

# Appendix A

## Thermal Conversion Factors

### Using Thermal Conversion Factors

The thermal conversion factors presented in the following tables can be used to estimate the heat content in British thermal units (Btu) of a given amount of energy measured in physical units, such as barrels or cubic feet. For example, 10 barrels of asphalt has a heat content of approximately 66.36 million Btu (10 barrels x 6.636 million Btu per barrel = 66.36 million Btu).

The heat content rates (i.e., thermal conversion factors) provided in this section represent the gross (or upper) energy content of the fuels. Gross heat content rates are applied in all Btu calculations for the *Annual Energy Review* and are commonly used in energy calculations in the United States; net (or lower) heat content rates are typically used in European energy calculations. The difference between the two rates is the amount of energy that is consumed to vaporize water that is created during the combustion process. Generally, the difference ranges from 2 percent to 10 percent, depending on the specific fuel and its hydrogen content. Some fuels, such as unseasoned wood, can be more than 40 percent different in their gross and net heat content rates. More information about British thermal units (Btu) can be found in the Glossary.

Thermal conversion factors for hydrocarbon mixes (Table A1) are weighted averages of the thermal conversion factors for each hydrocarbon included in the mix. For example, in calculating the thermal conversion factor for a 60-40 butane-propane mixture, the thermal conversion factor for butane is weighted 1.5 times the thermal conversion factor for propane.

In general, the annual thermal conversion factors presented in Tables A2 through A6 are computed from final annual data or from the best available data and are labeled “preliminary.” Often, the previous year’s factor is used as the preliminary value until data become available to calculate the factor appropriate to the year. The source of each factor is described in the section entitled “Thermal Conversion Factor Source Documentation,” which follows Table A6 in this appendix.

**Table A1. Approximate Heat Content of Petroleum Products**  
(Million Btu per Barrel)

Asphalt	6.636
Aviation Gasoline	5.048
Butane	4.326
Butane-Propane Mixture (60 percent-40 percent)	4.130
Distillate Fuel Oil	5.825
Ethane	3.082
Ethane-Propane Mixture (70 percent-30 percent)	3.308
Isobutane	3.974
Jet Fuel, Kerosene-Type	5.670
Jet Fuel, Naphtha-Type	5.355
Kerosene	5.670
Lubricants	6.065
Motor Gasoline	
Conventional <sup>1</sup>	5.253
Oxygenated <sup>1</sup>	5.150
Reformulated <sup>1</sup>	5.150
Fuel Ethanol <sup>2</sup>	3.539
Natural Gasoline	4.620
Pentanes Plus	4.620
Petrochemical Feedstocks	
Naphtha less than 401° F	5.248
Other Oils equal to or greater than 401° F	5.825
Still Gas	6.000
Petroleum Coke	6.024
Plant Condensate	5.418
Propane	3.836
Residual Fuel Oil	6.287
Road Oil	6.636
Special Naphthas	5.248
Still Gas	6.000
Unfinished Oils	5.825
Unfractionated Stream	5.418
Waxes	5.537
Miscellaneous	5.796

<sup>1</sup>See Table A3 for motor gasoline annual weighted averages beginning in 1994.

<sup>2</sup>Fuel ethanol, which is derived from agricultural feedstocks (primarily corn), is not a petroleum product but is blended into motor gasoline. Its gross heat content (3.539 million Btu per barrel) is used in *Annual Energy Review* calculations; its net heat content (3.192 million Btu per barrel) is used in the Energy Information Administration’s *Renewable Energy Annual* calculations.

Web Page: For related information, see <http://www.eia.doe.gov/emeu/aer/append.html>.

Sources: See “Thermal Conversion Factor Source Documentation,” which follows Table A6.

