Energy Data Conversion Handbook

How to Combine and Compare International Energy Data

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MACMILLAN PUBLISHERS
LONDON

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By McGraw-Hill Publications Company, Special Publications, Washington D.C.
Cover Art: Mark Nedostup

Published in North America in 1984 by:
McGraw-Hill Publications
1120 Vermont Avenue N.W.
Suite 1200-NPC
Washington D.C. 20005

ISBN: 07-606892-7

Published outside North America in 1984 by:
Macmillan Publishers Ltd. (Journals Division)
Distributed by Globe Book Services Ltd.
Brunel Road, Houndsmills, Basingstoke,
Hampshire RG21 2XS, England
ISBN: 0 333 37215 8

British Library Cataloging in Publication Data
Energy Data Conversion Handbook
1. Force and Energy
I. Title
531'.6 QC73
ISBN: 0-333-37215-8

PREFACE

Energy Data Conversion Handbook consists primarily of tables and charts for comparing and combining energy data. Its purpose is twofold: (1) to provide a framework for understanding the contributions of different energy fuels and (2) to provide precise tools for converting energy statistics in different measurement units to common units in order to permit comparative analyses.

FOREWORD

Events of the 1970s shattered the world's comfortable reliance on oil as an inexpensive and seemingly limitless source of energy. In the face of spiraling prices and supply disruptions, energy consumers, producers, and policy makers looked with unprecedented urgency at the ability of other fuels to meet energy needs in a more cost-effective and secure manner.

In so doing, they ran into a problem that has plagued energy analysts for decades. Energy is derived from many fuels and technologies that use different measuring systems, resulting in data that are not easily comparable or combinable across different energy commodities.

On the international level, combining or comparing energy data is further complicated by two factors: (1) different national measurement systems (most noticeably metric and non-metric) can make it difficult to compare even the same energy commodity across countries; and (2) the same commodity from different countries may vary significantly in its energy value because of different physical characteristics.

Background and Purpose of This Handbook

Energy Data Conversion Handbook consists primarily of tables and charts for comparing and combining energy data. Its purpose is twofold: (1) to provide a framework for understanding the contributions of different energy fuels and (2) to provide precise tools for converting energy statistics in different measurement units to common units in order to permit comparative analyses. Although the title stresses the applications in international data, the book's treatment of conversion across different fuels and measurement systems will benefit users with interests in:

- Different energy commodities within a single country.
- A single commodity across multiple countries.
- The broad spectrum of energy sources on an international basis.

This handbook was prepared originally by the U.S. Federal Energy Administration in the late 1970s, and distributed in limited quantities at that time. This edition marks its first publication for large-scale audiences.

Organization of Content

Energy Data Conversion Handbook is divided into three main parts, plus a bibliography of sources used to prepare the tables and text. Part I is a brief introduction to the measurement systems (e.g. mass, volume, work, etc.) found with energy statistics and tells how to move from one unit to another within each measurement system. Part II describes particular energy commodities and indicates how they can be compared on the basis of their energy values. Part III provides a series of conversion tables for converting different energy commodities, measured in their customary units, to any one of ten equivalent units commonly employed in combining or comparing energy data.

Each part is heavily oriented toward tables. However, readers should not ignore the important text explaining when and how the tables should be used. The text also contains definitions of fundamental terms required for proper analysis and should be read through before the book is used in its entirety as a reference.

Part I. Measurement Systems: This section identifies the many units in which energy commodities are measured around the world — measures of mass, volume, heat, power, and work. Accompanying tables permit easy conversion among different units within a single system of measurement. With this consolidation of the many measurement units, the user can identify quickly the comparative meaning of even the most unfamiliar terms. In addition, both metric and non-metric relationships are portrayed clearly and completely for every conceivable unit used with energy statistics (subtle distinctions, such as between the American and British gallon, illustrate the importance of sufficiently clarifying certain international expressions). The section's discussion of mass and volume, whose interrelationships are significant when evaluating petroleum data, explains the difficult concepts of specific and API gravity.

