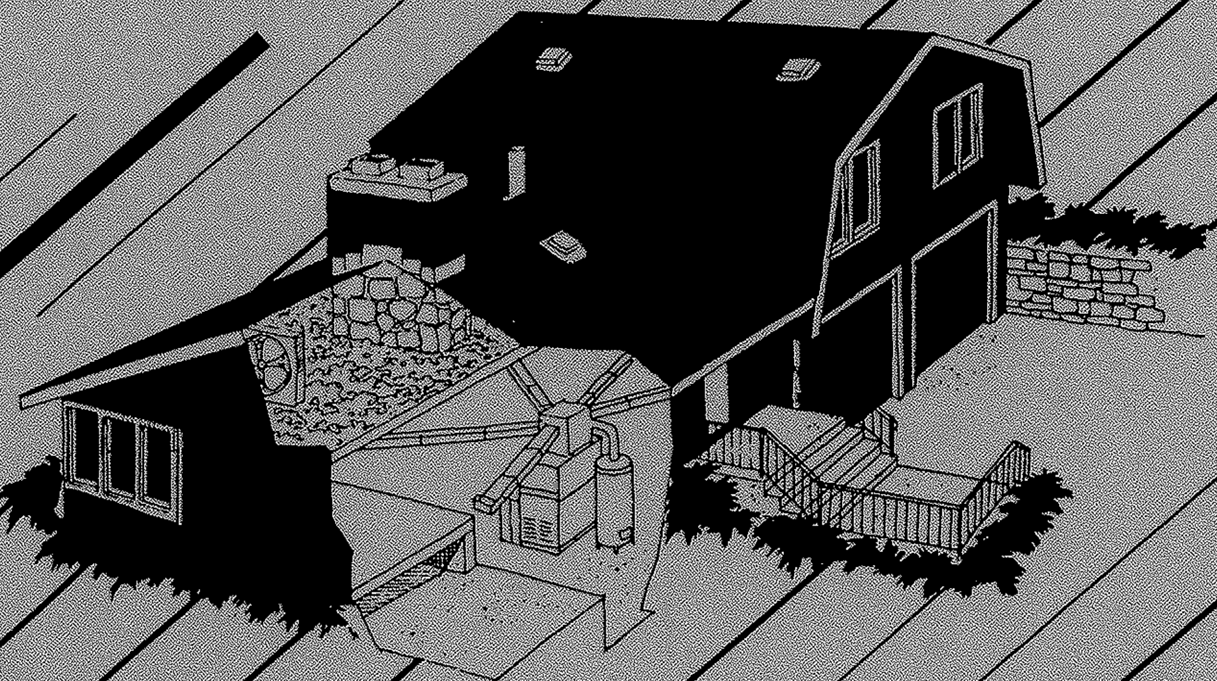
HOW TO COMPARE FUEL AND ELECTRICITY COSTS FOR HOME HEATING



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Selecting the least expensive energy source for heating a building can be a confusing task. The confusion usually is caused by the units used to measure energy consumption and the efficiencies of the device used to convert the energy source into heat. This document provides typical information which will aid in comparison of different energy sources.

Table 1 lists typical units used to measure fuels and electricity and their energy content in therms. A therm is equivalent to 100,000 BTU (British Thermal Units). Natural gas consumption is typically billed in therms. The energy content in Table 1 is the maximum heat which could be obtained by combustion of the fuels. The energy content of electricity is the heat available from a resistance heater.