**Table A2. Approximate Heat Content of Petroleum Production, Imports, and Exports, Selected Years, 1949-2003**  
(Million Btu per Barrel)

Year	Production		Imports			Exports		
	Crude Oil	Natural Gas Plant Liquids	Crude Oil	Petroleum Products	Total	Crude Oil	Petroleum Products	Total
1949	5.800	4.544	5.952	6.261	6.059	5.800	5.651	5.692
1950	5.800	4.522	5.943	6.263	6.080	5.800	5.751	5.766
1955	5.800	4.406	5.924	6.234	6.040	5.800	5.765	5.768
1960	5.800	4.295	5.911	6.161	6.021	5.800	5.835	5.834
1965	5.800	4.264	5.872	6.123	5.997	5.800	5.742	5.743
1970	5.800	4.146	5.822	6.088	5.985	5.800	5.811	5.810
1971	5.800	4.117	5.824	6.062	5.961	5.800	5.775	5.775
1972	5.800	4.070	5.809	6.045	5.935	5.800	5.741	5.741
1973	5.800	4.049	5.817	5.983	5.897	5.800	5.752	5.752
1974	5.800	4.011	5.827	5.959	5.884	5.800	5.773	5.774
1975	5.800	3.984	5.821	5.935	5.858	5.800	5.747	5.748
1976	5.800	3.964	5.808	5.980	5.856	5.800	5.743	5.745
1977	5.800	3.941	5.810	5.908	5.834	5.800	5.796	5.797
1978	5.800	3.925	5.802	5.955	5.839	5.800	5.814	5.808
1979	5.800	3.955	5.810	5.811	5.810	5.800	5.864	5.832
1980	5.800	3.914	5.812	5.748	5.796	5.800	5.841	5.820
1981	5.800	3.930	5.818	5.659	5.775	5.800	5.837	5.821
1982	5.800	3.872	5.826	5.664	5.775	5.800	5.829	5.820
1983	5.800	3.839	5.825	5.677	5.774	5.800	5.800	5.800
1984	5.800	3.812	5.823	5.613	5.745	5.800	5.867	5.850
1985	5.800	3.815	5.832	5.572	5.736	5.800	5.819	5.814
1986	5.800	3.797	5.903	5.624	5.808	5.800	5.839	5.832
1987	5.800	3.804	5.901	5.599	5.820	5.800	5.860	5.858
1988	5.800	3.800	5.900	5.618	5.820	5.800	5.842	5.840
1989	5.800	3.826	5.906	5.641	5.833	5.800	5.869	5.857
1990	5.800	3.822	5.934	5.614	5.849	5.800	5.838	5.833
1991	5.800	3.807	5.948	5.636	5.873	5.800	5.827	5.823
1992	5.800	3.804	5.953	5.623	5.877	5.800	5.774	5.777
1993	5.800	3.801	5.954	5.620	5.883	5.800	5.777	5.779
1994	5.800	3.794	5.950	5.534	5.861	5.800	5.777	5.779
1995	5.800	3.796	5.938	5.483	5.855	5.800	5.740	5.746
1996	5.800	3.777	5.947	5.468	5.847	5.800	5.728	5.736
1997	5.800	3.762	5.954	5.469	5.862	5.800	5.726	5.734
1998	5.800	3.769	5.953	5.462	5.861	5.800	5.710	5.720
1999	5.800	3.744	5.942	5.421	5.840	5.800	5.684	5.699
2000	5.800	3.733	5.959	5.432	5.849	5.800	5.651	5.658
2001	5.800	3.735	5.976	5.443	5.862	5.800	5.751	5.752
2002	5.800	R3.729	R5.971	R5.451	R5.863	5.800	R5.687	R5.688
2003P	5.800	3.739	5.971	5.445	5.859	5.800	5.745	5.746

R=Revised. P=Preliminary.

Note: Crude oil includes lease condensate.

Web Page: For data not shown for 1951-1969, see <http://www.eia.doe.gov/emeu/aer/append.html>.

Sources: See "Thermal Conversion Factor Source Documentation," which follows Table A6.