Part II. Energy Commodities and Uses: This section is the heart of the book. It describes all principal energy fuels and identifies various methods of placing them on a comparable basis using measures of heat. Specifically, its extensive tables deal with converting from units of mass or volume (such as tons or barrels) — typically employed by primary data reporting sources — to units of heat equivalent, which may be compared meaningfully across all fuels. Emphasis is placed on variances in heat equivalent due to distinct qualities of specific fuels (such as coal used in power plants versus coal in steel-making, or crude oil from Venezuela versus crude from Indonesia). The many tables addressing these variations represent one of the most thorough efforts ever published on the issue of comparing different energy fuels and/or international data.

This part also describes certain vital, but often overlooked, methodological points dealing with heat equivalents. For example, the distinction between "gross" versus "net" heat value (known as "calorific" value in European countries) described on page 11, as well as the different approaches to expressing the fuel equivalent of electricity noted on page 24 have far-reaching impact yet they typically are given little salience in reported figures. By being aware of such contrasting methods, one can avoid misinterpreting data expressed in heat equivalents and avoid being mystified by seemingly unaccountable discrepancies from different reporting sources.

The definitions of various solid, liquid, and gaseous fuels in this part are extremely helpful for understanding the numerous commodity classifications. At the international level, these definitions reduce potential confusion about the many types of coal and refined products, which no two reporting entities seem to treat similarly.

Part III. Energy Equivalents of Fuels and Electricity: This section contains a series of tables showing how energy commodities can be converted into any of the commonly used units of "equivalent" measurements. Each fuel is presented in its typical primary measurement unit(s) and is converted into ten equivalents. The equivalents are: teracalorie, terajoule, net Btu, gigawatt-hour, metric ton of coal, metric ton of oil, kiloliter of oil, barrel of oil, barrel per day of oil, and gross Btu.

As is the case throughout this book, the brief text in this section adds an imperative insight for using the accompanying tables properly. Taking the suggestion in the text to use country-specific heat equivalents whenever available in favor of the "standard" equivalents, one ordinarily would use the more precise conversion factors in Part II (or, if available, the current value from the reporting entity) to compute heat equivalents. Once heat equivalents are computed as accurately as possible, the tables in Part III may be used as convenient tools for quickly computing other equivalent expressions. Similarly, if one is using data already expressed in a standardized oil, gas, or coal "equivalent" as the point of departure, then these tables may be used freely withought risks of distortion.

How This Handbook Can Be Used

In my own work in strategic planning and information services for the international energy industry, I have made frequent use of this book to compile consistent historical data, to analyze forecasts expressed in different fuel equivalents, and to place isolated statistics in unfamiliar units into meaningful perspective. I found *Energy Data Conversion Handbook* very instructive when I needed to be familiar with related energy resource industries outside my main area of expertise. In constructing a worldwide data bank to address the need for retrieving compatible data covering various energy commodities in whatever unit suited the immediate task, this book was indispensable.

The following examples illustrate a few of the many types of conversion problems that this handbook can help resolve:

- You need to estimate freight charges (based on tonnage) for a volume of 33° API gravity oil measured in barrels. To do so, you must convert the barrel measurement to tons. Use Table 4 to discover the density of this oil (7.32 barrels per ton) and then divide the total number of barrels by this density value.

- You want to compare the price of liquefied natural gas (reported per metric ton of liquid) with dry natural gas (reported per cubic meter of gaseous volume) to see which is more cost effective in terms of heat. Using Table 15 for liquids, you see that there are 12.6 megacalories per kilogram of LNG; using Table 17, you retrieve the megacalories per cubic meter of the dry gas based on the country of origin. With these two figures you can then compare the price of the two fuels from a common calorific base by dividing the original prices by the corresponding megacalorie equivalent, arriving at the prices per megacalorie.

