Mixed Softwoods - *15 MBtu/cord*
50% Efficiency
$/MBtu = $/cord ÷ 7.5

Coal - *12,500 Btu/lb*
60% Efficiency
$/MBtu = $/ton ÷ 15



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Fuel Price Information

Most electricity or natural gas is sold on a block pricing structure. A typical rate schedule might be, the first 12 kwh of electricity costs $3.00, the next 12-300 kwh costs 6¢ per kwh, the next 300-1200 cost 4¢ per kwh, etc. To calculate heating costs, use the price for the highest level of monthly consumption. For example, you would use the 4¢ per kwh value if you consumed between 300 and 1200 kwh per month in an area with the price structure mentioned above.

Some electric utility companies have a seasonal rate, so energy costs more at one time of the year than another. Areas with a high air conditioning load may have higher summer rates, while areas with a large electrical heating demand may have higher winter rates. Also several electric utilities offer lower off-peak rates at night because this is a low electrical demand period. Some electric heaters are now available to take advantage of these low rates by storing electrical energy at night by heating a ceramic material to a very high temperature. Then during the day the electrical heaters are switched off and the stored energy is used for heating.

Typical prices for electricity range from 3¢ to 8¢ per kwh. Natural gas prices range from 30¢ to 50¢ per therm. Contact your local utility to obtain the most current rates for the heating season. Prices for LP gas and fuel oil are available from local dealers. However, LP and fuel oil prices are somewhat seasonal; try to obtain prices during the heating season.

Heat Pumps

A heat pump is similar to a central air-conditioning unit. It either extracts heat from outside air for winter space heating, or removes heat from the air in the house for space cooling in the summer. A heat pump is most cost effective when both winter heating and summer cooling is needed.

Because the heat pump extracts heat from outside air it provides more heat per kilowatt hour than an electrical resistance heater. However, heat pumps work less efficiently as outside temperatures drop. Some heat pumps turn on supplemental resistance heaters to supply the heat required when the heat pump efficiency drops. Other heat pumps rely on a backup furnace fired by gas or oil to provide space heating when the outside air temperatures drop below about 20°F.

In most of the Northeast, heat pumps operate with an efficiency or Seasonal Performance Factor (SPF) of 1.8 to 2. The Seasonal Performance Factor is the total amount of heat energy delivery by the heat pump divided by the annual electrical energy used by the heat pump. In cold areas the SPF will be lower; in warm areas it will be higher. Heat pump dealers generally have detailed information regarding the SPF expected for heat pumps in various parts of the country.

You can use the fuel chart to determine the cost of heat supplied by a heat pump. First divide the price of electricity by 1.8 or 2 (or by the SPF of your heat pump in your area) and then use this effective price of electricity in the chart. Remember, this is the fuel cost only. A complete analysis should include the additional initial cost (if any) of the heat pump over that of the alternative heating system.

Wood or Coal as Fuels

The wood and coal heating values on the fuel cost chart are for good airtight stoves or furnaces—the only devices which efficiently deliver the heat from wood and coal.

If you have a non-airtight stove and want to calculate the cost of wood or coal as a heating fuel, multiply the fuel cost in $/MBtu for wood or coal shown on the fuel chart by 2. Example: Mixed hardwood at $100/full cord has a fuel cost equivalent of $8.33/MBtu in an airtight stove. In a non-airtight stove its heating equivalent would be $16.66/MBtu.

Which Fuel?

For most of the Northeast, natural gas is the most economical fuel. Following natural gas are either wood, in more rural areas, or fuel oil in the heavily urban areas. Coal is generally less costly than fuel oil. In many areas, LP gas is more expensive than electric resistance heating, but in the New York City area, electricity is more costly. Heat pump systems often have cheaper fuel costs than LP gas, fuel oil and commercially purchased wood. However, heat pumps may have substantially higher capital costs than heating systems using these fuels. In areas that use air conditioning, heat pumps have additional advantages since they can both heat and cool.