**Table A3. Approximate Heat Content of Petroleum Consumption, Selected Years, 1949-2003**  
(Million Btu per Barrel)

Year	Total Petroleum <sup>1</sup>						Liquefied Petroleum Gases	Motor Gasoline
	End-Use Sectors				Electric Power Sector <sup>2</sup>	Total		
	Residential	Commercial	Industrial	Transportation				
1949	5.493	5.858	5.946	5.465	6.254	5.649	4.011	5.253
1950	5.482	5.865	5.940	5.461	6.254	5.649	4.011	5.253
1955	5.480	5.832	5.867	5.408	6.254	5.591	4.011	5.253
1960	5.430	5.849	5.800	5.388	6.267	5.555	4.011	5.253
1965	5.380	5.837	5.728	5.387	6.267	5.532	4.011	5.253
1970	5.216	5.773	5.603	5.393	6.252	5.503	3.779	5.253
1971	5.212	5.758	5.598	5.389	6.245	5.504	3.772	5.253
1972	5.193	5.733	5.563	5.388	6.233	5.500	3.760	5.253
1973	5.205	5.749	5.569	5.395	6.245	5.515	3.746	5.253
1974	5.196	5.740	5.538	5.394	6.238	5.504	3.730	5.253
1975	5.192	5.704	5.527	5.392	6.250	5.494	3.715	5.253
1976	5.215	5.726	5.536	5.395	6.251	5.504	3.711	5.253
1977	5.213	5.733	5.554	5.400	6.249	5.518	3.677	5.253
1978	5.213	5.716	5.554	5.404	6.251	5.519	3.669	5.253
1979	5.298	5.769	5.419	5.428	6.258	5.494	3.680	5.253
1980	5.245	5.803	5.374	5.440	6.254	5.479	3.674	5.253
1981	5.191	5.751	5.312	5.432	6.258	5.448	3.643	5.253
1982	5.167	5.751	5.263	5.422	6.258	5.415	3.615	5.253
1983	5.022	5.642	5.275	5.415	6.255	5.406	3.614	5.253
1984	5.184	5.705	5.223	5.418	6.251	5.395	3.599	5.253
1985	5.153	5.661	5.215	5.422	6.247	5.387	3.603	5.253
1986	5.169	5.694	5.283	5.425	6.257	5.418	3.640	5.253
1987	5.144	5.661	5.248	5.429	6.249	5.403	3.659	5.253
1988	5.165	5.661	5.241	5.433	6.250	5.410	3.652	5.253
1989	5.105	5.621	5.234	5.437	26.240	5.410	3.683	5.253
1990	5.027	5.621	5.270	5.442	6.244	5.411	3.625	5.253
1991	4.968	5.599	5.186	5.440	6.246	5.384	3.614	5.253
1992	5.004	5.589	5.185	5.442	6.238	5.378	3.624	5.253
1993	4.975	5.580	5.196	5.436	6.230	5.379	3.606	5.253
1994	4.983	5.592	5.166	5.424	6.213	5.361	3.635	45.230
1995	4.940	5.554	5.137	5.417	6.188	5.341	3.623	5.215
1996	4.869	5.498	5.133	5.420	6.195	5.336	3.613	5.216
1997	4.859	5.459	5.138	5.416	6.199	5.336	3.616	5.213
1998	4.837	5.446	5.155	5.413	6.210	5.349	3.614	5.212
1999	4.761	5.369	5.113	5.413	6.205	5.328	3.616	5.211
2000	4.761	5.394	5.082	5.421	6.189	5.326	3.607	5.210
2001	4.796	5.403	5.164	5.412	6.199	5.345	3.614	5.210
2002	RE4.739	RE5.382	RE5.131	RE5.407	R6.173	R5.324	R3.613	5.208
2003	E4.798	E5.409	E5.171	E5.405	P6.181	P5.341	P3.629	P5.206

<sup>1</sup> Petroleum products supplied, including natural gas plant liquids and crude oil burned directly as fuel.

<sup>2</sup> Electricity-only and combined-heat-and-power (CHP) plants within the NAICS (North American Industry Classification System) 22 category whose primary business is to sell electricity, or electricity and heat, to the public. Through 1988, data are for electric utilities only; beginning in 1989, data are for electric utilities and independent power producers.

<sup>3</sup> There is a discontinuity in this time series between 1966 and 1967; beginning in 1967, the single constant factor is replaced by a quantity-weighted average of liquefied petroleum gases' major components.