ENERGY MEASUREMENTS AND CONTENTS

FUEL OR ENERGY SOURCE	TYPICAL CONSUMPTION UNITS	ENERGY CONTENT IN THERMS
Natural Gas	Therms CCF (100 cubic feet)	1.0 0.96 therms/CCF
Fuel Oil	Gallons	1.387 therms/gallon
LPG (propane)	gallons pounds (lb)	0.955 therms/gallon 0.227 therms/lb
Electricity	Kilowatt-hours (kWh)	0.0341 therms/kWh
Coal	Tons (2000 lb) Pounds (lb)	245. therms/ton 0.122 therms/lb
Wood (air dried)*	pounds (lb)	0.058 therms/lb
Lodgepole and Ponderosa pines, aspen, spruce, cottonwood	cords (128 ft^3)	130 therms/cord
Douglas fir, box elder, juniper (cedars)	cords	160 therms/cord
Maple, ash	cords	180 therms/cord
Oak, mahogany	cords	210 therms/cord

*Assumes wood is air dried to 12% moisture. Energy content values for wood are only approximate. The energy content of 0.058 therms/lb is approximately correct for all wood varieties.

TABLE 1

Most fuel burning devices cannot deliver all of the energy content of a fuel to a home. Thus, the efficiency at which a fuel is converted into useable heat needs to be considered. Table 2 lists typical efficiencies for various furnaces and electrical heating equipment. Efficiencies vary considerably and determining accurate efficiencies of older equipment usually requires combustion measurements. Efficiencies of new fuel burning furnaces and boilers are available from the equipment dealers. You should ask the dealer for the AFUE (Annual Fuel Utilization Efficiency) rating which is a percent efficiency measured by the federal government.

EFFICIENCIES OF HEATING EQUIPMENT

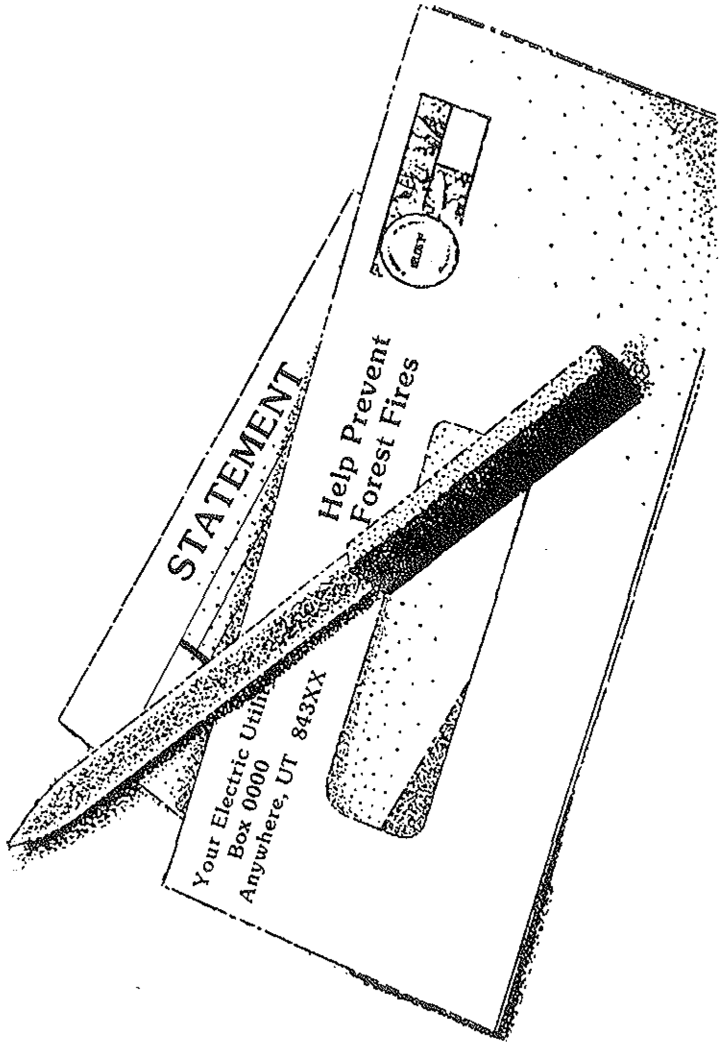
DEVICE	TYPICAL SEASONAL EFFICIENCY (Percent)
Natural Gas or LPG Furnace or Boiler	
Conventional model, standing pilot	62
With electronic ignition	66
With electronic ignition and vent damper	72
Forced draft model with electronic ignition	82
Pulse combustion model	95
Fuel Oil Furnace, conventional	70
Coal Furnace	60
Electric Resistance Furnace	100
Electric Air to Air Heat Pump*	130
Wood stove	
Uncontrolled stove	30
Air tight stove	50
Fireplace	10

