

B

Appendix

Metric Conversion Factors, Metric Prefixes, and Other Physical Conversion Factors

Data presented in the *Monthly Energy Review* and in other Energy Information Administration publications are expressed predominately in units that historically have been used in the United States, such as British thermal units, barrels, cubic feet, and short tons. However, because U.S. commerce involves other nations, most of which use metric units of measure, the U.S. Government is committed to the transition to the metric system, as stated in the Metric Conversion Act of 1975 (Public Law 94–168), amended by the Omnibus Trade and Competitiveness Act of 1988 (Public Law 100–418), and Executive Order 12770 of July 25, 1991.

The metric conversion factors presented in Table B1 can be used to calculate the metric-unit equivalents of values expressed in U.S. Customary units. For example, 500 short

tons are the equivalent of 453.6 metric tons (500 short tons x 0.9071847 metric tons/short ton = 453.6 metric tons).

In the metric system of weights and measures, the names of multiples and subdivisions of any unit may be derived by combining the name of the unit with prefixes, such as deka, hecto, and kilo, meaning, respectively, 10, 100, 1,000, and deci, centi, and milli, meaning, respectively, one-tenth, one-hundredth, and one-thousandth. Common metric prefixes can be found in Table B2.

The conversion factors presented in Table B3 can be used to calculate equivalents in various physical units commonly used in energy analyses. For example, 10 barrels are the equivalent of 420 U.S. gallons (10 barrels x 42 gallons/barrel = 420 gallons).

Table B1. Metric Conversion Factors

| Type of Unit | U.S. Unit | | Equivalent in | Metric Units |
|--------------------------------|---|---|-------------------------------|---------------------------------------|
| Mass | 1 short ton (2,000 lb) | = | 0.907 184 7 | metric tons (t) |
| | 1 long ton | = | 1.016 047 | metric tons (t) |
| | 1 pound (lb) | = | 0.453 592 37 ^a | kilograms (kg) |
| | 1 pound uranium oxide (lb U ₃ O ₈) | = | 0.384 647 ^b | kilograms uranium (kgU) |
| | 1 ounce, avoirdupois (avdp oz) | = | 28.349 52 | grams (g) |
| Volume | 1 barrel of oil (bbl) | = | 0.158 987 3 | cubic meters (m ³) |
| | 1 cubic yard (yd ³) | = | 0.764 555 | cubic meters (m ³) |
| | 1 cubic foot (ft ³) | = | 0.028 316 85 | cubic meters (m ³) |
| | 1 U.S. gallon (gal) | = | 3.785 412 | liters (L) |
| | 1 ounce, fluid (fl oz) | = | 29.573 53 | milliliters (mL) |
| | 1 cubic inch (in ³) | = | 16.387 06 | milliliters (mL) |
| Length | 1 mile (mi) | = | 1.609 344 ^a | kilometers (km) |
| | 1 yard (yd) | = | 0.914 4 ^a | meters (m) |
| | 1 foot (ft) | = | 0.304 8 ^a | meters (m) |
| | 1 inch (in) | = | 2.54 ^a | centimeters (cm) |
| Area | 1 acre | = | 0.404 69 | hectares (ha) |
| | 1 square mile (mi ²) | = | 2.589 988 | square kilometers (km ²) |
| | 1 square yard (yd ²) | = | 0.836 127 4 | square meters (m ²) |
| | 1 square foot (ft ²) | = | 0.092 903 04 ^a | square meters (m ²) |
| | 1 square inch (in ²) | = | 6.451 6 ^a | square centimeters (cm ²) |
| Energy | 1 British thermal unit (Btu) ^c | = | 1,055.055 852 62 ^a | joules (J) |
| | 1 calorie (cal) | = | 4.186 8 ^a | joules (J) |
| | 1 kilowatthour (kWh) | = | 3.6 ^a | megajoules (MJ) |
| Temperature^d | 32 degrees Fahrenheit (°F) | = | 0 ^a | degrees Celsius (°C) |
| | 212 degrees Fahrenheit (°F) | = | 100 ^a | degrees Celsius (°C) |

^aExact conversion.

^bCalculated by the Energy Information Administration.

^cThe Btu used in this table is the International Table Btu adopted by the Fifth International Conference on Properties of Steam, London, 1956.

^dTo convert degrees Fahrenheit (°F) to degrees Celsius (°C) exactly, subtract 32, then multiply by 5/9.

Notes: • Spaces have been inserted after every third digit to the right of the decimal for ease of reading. • Most metric units belong to the International System of Units (SI), and the liter, hectare, and metric ton are accepted for use with the SI units. For more information about the SI units, see <http://physics.nist.gov/cuu/Units/index.html>.

Web Page: http://www.eia.doe.gov/emeu/mer/append_b.html.

Sources: • General Services Administration, Federal Standard 376B, *Preferred Metric Units for General Use by the Federal Government* (Washington, DC, January 1993), pp. 9-11, 13, and 16. • U.S. Department of Commerce, National Institute of Standards and Technology, Special Publications 330, 811, and 814. • American National Standards Institute/Institute of Electrical and Electronic Engineers, ANSI/IEEE Std 268-1992, pp. 28 and 29.

Table B2. Metric Prefixes

| Unit Multiple | Prefix | Symbol | Unit Subdivision | Prefix | Symbol |
|------------------|--------|--------|-------------------|--------|--------|
| 10 ¹ | deka | da | 10 ⁻¹ | deci | d |
| 10 ² | hecto | h | 10 ⁻² | centi | c |
| 10 ³ | kilo | k | 10 ⁻³ | milli | m |
| 10 ⁶ | mega | M | 10 ⁻⁶ | micro | μ |
| 10 ⁹ | giga | G | 10 ⁻⁹ | nano | n |
| 10 ¹² | tera | T | 10 ⁻¹² | pico | p |
| 10 ¹⁵ | peta | P | 10 ⁻¹⁵ | femto | f |
| 10 ¹⁸ | exa | E | 10 ⁻¹⁸ | atto | a |
| 10 ²¹ | zetta | Z | 10 ⁻²¹ | zepto | z |
| 10 ²⁴ | yotta | Y | 10 ⁻²⁴ | yocto | y |

Web Page: http://www.eia.doe.gov/emeu/mer/append_b.html.

Source: U.S. Department of Commerce, National Institute of Standards and Technology, *The International System of Units (SI)*, NIST Special Publication 330, 1991 Edition (Washington, DC, August 1991), p.10.

Table B3. Other Physical Conversion Factors

| Energy Source | Original Unit | | Equivalent in Final Units |
|------------------|------------------|---|--|
| Petroleum | 1 barrel (bbl) | = | 42 ^a U.S. gallons (gal) |
| Coal | 1 short ton | = | 2,000 ^a pounds (lb) |
| | 1 long ton | = | 2,240 ^a pounds (lb) |
| | 1 metric ton (t) | = | 1,000 ^a kilograms (kg) |
| Wood | 1 cord (cd) | = | 1.25 ^b shorts tons |
| | 1 cord (cd) | = | 128 ^a cubic feet (ft ³) |

^aExact conversion.

^bCalculated by the Energy Information Administration.

Web Page: http://www.eia.doe.gov/emeu/mer/append_b.html.

Source: U.S. Department of Commerce, National Institute of Standards and Technology, *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices*, NIST Handbook 44, 1994 Edition (Washington, DC, October 1993), pp. B-10, C-17 and C-21.