<sup>4</sup> There is a discontinuity in this time series between 1993 and 1994; beginning in 1994, the single constant factor is replaced by a factor that is a quantity-weighted average of motor gasoline's major components. See Table A1.

R=Revised. P=Preliminary. E=Estimate.

Note: Weighted averages of the products included in each category are calculated by using heat content values shown in Table A1.

Web Page: For data not shown for 1951-1969, see <http://www.eia.doe.gov/emeu/aer/append.html>.  
Sources: See "Thermal Conversion Factor Source Documentation," which follows Table A6.

**Table A4. Approximate Heat Content of Natural Gas, Selected Years, 1949-2003**  
(Btu per Cubic Foot)

Year	Production		Consumption <sup>1</sup>			Imports	Exports
	Marketed	Dry	End-Use Sectors	Electric Power Sector <sup>2</sup>	Total		
1949	1,120	1,035	1,035	1,035	1,035	—	1,035
1950	1,119	1,035	1,035	1,035	1,035	—	1,035
1955	1,120	1,035	1,035	1,035	1,035	1,035	1,035
1960	1,107	1,035	1,035	1,035	1,035	1,035	1,035
1965	1,101	1,032	1,032	1,032	1,032	1,032	1,032
1970	1,102	1,031	1,031	1,031	1,031	1,031	1,031
1971	1,103	1,031	1,031	1,031	1,031	1,031	1,031
1972	1,100	1,027	1,027	1,027	1,027	1,027	1,027
1973	1,093	1,021	1,020	1,024	1,021	1,026	1,023
1974	1,097	1,024	1,024	1,022	1,024	1,027	1,016
1975	1,095	1,021	1,020	1,026	1,021	1,026	1,014
1976	1,093	1,020	1,019	1,023	1,020	1,025	1,013
1977	1,093	1,021	1,019	1,029	1,021	1,026	1,013
1978	1,088	1,019	1,016	1,034	1,019	1,030	1,013
1979	1,092	1,021	1,018	1,035	1,021	1,037	1,013
1980	1,098	1,026	1,024	1,035	1,026	1,022	1,013
1981	1,103	1,027	1,025	1,035	1,027	1,014	1,011
1982	1,107	1,028	1,026	1,036	1,028	1,018	1,011
1983	1,115	1,031	1,031	1,030	1,031	1,024	1,010
1984	1,109	1,031	1,030	1,035	1,031	1,005	1,010
1985	1,112	1,032	1,031	1,038	1,032	1,002	1,011
1986	1,110	1,030	1,029	1,034	1,030	997	1,008
1987	1,112	1,031	1,031	1,032	1,031	999	1,011
1988	1,109	1,029	1,029	1,028	1,029	1,002	1,018
1989	1,107	1,031	1,031	<sup>1</sup> 1,028	1,031	1,004	1,019
1990	1,105	1,029	1,030	1,027	1,029	1,012	1,018
1991	1,108	1,030	1,031	1,025	1,030	1,014	1,022
1992	1,110	1,030	1,031	1,025	1,030	1,011	1,018
1993	1,106	1,027	1,028	1,025	1,027	1,020	1,016
1994	1,105	1,028	1,029	1,025	1,028	1,022	1,011
1995	1,106	1,026	1,027	1,021	1,026	1,021	1,011
1996	1,109	1,026	1,027	1,020	1,026	1,022	1,011
1997	1,107	1,026	1,027	1,020	1,026	1,023	1,011
1998	1,109	1,031	1,033	1,024	1,031	1,023	1,011
1999	1,107	1,027	1,028	1,022	1,027	1,022	1,006
2000	1,107	1,025	1,026	1,021	1,025	1,023	1,006
2001	1,105	<sup>R</sup> 1,030	<sup>R</sup> 1,031	<sup>R</sup> 1,026	<sup>R</sup> 1,030	1,023	1,010
2002	<sup>R</sup> 1,107	<sup>R</sup> 1,028	<sup>R</sup> 1,030	1,020	<sup>R</sup> 1,028	<sup>R</sup> 1,022	<sup>R</sup> 1,008
2003 <sup>E</sup>	1,106	1,028	1,029	1,025	1,028	1,023	1,008

<sup>1</sup> Consumption factors are for natural gas, plus a small amount of supplemental gaseous fuels that cannot be identified separately.