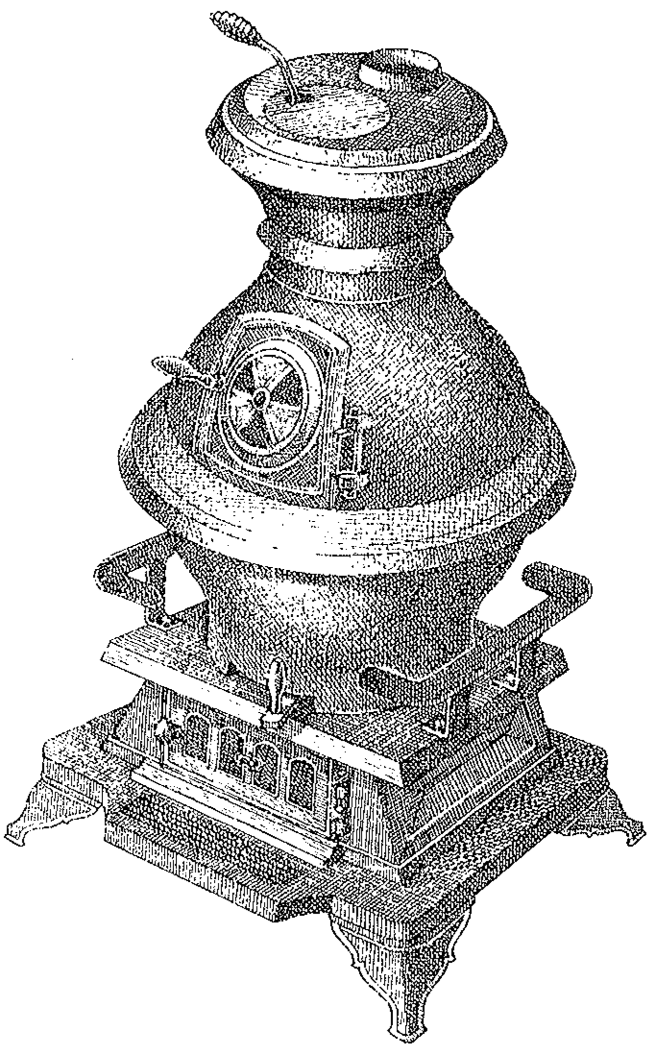
*Heat pump efficiencies vary considerably with climate, being more efficient in warmer climates.

TABLE 2

The efficiency of a heat pump exceeds 100% because a heat pump is capable of extracting energy from cold outside air for heating the inside air. However, the efficiency of a heat pump is difficult to determine because its efficiency varies with outside temperature and decreases with lower temperatures.

Another important consideration is the cost for an energy source. For fuel oil, propane, and coal, the cost is easily obtained by contacting the local dealer. However, natural gas and electricity for an all-electric home are billed on a block schedule, with the cost decreasing as consumption increases. Additionally, a monthly customer service charge or minimum charges may be required. These require one tc estimate the total monthly consumption so as to compute an average monthly cost per unit consumed. If you are currently consuming electricity or natural gas, probably the easiest method for determining the average energy cost is to compute it from a past bill during a recent winter month. For example, if a home is heated electrically, and a total bill for January was $200.00 for 2,000 kWh (kilowatt-hours) of electricity, then the average cost is $200/2000 kWh = $0.10/kWh. If you are to compute the cost of firewood which you are going to gather yourself, don't forget to include the cost for permits, transportation, chain saw depreciation and maintenance, and labor.