- You want to analyze the contribution of nuclear power to France's total energy requirements. You gather data on energy consumption in France from all fuel sources, but each, of course, is expressed in different measurements (nuclear power in kilowatt hours, coal in metric tons, natural gas in terajoules, etc.) and difficult to combine or compare. To get the data into a common measurement system, you convert all figures to Btu equivalents, using Table 6c to convert nuclear power data in kilowatt hours to Btus and the various tables in Part II to convert data for other energy sources into Btu equivalents. Once all sources are in Btus, you can easily determine the proportional contribution of each. (If you want to express the contribution of all fuels in standard equivalents other than Btus, you can use the Table 24 series to convert Btu values into any of 13 other standard equivalents.)

A more complicated example, which follows, involves using many tables within the various sections of this handbook. It further illustrates how to use this book for such typical needs as converting from one unit to another within a single measurement system (e.g. from kiloliters to barrels), from one system to another (e.g. from volume to heat), as well as methodological considerations for "gross" versus "net" heat values and for converting from heat to standard fuel equivalents.

- You want to assess the dependence of the U.S., Japan, and the EEC on OPEC oil supplies. You assemble data for U.S., Japan, and EEC crude oil imports from Iran, Iraq, and total OPEC, as well as data on all other oil imports and total consumption of all other energy fuels. Without a tool such as *Energy Data Conversion Handbook,* you probably would face an overwhelming task of reconciling diverse measurements into a coherent picture. Instead, you use the tables in this book to transform these measurements rapidly into comparable form. The general approach is to convert all data to Btu equivalents first, then use tables in Part III if you need to convert further from heat to any desired standard equivalents. You would proceed as shown in the following chart:

Data Category	Typical Primary Reported Unit	How to Use Tables to Yield Btu Heat Equivalents
Crude oil imports from Iran, Iraq, and Total OPEC for:		
United States	1000 barrels/day	x 365 days x 5500 million Btu per 1000 barrels (Table 15) for total or OPEC imports. (Heat equivalents can be made more specific by using Btu values from specific countries per 1000 barrels, as shown in Table 16. In the calculation preceeding, for example, 5500 would be replaced by 5523 for crude oil coming from Iran and by 5475 for oil from Iraq.)
Japan	1000 kiloliters	x 1 barrel ÷ .159 kiloliters (Table 2) x respective Btu values in Tables 15 and/or 16.
EEC	1000 metric tons oil equivalent	x 40500 million Btu per 1000 mt (Table 24b).

To complete the task, the next step is to determine total energy consumption for:

United States	Pre-converted (by U.S. government) in quadrillion Btus (gross)	x [5.5 net Btus per barrel ÷ 6.0 gross Btu per barrel (Table 15 and p. 11)] x 10^9 million Btu per quadrillion Btu.
Japan	1000 kiloliters oil equivalent	x 34800 million Btu per 1000 kiloliters (Table 24b).
EEC	Terajoules (net)	x 947.8 million Btu per Terajoule (Table 6c).

Once all data are in million Btu heat equivalent, they can be compared on that common basis. If you need to compare the data within another measurement system, use the Table 24 series — for example, use Table 24b ("Net Btu Equivalents of Liquid Fuels") to convert the Btu data into "per barrel" oil equivalents. If you wanted to analyze dependence on oil imports by comparison with other energy fuel imports reported in their different primary units, then the other tables in Part II would be appropriate to calculate heat equivalents.

Summary

Energy Data Conversion Handbook is a valuable primer for anyone who uses energy statistics and an essential guide for those who undertake statistical research or analysis. The convenience of having such a broad range of important related definitions and conversion tables in a single volume should save a great deal of time — and probably even make possible research previously unattempted because of data incompatibility. Those who are fortunate enough to come across this unique book surely should feel a sense of discovery and relief in unfolding many mysteries of energy data.