<sup>2</sup> Electricity-only and combined-heat-and-power (CHP) plants within the NAICS (North American Industry Classification System) 22 category whose primary business is to sell electricity, or electricity and heat, to the public. Through 1988, data are for electric utilities only; beginning in 1989, data are for electric

utilities and independent power producers.

R=Revised. E=Estimate. — = Not applicable.

Web Page: For data not shown for 1951-1969, see <http://www.eia.doe.gov/emeu/aer/append.html>.

Sources: See "Thermal Conversion Factor Source Documentation," which follows Table A6.

**Table A5. Approximate Heat Content of Coal and Coal Coke, Selected Years, 1949-2003**  
(Million Btu per Short Ton)

Year	Coal								Coal Coke
	Production	Consumption					Imports	Exports	Imports and Exports
		End-Use Sectors			Electric Power Sector <sup>2,3</sup>	Total			
		Residential and Commercial	Industrial						
	Coke Plants		Other <sup>1</sup>						
1949	24.916	24.263	26.797	24.612	23.761	24.793	25.000	26.759	24.800
1950	25.090	24.461	26.798	24.820	23.937	24.989	25.020	26.788	24.800
1955	25.201	24.373	26.794	24.821	24.056	24.982	25.000	26.907	24.800
1960	24.906	24.226	26.791	24.609	23.927	24.713	25.003	26.939	24.800
1965	24.775	24.028	26.787	24.385	23.780	24.537	25.000	26.973	24.800
1970	23.842	23.203	26.784	22.983	22.573	23.440	25.000	26.982	24.800
1971	23.507	23.090	26.784	22.670	22.301	23.124	25.000	26.981	24.800
1972	23.389	22.998	26.782	22.550	22.204	23.036	25.000	26.979	24.800
1973	23.376	22.831	26.780	22.586	22.246	23.057	25.000	26.596	24.800
1974	23.072	22.479	26.778	22.419	21.781	22.677	25.000	26.700	24.800
1975	22.897	22.261	26.782	22.436	21.642	22.506	25.000	26.562	24.800
1976	22.855	22.774	26.781	22.530	21.679	22.498	25.000	26.601	24.800
1977	22.597	22.919	26.787	22.322	21.508	22.265	25.000	26.548	24.800
1978	22.248	22.466	26.789	22.207	21.275	22.017	25.000	26.478	24.800
1979	22.454	22.242	26.788	22.452	21.364	22.100	25.000	26.548	24.800
1980	22.415	22.543	26.790	22.690	21.295	21.947	25.000	26.384	24.800
1981	22.308	22.474	26.794	22.585	21.085	21.713	25.000	26.160	24.800
1982	22.239	22.695	26.797	22.712	21.194	21.674	25.000	26.223	24.800
1983	22.052	22.775	26.798	22.691	21.133	21.576	25.000	26.291	24.800
1984	22.010	22.844	26.799	22.543	21.101	21.573	25.000	26.402	24.800
1985	21.870	22.646	26.798	22.020	20.959	21.366	25.000	26.307	24.800
1986	21.913	22.947	26.798	22.198	21.084	21.462	25.000	26.292	24.800
1987	21.922	23.404	26.799	22.381	21.136	21.517	25.000	26.291	24.800
1988	21.823	23.571	26.799	22.360	20.900	21.328	25.000	26.299	24.800
1989	21.765	23.650	26.800	22.347	<sup>2</sup> 20.898	21.307	25.000	26.160	24.800
1990	21.822	23.137	26.799	22.457	20.779	21.197	25.000	26.202	24.800
1991	21.681	23.114	26.799	22.460	20.730	21.120	25.000	26.188	24.800
1992	21.682	23.105	26.799	22.250	20.709	21.068	25.000	26.161	24.800
1993	21.418	22.994	26.800	22.123	20.677	21.010	25.000	26.335	24.800
1994	21.394	23.112	26.800	22.068	20.589	20.929	25.000	26.329	24.800
1995	21.326	23.118	26.800	21.950	20.543	20.880	25.000	26.180	24.800
1996	21.322	23.011	26.800	22.105	20.547	20.870	25.000	26.174	24.800
1997	21.296	22.494	26.800	22.172	20.518	20.830	25.000	26.251	24.800
1998	21.418	21.620	27.426	23.164	20.516	20.881	25.000	26.800	24.800
1999	21.070	23.880	27.426	22.489	20.490	20.818	25.000	26.081	24.800
2000	21.072	25.020	27.426	22.433	20.511	20.828	25.000	26.117	24.800
2001	<sup>R</sup> 20.865	<sup>R</sup> 24.909	27.426	23.209	<sup>R</sup> 20.337	<sup>R</sup> 20.707	25.000	25.998	24.800
2002	<sup>R</sup> 20.742	<sup>R</sup> 22.962	27.426	<sup>R</sup> 23.793	<sup>R</sup> 20.238	<sup>R</sup> 20.612	25.000	26.062	24.800
2003 <sup>P</sup>	20.861	24.916	27.425	23.941	20.381	20.754	25.000	25.972	24.800