High Efficiency Heaters

The fuel cost comparison table uses efficiencies typical of furnaces and boilers found in most older homes. Many new furnaces and boilers have efficiency values significantly higher. In addition, improvements can be made in existing heating systems to improve their efficiencies. Among these improvements are flue dampers, electrical ignitions, outside combustion air and the installation of new burners.

Use Table 1 to help evaluate the value of replacing an existing furnace or boiler with a more efficient one. For example, calculate the fuel savings achieved by replacing an old oil furnace with an assumed 65% efficiency with one that has a seasonal heating efficiency of 80%. The example home annually uses 1000 gallons of oil that costs $1.20 per gallon for an annual cost of $1.20 × 1000 = $1200. Table 1 shows that an efficiency improvement to 80% will lower the annual heating bill by 19%. The annual fuel savings is then 0.19 × $1200 = $228.

Table 1. Percent Reduction in Fuel Use for Improved Heating System Efficiency.

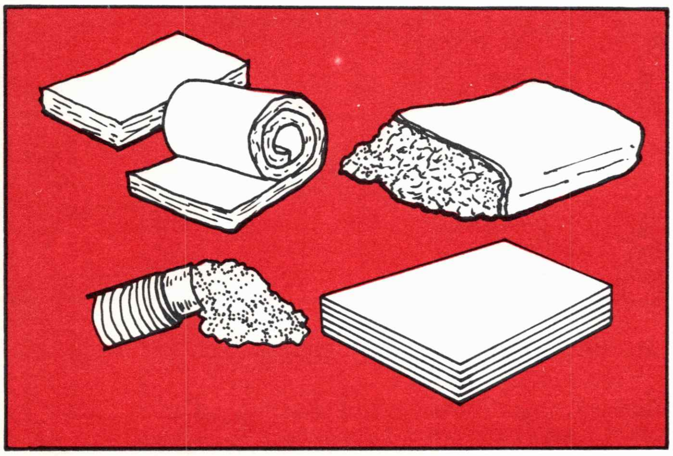
New Heating System Seasonal Heating Efficiency[1]	Percent Reduction in Annual Heating Fuel Usage[2]
70%	7
75%	13
80%	19
85%	24
90%	28
95%	32

[1] Energy delivered to dwelling ÷ Energy Input to Heating System.
[2] Current system assumed to be 65% Efficient.

Added Insulation

An alternative way to lower heating costs is to add insulation. The fuel savings from additional insulation depend on the:

- amount of existing insulation
- amount of insulation to be added
- current cost of heating fuel.



The following steps may be used to calculate the value of fuel saved by increasing insulation. As an example of this calculation look at a single story, 1500 square foot home in Hanover, NH. It has 6 inches of fiberglass insulation in the attic with an equivalent R value, or resistance to heat loss, of about 19. The house uses oil for heating at a cost of $1.20 per gallon. Calculate how much can be saved by adding 6″ of insulation (R-19) as follows:

Step 1. Find the heating degree days for the area from the heating degree day map. Hanover, NH has 7500 heating degree days.

Step 2. Calculate the heat loss through the existing insulation by the following equation:

$$\text{Rate of Heat Loss} = Q = \frac{1}{R} \times A \times HDD \times 24$$

where R = R value of insulation
A = area of insulated surface
HDD = heating degree days

The heat loss for the existing ceiling (R-19) is about:

$$Q = \frac{1}{19} \times 1500 \times 7500 \times 24$$

= 14.2 million Btu's.

Step 3. Find the new total R value by adding the R value of the new insulation to the existing insulation R value.

New R = 19 + 19 = 38

Step 4. Calculate the newly insulated ceiling heat loss.

$$Q = \frac{1}{38} \times 1500 \times 7500 \times 24$$

= 7.1 million Btu's

Step 5. Find the fuel heating equivalent from the fuel cost comparison chart.