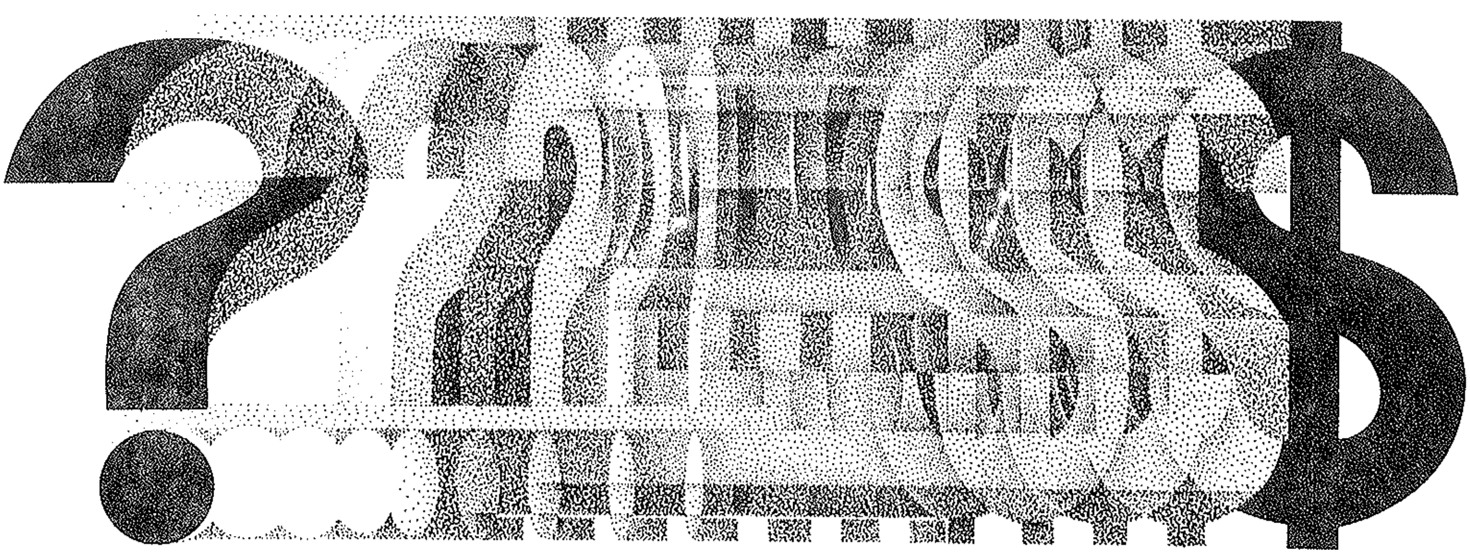
Once you have obtained the energy cost, energy content, and equipment efficiency for a particular heating system, then the cost per therm of heat delivered to your home can be computed. For example, consider burning pine firewood. Assume the wood is purchased at $100.00/cord (a cord of firewood consists of 128 cubic feet of closely stacked wood) and is burned in an air tight stove with an efficiency of 50%. From Table 1 the energy content of firewood is 130 therms/cord. The cost per therm of heat delivered to the home is:

$$\frac{(\$100.00/\text{cord})}{(130\ \text{therms/cord})\ (0.50\ \text{efficiency})} = \$1.54/\text{therm}$$

Dividing energy cost by the product of the energy content and the efficiency gives the cos+ per therm of heat delivered to the home. By gathering the appropriate information on various heating systems, you can compare heating costs. For example, suppose we wish to compare the 3 following home heating alternatives:

ALTERNATIVE	A	B	C
Energy Source	Natural Gas	Firewood (Pine)	Electricity
Energy Cost	\$0.45/therm	\$100/cord	8¢/kWh
Energy Content (from Table 1)	1.0	130 therms/cord	0.0341 therms/kWh
Heating Device	Conventional Furnace	Airtight Stove	Heat pump
Equipment Efficiency	62%	50%	130%
Cost/(Heat delivered) (\$/therm)	$\frac{(0.45)}{(1.0)(.62)} = 0.73$	$\frac{(100)}{(130)(0.50)} = 1.54$	$\frac{(0.08)}{(0.0341)(1.30)} = 1.80$
Cost relative to alternative A	1.0	2.1	2.47

The comparison indicates that energy costs for alternatives B and C would be 2.1 and 2.47 times greater respectively than alternative A.