<sup>1</sup> Includes transportation.

<sup>2</sup> Electricity-only and combined-heat-and-power (CHP) plants within the NAICS (North American Industry Classification System) 22 category whose primary business is to sell electricity, or electricity and heat, to the public. Through 1988, data are for electric utilities only; beginning in 1989, data are for electric utilities and independent power producers.

<sup>3</sup> Electric power sector factors are for anthracite, bituminous coal, subbituminous coal, lignite, waste coal, and synthetic coal.

R=Revised. P=Preliminary.

Web Page: For data not shown for 1951-1969, see <http://www.eia.doe.gov/emeu/aer/append.html>.

Sources: See "Thermal Conversion Factor Source Documentation," which follows Table A6.

**Table A6. Approximate Heat Rates for Electricity, Selected Years, 1949-2003**  
(Btu per Kilowatthour)

Year	Electricity Net Generation			Electricity Consumption <sup>5</sup>
	Fossil-Fueled Plants <sup>1,2</sup>	Nuclear Plants <sup>3</sup>	Geothermal Energy Plants <sup>4</sup>	
1949	15,033	—	—	3,412
1950	14,030	—	—	3,412
1955	11,699	—	—	3,412
1960	10,760	11,629	23,200	3,412
1965	10,453	11,804	22,182	3,412
1970	10,494	10,977	21,606	3,412
1971	10,478	10,837	21,655	3,412
1972	10,379	10,792	21,668	3,412
1973	10,389	10,903	21,674	3,412
1974	10,442	11,161	21,674	3,412
1975	10,406	11,013	21,611	3,412
1976	10,373	11,047	21,611	3,412
1977	10,435	10,769	21,611	3,412
1978	10,361	10,941	21,611	3,412
1979	10,353	10,879	21,545	3,412
1980	10,388	10,908	21,639	3,412
1981	10,453	11,030	21,639	3,412
1982	10,454	11,073	21,629	3,412
1983	10,520	10,905	21,290	3,412
1984	10,440	10,843	21,303	3,412
1985	10,447	10,622	21,263	3,412
1986	10,446	10,579	21,263	3,412
1987	10,419	10,442	21,263	3,412
1988	10,324	10,602	21,096	3,412
1989	10,432	10,583	21,096	3,412
1990	10,402	10,582	21,096	3,412
1991	10,436	10,484	20,997	3,412
1992	10,342	10,471	20,914	3,412
1993	10,309	10,504	20,914	3,412
1994	10,316	10,452	20,914	3,412
1995	10,312	10,507	20,914	3,412
1996	10,340	10,503	20,960	3,412
1997	10,213	10,494	20,960	3,412
1998	10,197	10,491	21,017	3,412
1999	10,226	10,450	21,017	3,412
2000	10,201	10,429	21,017	3,412
2001	10,146	<sup>R</sup> 10,448	21,017	3,412
2002	<sup>P</sup> 10,119	<sup>R</sup> 10,439	21,017	3,412
2003	<sup>P</sup> 10,107	<sup>P</sup> 10,439	<sup>P</sup> 21,017	3,412

<sup>1</sup> Through 2000, used as the thermal conversion factor for wood and waste electricity net generation at electric utilities. For all years, used as the thermal conversion factor for hydroelectric, solar, and wind electricity net generation.