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INTRODUCTION

The science of energy economics began to take shape in the 1920's with Tryon's exploration of the relationship of energy consumption to industrial production. It grew slowly thereafter until World War II,[1] when energy shortages made the world conscious of the importance of energy in human affairs. This consciousness stimulated numerous efforts to develop energy data and to investigate in depth the causes and consequences of energy use. During the War, such analyses were conducted in the U.S. Department of State. Following the War, the effort was continued by the United Nations, the Economic Commission for Europe, the Organization for Economic Cooperation and Development, the European Economic Community, and by certain countries that were particularly hard-pressed for energy, such as Italy and Chile.

Research on energy expanded enormously during the 1920's; it then exploded in the 1970's in response to a turnabout in the position of the U.S. with respect to oil self-sufficiency and a concomitant, enormous increase thereafter in the price of oil.

This growth in energy research, while healthy, created a number of problems, especially problems of comparability. It also focused attention on the inadequacy of energy data. Many of the data needed were not available, and those available were frequently insufficiently accurate for use in anything more than superficial analyses.

Moreover, there was little standardization in the methodology of energy research. Too little was known about the qualities of the different energy commodities, and there was little agreement on means of converting the several commodities to a common base. In the United States and Europe, the coal equivalent came into common use, but in the United States coal equivalents were succeeded by oil equivalents in million barrels or thousand barrels per day, electricity equivalents in kilowatt hours, and the British thermal unit. The coal equivalent prevailed for many years in Europe, but now seems to be giving way to calories, joules, and tons oil equivalent. In Latin America and Japan, an oil equivalent expressed in kiloliters or thousands of cubic meters is commonly used; Finnish studies have employed a fuelwood equivalent; Chilean, Romanian, and some American studies, an electricity equivalent.

The purpose of this book is to provide a fully compatible set of factors that takes into account both the information available and the practices followed in those countries and agencies which have gone furthest in their research into the facts and implications of energy. This publication is a guide for energy economists and statisticians who are undertaking studies in the field of energy.

Energy is not a simple concept. It is a multifaceted commodity which appears in the form of heat, light, motion, sound, and, to those who get a bit careless, electric shock. It is the heat that enables us to live in the middle and upper latitudes, to render foods edible and palatable, to extract metals from ores and reshape them into tools, kettles, tanks, and trusses. It is a means for protecting ourselves and our families from the discomforts of weather, and from contamination by tainted objects.

Energy is the light that lengthens our day, enables us to peer into the bowels of the earth, and helps us to find our way through the dark woods and the dark streets. It is the power that enables us to move ourselves from where we are to where we wish to be, and our goods from where we find them to where we need them. It is the power that enables us to reshape materials to our own ends—to push, pull, twist, bend, cut, stretch, or compress raw materials until they satisfy our material and esthetic demands. Energy is also the means by which we transmit signals through infinite space and pictures from Mars to Earth.

Energy is derived from many different sources, measured in many different units, and reported in many different terminologies. The definitions, conversion factors, and tables that follow should help to eliminate those problems of energy research that stem from such differences.

[1] Pre-World War II research on international aspects of energy reached a peak in 1937 with the publication of Regul and Mahnke's paper *Energiequellen der Welt*. Berlin: Institute für Konjunkturforschung, 1937.

I. MEASUREMENT SYSTEMS

The *units* in which energy is measured are innumerable. They comprise measures of mass or weight, of volume, of heat, of power, and of work.

Mass or Weight

Units of *mass* or *weight* are used in the measurement of most solid and most noncommercial fuels and, in some countries, in the measurement of liquid fuels. Units of *volume* are used in the measurement of liquid fuels in all countries, in the measurement of certain noncommercial fuels (such as fuelwood) in much of the world, and in the measurement of gas. Also used in the measurement of gas are calories and British thermal units (Btu), two true and direct measures of energy. Other units commonly employed in the measurement of energy or energy commodities are the kilowatt hour (kWh), used to measure electrical current, and the joule (J), the original link between heat and work.

Units of mass associated with energy commodities include the kilogram (kg) and the metric ton (t), the pound (lb), the long ton (lt) and the short ton (st), the hundredweight, the cental, the catty, the maund, and the carload.