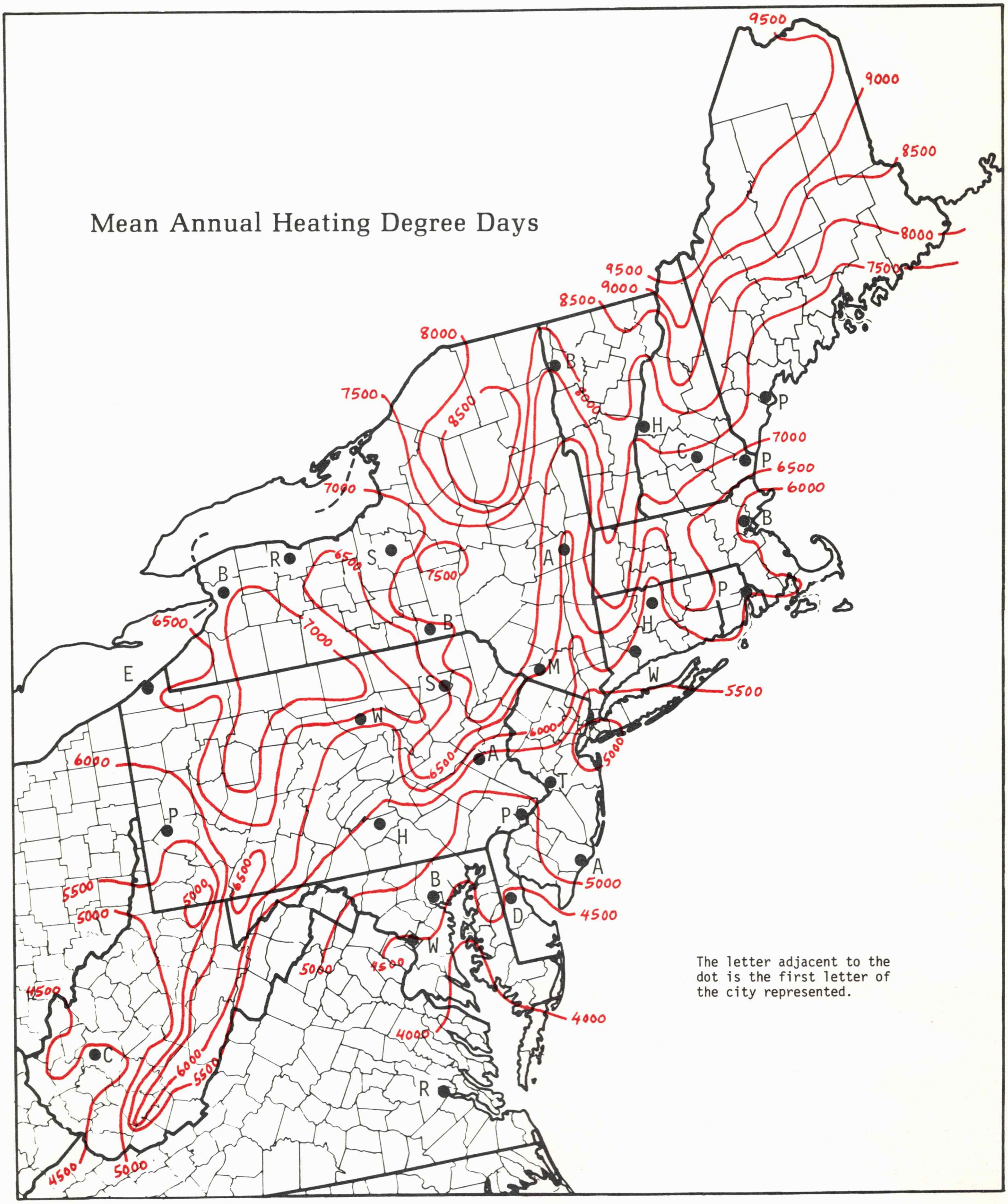
Fuel oil costing $1.20 per gallon is equivalent to $13.40 per million Btu's.

Step 6. Calculate the annual savings. Subtract the new heat loss from the old heat loss and multiply by the fuel heating equivalent.

Fuel cost savings = (14.2 - 7.1) × $13.40 = $95

So, an additional 6″ of insulation will lower annual fuel cost by $95 in this example. As fuel costs increase, the savings will increase each year.

Mean Annual Heating Degree Days



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