The following figure gives a graphical method of comparing heating costs. This figure compares eight typical heating methods. For example, consider comparing a 100% efficient electrical resistance furnaced with a 50% efficient wood stove. If the electricity costs 7¢/kWh, then by drawing a hoizontal line through the electric furnace axis at .07/kWh (see the dashed line in the figure) we see that the horizontal line intersects the left most vertical axis (labeled cost of heat delivered) at approximately \$2.00/therm. Thus, heat provided by the electrical furnace costs \$2.00 for every therm of heat delivered to the home. Using the same horizontal line we see that if pine firewood can be obtained at a cost less than approximately \$130/cord, then the firewood would be a less expensive energy resource to utilize.

COMPARISON OF HEATING COSTS

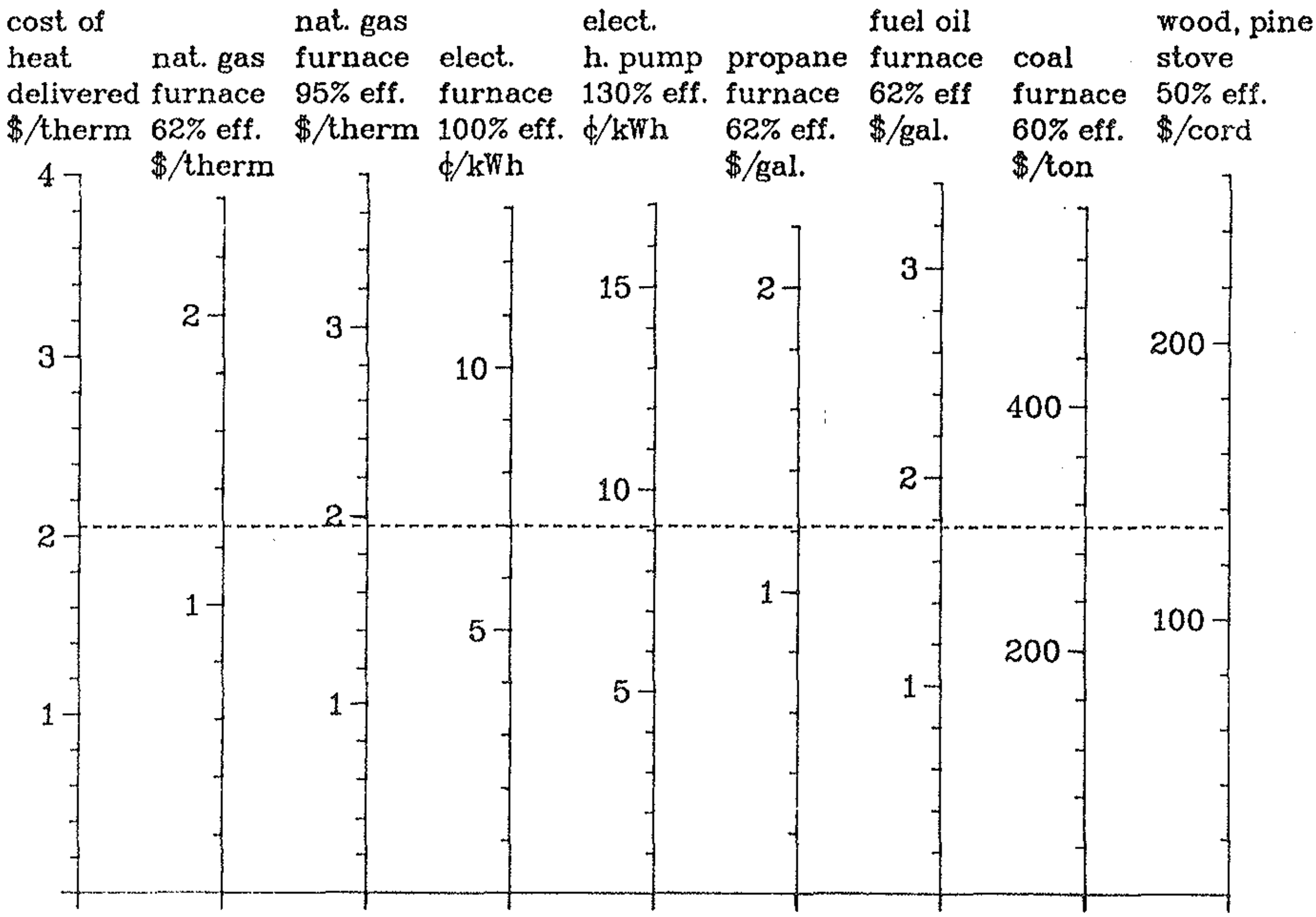


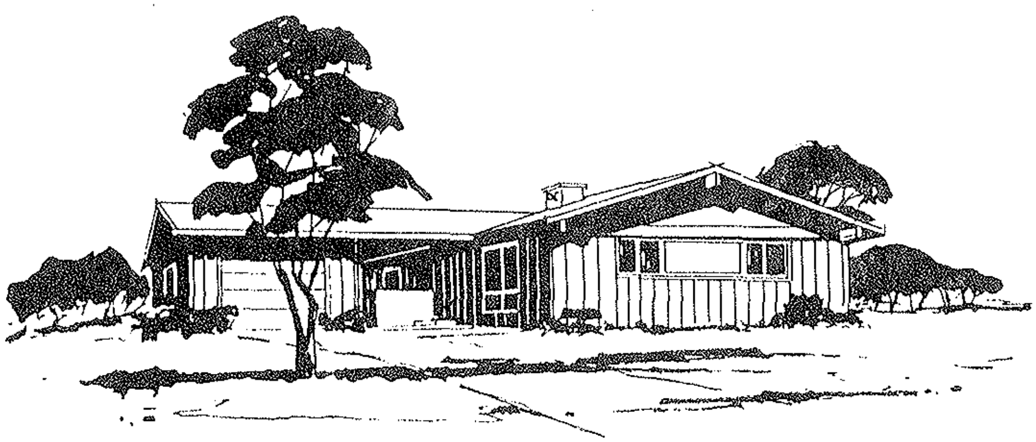
FIGURE 1

A summary of this comparison is illustrated below.

ALTERNATIVE	A	B
Energy Source	Electricity	Firewood (pine)
Energy Cost	7¢/kWh	$130/cord
Heating Device	Resistance Furnace	Airtight Stove
Equipment Efficiency	100%	50%
Cost/ (Heat delivered)	$2.00/therm	$2.00/therm

This document has described how to compare energy costs. There are other important considerations such as the initial cost of the heating device. For example, a high efficiency natural gas furnace could reduce heating costs by about 35% over a conventional model. However, the high efficiency furnace may cost $1,000.00 more than a conventional model. This may require 5 to 8 years of operation to recover the investment through energy savings. Similarly solar energy is free, however the initial cost of solar energy equipment is often high.

One can observe dramatic variations in climate in Utah by traveling only a few miles. Likewise, the availability and cost of fuels and electricity can also change from location to location. Fuel and electricity costs inevitably will increase each year. However, the rate of increase will be different for each energy source. The efficiency of heating equipment can also influence which energy source is least expensive. Thus, in answering the question "How shall I heat my home?", the answer will vary from location to location and from time to time. It is hoped that this document will aid home owners in deciding how to heat their homes.



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