Tons are the units most commonly used to measure and record quantities of coal, oil, and certain noncommercial fuels. The metric ton, or tonne, of 1000 kg is used in most of the world. The long ton, of 2240 lb, is used in most countries which employ the British system, many of which now report also in metric tons. The short ton, of 2000 lb, is used in the United States, Canada, and a few African countries. Factors for converting data from one system to another are shown in Table 1.

Energy values of particular fuels usually refer to units smaller than the ton. In the metric system, values are usually in kilogram calories per kilogram (kcal/kg). In the British system, they are usually expressed in British thermal units per pound (Btu/lb).

Volume

Units of *volume* are widely employed to measure liquid fuels. In most countries using the metric system, the units employed are the liter (L), the hectoliter (hL) (100 liters), and the kiloliter (kL) or cubic meter (m^3). In countries which retain the British system, the British (or Imperial) gallon is commonly used. In North America and some of the countries of Latin America, the U.S. system, which utilizes the U.S. gallon and barrel, is commonly used to measure liquid fuels.

Barrels of oil are the same throughout the world, being equivalent to 42 U.S. gallons or 35 (34.97) British gallons. The U.S. gallon, of 3.785 liters, is used in the United States and its overseas possessions and in Venezuela, Colombia, Ecuador, Bolivia, and certain Central American countries. The British gallon, of 4.546 liters, is employed in the United Kingdom and in most current and former member countries of the British Commonwealth.

Barrels per day is often used as an abbreviation for "1 barrel per day for 1 year," i.e., 365 barrels (or 366 barrels in leap years). The interrelationships of these units of measures are shown in Table 2.

Multiples in the British and American system are sometimes confused by differing interpretations of the word "billion," which, in the United States, represents one *thousand* million (10^9), in the British system, one *million* million (10^{12}).

One of the numerous advantages of the metric system is its set of prefixes for indicating multiples of com-

Table 1. Mass Equivalents

	Kilograms	Metric Tons	Long Tons	Short Tons	Pounds
1 Kilogram	1.0	0.001	0.000984	0.001102	2.2046
1 Metric Ton	1000	1.0	0.984	1.102	2204.6
1 Long Ton	1016	1,016	1.0	1.120	2240
1 Short Ton	907.2	0.9072	0.893	1.0	2000
1 Pound	0.454	0.000454	0.000446	0.0005	1.0

Table 2. Volume Equivalents

	U.S. Gallons	Imperial Gallons	Barrels	Barrels per Day
1 U.S. Gallon	1.000	0.8327	0.02381	0.06523×10^{-3}
1 Imp. Gallon	1.201	1.000	0.02859	0.07834×10^{-3}
1 Barrel	42	34.97	1.000	0.00274
1 Barrel per day	15330	12764	365	1.000
1 Kiloliter*	264.2	220	6.289	17.23×10^{-3}
1 Hectoliter	26.42	22.0	0.6289	1.723×10^{-3}
1 Liter	0.2642	0.220	6.289×10^{-3}	17.23×10^{-6}

	Kiloliters	Hectoliters	Liters
1 U.S. Gallon	3.785×10^{-3}	3.785×10^{-2}	3.785
1 Imp. Gallon	4.546×10^{-3}	4.546×10^{-2}	4.546
1 Barrel	0.159	1.59	159
1 Barrel per day	58.03	580.3	58.03×10^{3}
1 Kiloliter	1.0	10	1000
1 Hectoliter	0.1	1.0	100
1 Liter	1×10^{-3}	.01	1.0

* Or one cubic meter.

mon units. The prefixes most commonly employed in the measurement of energy, mass, and capacity are shown in Table 3.

