



BUILDING IN ALASKA

EEM-04253

Heating Values of Fuels

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The gross heat outputs of various fuels are listed in Table 1. For all fuels except electricity, the gross heat output is a theoretical quantity: you never get that much heat out by burning the fuel in a stove or furnace as part of the heat is wasted up the chimney.

Heat output of wood varies with species and moisture content at burning. A cord of wood is 4' x 4' x 8' (128 cu. ft.) but the actual volume of wood is around 80 to 90 cu. ft. The drier the wood is, the higher the heat output.

The average efficiencies of selected types of heating systems are listed in Table 2. Heating system efficiency depends upon a number of factors, such as: method of firing the fuel, firing rate, air supply, amount of heat surface, volume of the combustion chamber, and cleanliness of the combustion chamber and radiating surfaces of the heating system.

Although electrical resistance heating is rated 100 percent efficient at the heating point, the energy efficiency at the power generation plant in converting fossil-fired fuel to electricity is variable and in the range of 28 to 38 percent. If waste heat for cooling turbines was used for the central heating of a city, the energy end-

use efficiency could be increased to 60 to 70 percent.

The net heat outputs of various fuels and heating systems are listed in Table 3. These figures tell how much heat will actually be delivered to the house by burning a certain type of fuel in a certain type of heating system at the assumed efficiencies of Table 2. The numbers given in Table 3 are obtained by multiplying gross heat output of fuel times efficiency of heating system. Thus, a gallon of fuel oil contains 134,000 BTU's, but burned at 65 percent efficiency, it will deliver to the house 89,700 BTU's.

Abbreviations in Text

BTU stands for British Thermal Unit, and is defined as the amount of heat required to raise 1 lb. of water 1 degree Fahrenheit at 60°F;

cu. ft. = cubic foot (feet);

lb. = pound(s);

gal. = gallon(s);

kWh = Kilowatt-hour(s)

Specific gravity of wood is the ratio of weight of wood to equal volume of water, such that one cubic foot of wood at specific gravity of .55 weighs 34.3 lbs (.55 x 62.4).

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451/4-82/RDS/300

Reprinted March 2009



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TABLE 1: GROSS HEATING VALUES OF FUELS

Type Fuel	BTU/lb.	BTU/Unit
Propane	21,550	91,800 /gal.
Natural Gas	73,890	1,000 /cu. ft.
Lignite Coal	8,700	17,400,000 /ton
Fuel Oil	19,230	134,000 /gal.
Wood: Paper Birch ¹	8,600	23,600,000 /cord ³
Paper Birch	8,600	18,200,000 /cord ⁴
White Spruce ²	8,600	18,500,000 /cord ³
White Spruce	8,600	15,000,000 /cord ⁴
Electricity	—	3,413 /kWh

¹ Specific gravity = .55

² Specific gravity = .43

³ Oven dry, moisture content = 0%

⁴ Air dry, average moisture content = 20%

Wood values from the U.S. Forest Service/Alaska State Forester pamphlet entitled "Wood As a Fuel," 1979

TABLE 2: EFFICIENCY OF HEATING SYSTEMS

Type of Fuel	Firing Method	Efficiency (Percent)
Coal, lignite	Hand-fired w/ controls	50-65
Coal, lignite	Stoker-fired	50-60
Electric	Resistance	100
Gas	All types	70-85
Oil	Designed unit	65-85
Oil	Conversion	60-80
Wood	Space heater, hand fired w/ controls	50-60
Wood	Open fireplace	15-20*

*Fireplace efficiency is highly variable, but is especially diminished as outdoor temperatures decrease.

TABLE 3: NET HEATING VALUE OF FUEL

Type Fuel	Heating Plant Efficiency (percent)	Net Heat Output (BTU/Unit)	Quantity of fuel needed 100,000 BTU's
Gas, natural	70	700 /cu. ft.	140.00 cu. ft.
Coal, lignite	55	9,570,000 /ton	20.80 lb.
Electricity	100	3,413 /kWh	29.30 kWh
Fuel oil	80	107,000 /gal.	1.10 gal.
Wood: birch 20% mc	50	9,100,000 /cord	0.99 cu. ft.*
Wood: spruce 20% mc	50	7,500,000 /cord	1.20 cu. ft.*
Propane	80	73,600 /gal.	1.6 gal.
Steam	100	970,000 /1,000 lb.	103.0 lb.

*Cord equals 90 cu. ft.