



Comparing Values of Various Heating Fuels

Housing Fact Sheet

It is time to replace that ancient heating system in your basement. What type of new heating system should you buy? While there are several factors you will want to consider and compare before making your decision, one of the very first factors to decide is what type of heating fuel to use. To help you make that decision this Fact Sheet outlines calculations you can use to determine which type heating fuel is the best value. There are four different variables you will be working with as you do the calculations to determine which fuel provides the most heat for the fewest dollars.

These are:

- **The type of heating fuel**

Many choices are available, natural gas, electricity, fuel oil, propane and wood are common fuels used in New York State.

- **The unit cost of the heating fuel**

This is the amount of money the fuel costs **per unit of measure**. Fuel oil, a liquid, is typically sold by the gallon, Wood, a solid material, by the cubic foot.

- **The per unit energy content of the fuel (measured in Btu's)**

Btu, an abbreviation used for the term British thermal unit, is a measure of heat energy. One Btu is equal to the amount of heat required to raise the temperature of one pound of water by 1° farenheight. Different fuels produce different amounts of heat energy when burned. For example one gallon of kerosene will produce 134,000 Btu's of energy when burned, one gallon of propane 91,600 Btu's, and a thousand cubic feet of natural gas one million Btu's of heat energy.

- **AFUE: The overall efficiency of the heating unit you use**

Annual Fuel Utilization Efficiency (AFUE) is expressed as a percentage. It is a measure of how effectively a heating system turns heat released from burning fuel into heat you can use to warm your home. No heating system converts 100% of the fuels energy into heat for your house. All heating systems will lose some heat due to start-up, cool-down, and heat escaping up the chimney with combustion gasses. New and efficient heating systems should have an AFUE of 85% or higher. Few systems have AFUE's above 95%.

Doing the Calculations

Lets assume, you are deciding between two different heating systems. One uses propane as the heating fuel, the other uses kerosene (number one fuel oil). Lets further assume that the propane system has an AFUE of 95%, while the kerosene fueled system has an AFUE of 85%. You have called several fuel suppliers in your area and have learned that the average price of a gallon of kerosene is \$.89, and the average price of a gallon of propane is \$1.19. You determine the heat value content of burning a gallon of kerosene and a gallon of propane by referring to Table 1. Plug the numbers into the following formula to determine the heating value of propane with that of kerosene.

[(Cost per unit if fuel) multiplied by (1 million BTU)]

$$\frac{\frac{\text{(BTU's per Unit of Fuel)}}{\text{Annual Fuel Utilization Efficiency (AFUE)}}}{\text{Description:}} \times \text{Multiply the unit cost of the fuel by 1 million BTU, then divide this number by the amount of BTU's per unit of fuel. Then divide once again, this time by the AFUE of the heating appliance.}$$

Calculation for kerosene, where:

Unit cost of kerosene = \$.89 per gallon
 Heat value of kerosene=134,000 BTU per gallon
 Assuming AFUE of heating appliance at 85%

Plugging the numbers into the formula:

.89\$ per gallon x 1,000,000 BTU = 890,000

$$\frac{890,000 \text{ BTU}}{134,000 \text{ BTU per gallon kerosene}} = 6.64$$

$$\frac{6.64}{.85} = \$7.81 \text{ per million BTU's worth of kerosene consumed}$$

Using a kerosene fueled heating system with a seasonal AFUE of 85% would cost \$7.81 per million BTU's worth of kerosene consumed when the price of kerosene is \$.89 per gallon.

Table 1: Average Heat Content of Various Fuels (Source: U.S. Department of Energy)

Fuel Type	BTU/Unit	Kilocalories/Unit
Kerosene (No. 1 Fuel oil)	134,000/gallon	8,921/liter
Burner fuel oil (No. 2 oil)	140,000/gallon	9,320/liter
Electricity	3,413/kWh	860/kWh
Natural gas	1,000,000/thosand cu.ft.	7,139/cubic meter
Propane	91,600/gallon	6,098/liter
Anthracite coal	27,800,000/ton	6,354,286/tonne
Hardwood (20% moisture)	24,000,000/cord	1,687,500/cubic meter
Pine (20% moisture)	18,000,000/cord	1,265,625/cubic meter
Wood pellets (pellet stoves)	36,000,000	8,228,572/tonne

Calculation for propane, where:

Unit cost of propane = \$1.19 per gallon

Heat value of propane = 92,000 BTU per gallon

Assuming AFUE of heating appliance at 95%

Plugging the numbers into the formula:

\$1.19 per gallon x 1,000,000 BTU = 1,190,000

$$\frac{1,190,000 \text{ BTU}}{92,000 \text{ BTU per gallon kerosene}} = 12.93$$

$$\frac{12.93}{.95} = \$13.61 \text{ per million BTU's worth of propane consumed}$$

Using a propane fueled heating system with a seasonal AFUE of 95% would cost \$13.61 per million BTU's worth of propane consumed when the price of propane is \$1.19 per gallon.

With the price of propane almost 30 cents more per gallon than kerosene, coupled with the lower heat value of propane fuel compared to kerosene fuel, it would cost significantly more to heat with propane even though the propane fueled heating system is more efficient. Under this set of circumstances kerosene is a far better value than propane.

By plugging the appropriate numbers into the equations included in this Fact Sheet you can compare the cost of using different types of heating fuels in heating systems of varying efficiencies. When doing your own fuel value comparisons keep in mind that energy markets are volatile and subject to sudden price changes. So when you collect price information from various fuel suppliers, also ask if they can provide you with average fuel costs over the past several heating seasons.

Further Sources of Information:

Wilson, A. & Morril, J. (1997). *Consumer Guide To Home Energy Savings*, American Council For An Energy Efficient Economy, Washington DC.

Energy Efficiency And Renewable Energy Clearinghouse (EREC)
P.O. Box 3048 Merrifield, VA 22116, Phone: 1-800-363-3732
URL: <http://www.eren.doe.gov>

**Cornell
Cooperative
Extension**

Department of Design &
Environmental Analysis
Mark Pierce (1998)

Cornell University
Martha Van Rensselaer Hall
Ithaca, NY 14853
607-255-2144