Table 3.—Metric System Multiples*

$\times$ 10	deka
$\times$ 100	hecto
$\times$ 1000	kilo
$\times 10^{6}$	mega
$\times 10^{9}$	giga
$\times 10^{12}$	tera
$\times 10^{15}$	peta
$\times 10^{18}$	exa

* In the British System, the quad (q) is sometimes employed to represent Btu $\times 10^{15}$. This should not be confused with the Q (Btu $\times 10^{18}$) made fashionable some years ago by Palmer Putnam.

Mass and Volume

Because liquid fuels are sometimes measured by weight, sometimes by volume, it is often necessary to translate data from one type of unit to the other. Interrelationships of *mass* and *volume* are determined precisely by specific gravity. Within the metric system, conversions can be made by multiplying volume by specific gravity, or by dividing mass by specific gravity. In other systems, and between systems, conversions of *weight* to *volume* can be made by use of factors shown in Table 4. Conversions of *volume* to *weight* can be made by use of factors shown in Table 5.

Specific gravity is the relative weight per unit volume of water and any given substance. Since volumes change with changes in temperature, data on specific gravity are usually accompanied by a reference to the temperature at which the relationship is measured. In the case of petroleum and its products, the relationship is usually measured at 15 degrees Celsius (=59°F) or 60 degrees Fahrenheit (=15.6°C).

Specific gravity is often quoted as a percentage. Thus, a stated specific gravity of 85 means an actual specific gravity of 0.85. *API gravity* is commonly used for petroleum products and is precisely related to specific gravity by the following formula:

$$\text{API gravity} = \frac{141.5}{60^\circ \text{ specific gravity at } 60^\circ\text{F}} - 131.5$$

Specific gravity and API gravity move in opposite directions. API gravity moves in the same direction as energy content per *ton*, which rises from 9740 megacalories (net) at 10 degrees API to 10860 megacalories (net) at 125 degrees API. Specific gravity moves in the same direction as energy content per unit volume; e.g., from 3,780,000 Btu (net) per barrel at 0.55 specific gravity, it increases to 9,740,000 Btu (net) per barrel at 1.0 specific gravity.

Energy and Work

Energy is usually expressed in calories (cal)[1] or multiples thereof in the metric system; in British thermal units (Btu) or therms in British and American systems; in joules (J) or multiples thereof; or in kilowatt hours (kWh) or multiples thereof. The kWh and its multiples are also used, at times, as measures of *work*. Other measures of work include British and metric horsepower-hours (hp·h), the foot-pound (ft·lb), and the kilogram-meter (kg·m). The interrelationships of these units of measure are shown in Table 6.

Calorie equivalents are given in Table 6a, kilowatt hour equivalents in 6b, Btu equivalents in 6c, joule equivalents in 6d, and other equivalents in 6e.

[1] The *International Steam Table* (IT) calorie is the amount of heat required to raise the temperature of 1 gram of water at 14.5° C 1 degree Celsius. The *biological* calorie, used in the measurement of food energy, is in fact a kilogram calorie, or 1000 IT calories.

Common factors for moving between Btu and kcal per unit of mass or volume are as follows: Btu per lb × 0.555 = kcal per kg; kcal per kg × 1.8 = Btu per lb. Btu per cubic foot × 8.9 = kcal per cubic meter; kcal per cubic meter × 0.112 = Btu per cubic foot.

Table 4. Volume of Liquids of Different Specific Gravities Contained in One Metric Ton

