#3979

WSEO

Home Heating Systems

WASHINGTON STATE ENERGY OFFICE

Washington Energy Extension Service

Wise Use of Resources Through Education

Comparing the Cost of Home Heating Fuels

Attached is a table which allows simple comparison of the cost of home heating using different fuels. However, such comparisons are not a substitute for economic analysis that examines capital costs and other operating costs over the full service life of a heating system. This Technote is intended to help consumers make informed decisions regarding fuel use. WEES does not advocate one fuel type over another, but in fact encourages the efficient use of all fuels.

To use the table you need to know the prices of the fuels you want to compare. Write these in the column called "Average Cost Per Unit". Since we are using one million (10^6) Btus of heat energy as a common basis, this value is then multiplied by the number of "Units Required Per 10^6 Btu" taken from the preceding column. The number selected depends on the "Seasonal Heating Efficiency" of the heating system you are looking at and various choices are listed. For a discussion of Seasonal Heating Efficiency see below. The result of this calculation is an "equivalent" fuel cost based on the amount of fuel required to deliver 10^6 Btus to the conditioned space. Write it down in the space provided. Equivalent costs can be used to directly compare different fuels on a percentage basis.

Let's take an example. We'd like to compare the cost of using two types of portable heaters - electric and kerosene. First the electric. From our winter electric bill we estimate the average cost of electricity to be $.045/kWh (your utility can help you determine this). Multiplying this number by 293 (Units Required Per 10^6 Btu) from the table, we have $13.19 per 10^6 Btu. Now the kerosene. By checking with suppliers the average cost per gallon is about $1.75. Multiplying this number by 7.5 (99% efficiency) from the table, we get $13.13. We see that the difference in fuel cost is very small, practically insignificant. At this point it would be a good idea to consider the non-fuel operating costs listed at the far end of the table. In addition, the initial cost of the heaters, operating features, safety, and other factors could be considered.

Actual Savings

The actual savings you may expect during a heating season with one fuel versus another depends largely on how often your heating system is on. Furthermore, service and maintenance costs (as noted in the table) may affect these savings significantly. If you are considering converting to another fuel type or to a more efficient system using the same fuel, it is important to compare the estimated fuel savings with the cost of the investment required.

Another example will be useful. Assume we're presently heating with an inefficient oil furnace. We could install a flame retention burner improving seasonal heating efficiency from 60 to 75%. Or, we may consider installing a super efficient gas furnace with an efficiency of 90%. Let's take these options one at a time.

What are the fuel savings with the new burner? At $1.00 per gal, the present cost of oil is $11.90 per 10^6 Btu ($1.00 x 11.9 at 60% efficiency). With the new burner at 75% efficiency (not listed in the table) we need to first calculate the "Units Required Per 10^6 Btu" according to Note (3).

$$(10^6 \text{ Btu})/[(140{,}000 \text{ Btu/gal})\times(0.75)] = 9.52 \text{ gal}$$

The cost of oil with the new burner is then $9.52 per 10^6 Btu (1.00 x 9.52) for a 20% reduction ($11.90 vs. $9.52) in our fuel bills.

Next, what savings can we expect with a new gas furnace? At $0.55 per therm, the cost of gas would be $6.11 per 10^6 Btu ($0.55 x 11.1 at 90% efficiency) for almost a 50% reduction ($11.90 vs. $6.11 in our fuel bill. Is it better to switch to the gas furnace rather than the new oil burner? This of course depends on the actual energy savings and the cost of each investment.

If initially our fuel bill was $600 for the heating season, our savings will be $120 (20%) and $300 (50%) per year, respectively, for the new oil burner and the gas furnace. The $300 savings with the gas furnace is actually reduced somewhat by minimum monthly service charges (about $5 per month) so $240 net savings should be used instead. How much do these heating system replacements cost? It helps here to get actual price quotes from several contractors, however we will nominally choose figures of $600 (oil burner) and $2,400 (gas furnace) for illustration purposes only. The simple payback of each investment may be calculated by dividing the cost of the investment by its annual savings.

oil burner payback = $600/$120 = 5 years

gas furnace payback = $2,400/$240 = 10 years

So we see that in this case, the less costly investment, although less efficient, may prove the wiser choice. This comparison does not take into account the condition of the existing furnace which, if only the burner is replace, may require sooner replacement or repairs compared to a new gas furnace. Remember, economic comparisons are only as accurate as our assumptions and estimates. Also, they should only be used as one of many criteria for making decisions. Other criteria may include comfort, reliability and safety.

Seasonal Heating Efficiency

The seasonal heating efficiency of a particular heating system is used for comparison with other heating systems in the same way that mileage ratings are used with cars. It is also known as the "annual fuel utilization efficiency" or AFUE. It is generally different than efficiencies quoted by manufacturers or dealers which are actually "steady state" efficiencies. Let's see how they differ.

The steady state efficiency refers to an instantaneous efficiency while the system is warmed up and running steadily. The seasonal efficiency refers to an average efficiency accounting for the inefficiencies inherent in warm up and cool down, also known as "cycling" losses. In a wood stove, for example, the seasonal efficiency would refer to the average combustion efficiency (from the time wood ignites until it becomes ash) in addition to the heat transfer efficiency (accounting for heat losses up the chimney). Seasonal efficiencies are therefore lower than steady state efficiencies, the difference depending both on the nature of the fuel and the heating system design.

Written by Jack Brautigam

August 1988

Washington Energy Extension Service, a Washington State Energy Office program, is funded by the Bonneville Power Administration and the U.S. Department of Energy.

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TABLE FOR CALCULATING EQUIVALENT FUEL COSTS(1)

FUEL TYPE	FUEL UNIT	BTU/UNIT	SEASONAL HEATING (2) EFFICIENCY, %	UNITS REQUIRED(3) PER 10^6 BTU		AVERAGE (4) COST PER UNIT,$		COST PER(5) 10^6 BTU,$	SERVICE & MAINT.(6) COSTS
#2 Fuel Oil	Gallon	140,000	60 70 80	11.9 10.2 8.9	x	______	=	______	• tune-ups • tank insurance
Natural Gas	Therm	100,000	60 70 80 90	16.7 14.3 12.5 11.1	x	______	=	______	• tune-ups • service charge • burner lease (if applicable)
Electricity	kWh	3,413	100 (resistance) 170 (heat pump) 220 (heat pump)	293 172 133	x	______	=	______	• service charge (if applicable)
Wood	Cord	22×10^6 (Douglas Fir)	50 60	0.091 0.076	x	______	=	______	• operation
		17×10^6 (Red Alder)	50 60	0.118 0.098	x	______	=	______	• stove & chimney cleanings
Coal	Ton	24×10^6	60 70	0.070 0.060	x	______	=	______	• operation • stove & chimney cleanings
Kerosene	Gallon	135,000	90 99	8.2 7.5	x	______	=	______	• replacement wicks

(1) Based on fuel required to deliver one million (10^6) Btus to conditioned space.

(2) Suggested range of seasonal (AFUE) efficiencies for each fuel option. If known, use an actual efficiency and calculate "Units Required Per 10^6 Btu" according to Note (3).

(3) For efficiencies other than listed, "Units Required Per 10^6 Btu" = (10^6 Btu)/[(Btu/Unit) x (Seasonal Heating Efficiency)].

(4) Depends on utility rate schedules and/or dealer prices in your area.

(5) "Cost Per 10^6 Btu" = (Units Required Per 10^6 Btu) x (Average Cost Per Unit).

(6) These costs are in addition to the cost of fuel.