ENERGY CONTENT OF FUELS

Several fuels are compared in this table with respect to their energy content per unit mass and the amount of CO_2 released per unit of available energy. The energy content is taken to be the negative of the standard enthalpy of combustion (see the table "Heat of Combustion" in this section for more details). The energy is assumed to be released by combustion with oxygen at normal atmospheric pressure, with products of gaseous CO_2 and liquid H_2O at room temperature. This quantity is often called the "gross heat of combustion" to distinguish it from the "net heat of combustion," for which the water remains in the gas state. The latter quantity is typically 5% to 10% less than the values given here.

The energy content is given both in SI units of MJ/kg and conventional units of BTU/lb. Values for the fossil fuels and other materials are typical; individual samples show wide variations.

The last column gives the grams of carbon released as carbon dioxide per megajoule of energy. Examination of the table shows that the minimum CO_2 release occurs for fuels that have a high ratio of hydrogen to carbon. Furthermore, fuels containing oxygen have a lower energy content and higher CO_2 release than hydrocarbons with the same number of carbon atoms.

References

1. Domalski, E. S., Jobe, T. L., and Milne, T. A., *Thermodynamic Data for Biomass Conversion and Waste Incineration,* SERI/SP-271-2839, Solar Technical Information Program, U. S. Department of Energy, September 1986; see also NBSIR 78-1479, National Bureau of Standards, August 1978.
2. Green, D. W., and Ackers, D. E, *Perry's Chemical Engineers' Handbook, Eighth Edition*, McGraw-Hill, New York, 2007.
3. *Transportation Energy Data Book,* U. S. Department of Energy, May 2007, http://cta.ornl.gov/data/index.shtml.
4. *Chemical Composition of Natural Gas,* Union Gas Limited, http://www.uniongas.com/aboutus/aboutng/composition.asp.

Fuel	Energy content MJ/kg	Energy content 10^3 BTU/lb	g of C per MJ
Pure compounds			
Hydrogen	141.8	61.0	0.0
Methane	55.5	23.9	13.5
Ethane	51.9	22.3	15.4
Propane	50.3	21.7	16.2
Hexane	48.3	20.8	17.3
Heptane	48.1	20.7	17.5
Octane	47.9	20.6	17.6
Methanol	22.7	9.7	16.5
Ethanol	29.7	12.8	17.6
1-Propanol	33.6	14.5	17.8
1-Butanol	36.1	15.5	18.0
1-Octanol	40.7	17.5	18.1
Methyl *tert*-butyl ether	38.2	16.4	17.8
Fossil fuels			
Natural gas[a]	54.0	23.2	13.9
Gasoline	46.5	20.0	17.6
Kerosene	46.4	20.0	18.5
Fuel oil	40.9	17.6	21.3
Coal, high bituminous	36.3	15.6	23.5
Coal, low bituminous	28.9	12.4	26.3
Coal, anthracite	34.6	14.9	27.3
Other materials			
Wood, oak	18.9	8.1	25.3
Wood, locust	19.7	8.5	25.7
Wood, Ponderosa pine	20.0	8.6	24.6
Wood, redwood	20.7	8.9	24.4
Charcoal, wood	34.7	14.9	26.8
Newsprint	18.6	8.0	26.5
Cellulose	17.3	7.5	25.6
Grass (lawn clippings)	19.3	8.3	24.9

[a] Assumed to be 95% methane, 2.5% ethane, and 2.5% inert compounds; however, the actual composition varies widely (see Reference 4).