Specific Gravity	Liters	Kiloliters	Imperial Gallons	U.S. Gallons	Barrels	Barrels per Day	API Gravity *
50	2002	2.002	440	529	12.59	0.0345	—
51	1962	1.962	432	519	12.34	0.0338	—
52	1925	1.925	423	509	12.11	0.0332	—
53	1888	1.888	415	499	11.88	0.0325	—
54	1853	1.853	408	490	11.66	0.0319	—
55	1820	1.820	400	481	11.45	0.0314	—
56	1787	1.787	393	472	11.24	0.0308	—
57	1756	1.756	386	464	11.04	0.0303	—
58	1726	1.726	380	456	10.85	0.0297	—
59	1696	1.696	373	448	10.67	0.0292	—
60	1668	1.668	367	441	10.49	0.0288	—
61	1641	1.641	361	436	10.32	0.0283	—
62	1614	1.614	355	427	10.15	0.0278	96.73
63	1589	1.589	349	420	9.99	0.0274	93.10
64	1564	1.564	344	413	9.84	0.0270	89.59
65	1540	1.540	339	407	9.69	0.0265	86.19
66	1516	1.516	334	401	9.54	0.0261	82.89
67	1494	1.494	329	395	9.40	0.0257	79.69
68	1472	1.472	324	389	9.26	0.0254	76.59
69	1450	1.450	319	383	9.12	0.0250	73.57
70	1430	1.430	315	378	8.99	0.0246	70.64
71	1410	1.410	310	372	8.87	0.0243	67.80
72	1390	1.390	306	367	8.74	0.0240	65.03
73	1371	1.371	302	362	8.62	0.0236	62.34
74	1352	1.352	298	357	8.51	0.0233	59.72
75	1334	1.334	294	353	8.39	0.0230	57.17
76	1317	1.317	290	348	8.28	0.0227	54.68
77	1300	1.300	286	343	8.18	0.0224	52.27
78	1283	1.283	282	339	8.07	0.0221	49.91
79	1267	1.267	279	335	7.97	0.0218	47.61
80	1251	1.251	275	331	7.87	0.0216	45.38
81	1236	1.236	272	326	7.77	0.0213	43.19
82	1220	1.220	269	323	7.68	0.0210	41.06
83	1206	1.206	265	319	7.59	0.0208	38.98
84	1191	1.191	262	315	7.50	0.0205	36.95
85	1177	1.177	259	311	7.41	0.0203	34.97
86	1164	1.164	256	308	7.32	0.0201	33.03
87	1150	1.150	253	304	7.24	0.0198	31.14
88	1137	1.137	250	301	7.15	0.0196	29.30
89	1124	1.124	247	297	7.07	0.0194	27.49
90	1112	1.112	245	294	7.00	0.0192	25.72
91	1100	1.100	242	291	6.92	0.0190	23.99
92	1088	1.088	239	287	6.84	0.0189	22.30
93	1076	1.076	237	284	6.77	0.0186	20.65
94	1065	1.065	234	281	6.70	0.0184	19.03
95	1053	1.053	232	278	6.63	0.0182	17.45
96	1043	1.043	229	275	6.56	0.0180	15.90
97	1032	1.032	227	273	6.49	0.0178	14.38
98	1021	1.021	225	270	6.42	0.0176	12.89
99	1011	1.011	222	267	6.36	0.0174	11.43
100	1001	1.001	220	264	6.30	0.0173	10.00
101	991	0.991	218	262	6.23	0.0171	8.60
102	981	0.981	216	259	6.17	0.0169	7.23
103	972	0.972	214	257	6.11	0.0168	5.88
104	962	0.962	212	254	6.05	0.0166	4.56
105	953	0.953	210	252	6.00	0.0164	3.26

* In this table and elsewhere, a single hyphen denotes zero or not applicable; two hyphens denote information is not available.

Table 5. Weights of Liquids of Different Gravities in Kilograms

Specific Gravity	Per Liter	Per Hectoliter	Per Kiloliter	Per Imperial Gallon	Per U.S. Gallon	Per Barrel	Per Barrel Per Day (in tons)	API Gravity
50	0.500	50.0	500	2.275	1.894	79.5	29.0	—
51	0.510	51.0	510	2.320	1.932	81.1	29.6	—
52	0.520	52.0	520	2.366	1.970	82.7	30.2	—
53	0.530	53.0	530	2.411	2.008	84.3	30.8	—
54	0.540	54.0	540	2.457	2.046	85.9	31.4	—
55	0.550	55.0	550	2.502	2.083	87.5	31.9	—
56	0.560	56.0	560	2.548	2.121	89.1	32.5	—
57	0.570	57.0	570	2.593	2.159	90.7	33.1	—
58	0.580	58.0	580	2.639	2.197	92.3	33.7	—
59	0.590	59.0	590	2.684	2.235	93.9	34.3	—
60	0.600	60.0	600	2.730	2.273	95.5	34.8	—
61	0.610	61.0	610	2.775	2.311	97.1	35.4	—
62	0.620	62.0	620	2.821	2.349	98.7	36.0	96.73
63	0.631	63.1	631	2.866	2.386	100.2	36.6	93.10
64	0.641	64.1	641	2.912	2.424	101.8	37.2	89.59
65	0.651	65.1	651	2.957	2.462	103.4	37.7	86.19
66	0.661	66.1	661	3.003	2.500	105.0	38.3	82.89
67	0.671	67.1	671	3.048	2.538	106.6	38.9	79.69
68	0.681	68.1	681	3.094	2.576	108.2	39.5	76.59
69	0.691	69.1	691	3.139	2.614	109.8	40.1	73.57
70	0.701	70.1	701	3.185	2.652	111.4	40.7	70.64
71	0.711	71.1	711	3.230	2.689	112.9	41.2	67.80
72	0.721	72.1	721	3.276	2.727	114.5	41.8	65.03
73	0.731	73.1	731	3.321	2.765	116.1	42.4	62.34
74	0.741	74.1	741	3.367	2.803	117.7	43.0	59.72
75	0.751	75.1	751	3.412	2.841	119.3	43.6	57.17
76	0.761	76.1	761	3.458	2.879	120.9	44.1	54.68
77	0.771	77.1	771	3.503	2.917	122.5	44.7	52.27
78	0.781	78.1	781	3.549	2.955	124.1	45.3	49.91
79	0.791	79.1	791	3.594	2.993	125.7	45.9	47.61
80	0.801	80.1	801	3.640	3.030	127.3	46.4	45.38
81	0.811	81.1	811	3.685	3.068	128.9	47.0	43.19
82	0.821	82.1	821	3.731	3.106	130.5	47.6	41.06
83	0.831	83.1	831	3.776	3.144	132.0	48.2	38.98
84	0.841	84.1	841	3.822	3.182	133.6	48.8	36.95
85	0.851	85.1	851	3.867	3.220	135.2	49.4	34.97
86	0.861	86.1	861	3.913	3.258	136.8	49.9	33.03
87	0.871	87.1	871	3.958	3.296	138.4	50.5	31.14
88	0.881	88.1	881	4.004	3.333	140.0	51.1	29.30
89	0.891	89.1	891	4.049	3.371	141.6	51.7	27.49
90	0.901	90.1	901	4.095	3.409	143.2	52.3	25.72
91	0.911	91.1	911	4.140	3.447	144.8	52.8	23.99
92	0.921	92.1	921	4.186	3.485	146.4	53.4	22.30
93	0.931	93.1	931	4.231	3.523	148.0	54.0	20.65
94	0.941	94.1	941	4.277	3.561	149.6	54.6	19.03
95	0.951	95.1	951	4.322	3.599	151.2	55.2	17.45
96	0.961	96.1	961	4.368	3.637	152.8	55.8	15.90
97	0.971	97.1	971	4.413	3.674	154.3	56.3	14.38
98	0.981	98.1	981	4.459	3.712	155.9	56.9	12.89
99	0.991	99.1	991	4.504	3.750	157.5	57.5	11.43
100	1.001	100.1	1001	4.550	3.788	159.1	58.1	10.00
101	1.011	101.1	1011	4.595	3.826	160.7	58.7	8.60
102	1.021	102.1	1021	4.641	3.864	162.3	59.2	7.23
103	1.031	103.1	1031	4.686	3.902	163.9	59.8	5.88
104	1.041	104.1	1041	4.732	3.940	165.5	60.4	4.56
105	1.051	105.1	1051	4.777	3.977	167.0	61.0	3.26