<sup>2</sup> Through 2000, heat rates are for fossil-fueled steam-electric plants at electric utilities. For 2001 and 2002, heat rates are for fossil-fueled steam-electric plants at electric utilities and independent power producers. For 2003, the heat rate is for all fossil-fueled plants at electric utilities and independent power producers.

<sup>3</sup> Used as the thermal conversion factor for nuclear electricity net generation.

<sup>4</sup> Used as the thermal conversion factor for geothermal electricity net generation.

<sup>5</sup> Used as the thermal conversion factor for electricity retail sales, and electricity imports and exports. R=Revised data. P=Preliminary data. — = Not applicable.

Web Page: For data not shown for 1951-1969, see <http://www.eia.doe.gov/emeu/aer/append.html>. Sources: See "Thermal Conversion Factor Source Documentation," which follows this table.

# Thermal Conversion Factor Source Documentation

## Approximate Heat Content of Petroleum and Natural Gas Plant Liquids

**Asphalt.** The Energy Information Administration (EIA) adopted the thermal conversion factor of 6.636 million British thermal units (Btu) per barrel as estimated by the Bureau of Mines and first published in the *Petroleum Statement, Annual, 1956*.

**Aviation Gasoline.** EIA adopted the thermal conversion factor of 5.048 million Btu per barrel as adopted by the Bureau of Mines from the Texas Eastern Transmission Corporation publication *Competition and Growth in American Energy Markets 1947-1985*, a 1968 release of historical and projected statistics.

**Butane.** EIA adopted the Bureau of Mines thermal conversion factor of 4.326 million Btu per barrel as published in the *California Oil World and Petroleum Industry*, First Issue, April 1942.

**Butane-Propane Mixture.** EIA adopted the Bureau of Mines calculation of 4.130 million Btu per barrel based on an assumed mixture of 60 percent butane and 40 percent propane. See **Butane** and **Propane**.

**Crude Oil Exports.** Assumed by EIA to be 5.800 million Btu per barrel or equal to the thermal conversion factor for crude oil produced in the United States. See **Crude Oil Production**.

**Crude Oil Imports.** Calculated annually by EIA as the average of the thermal conversion factors for each type of crude oil imported weighted by the quantities imported. Thermal conversion factors for each type were calculated on a foreign country basis, by determining the average American Petroleum Institute (API) gravity of crude oil imported from each foreign country from Form ERA-60 in 1977 and converting average API gravity to average Btu content by using National Bureau of Standards, Miscellaneous Publication No. 97, *Thermal Properties of Petroleum Products*, 1933.

**Crude Oil Production.** EIA adopted the thermal conversion factor of 5.800 million Btu per barrel as reported in a Bureau of Mines internal memorandum, "Bureau of Mines Standard Average Heating Values of Various Fuels, Adopted January 3, 1950."

**Distillate Fuel Oil.** EIA adopted the Bureau of Mines thermal conversion factor of 5.825 million Btu per barrel as reported in a Bureau of Mines internal memorandum, "Bureau of Mines Standard Average Heating Values of Various Fuels, Adopted January 3, 1950."

**Ethane.** EIA adopted the Bureau of Mines thermal conversion factor of 3.082 million Btu per barrel as published in the *California Oil World and Petroleum Industry*, First Issue, April 1942.

**Ethane-Propane Mixture.** EIA calculation of 3.308 million Btu per barrel based on an assumed mixture of 70 percent ethane and 30 percent propane. See **Ethane** and **Propane**.

**Fuel Ethanol (Blended Into Motor Gasoline).** EIA adopted the thermal conversion factor of 3.539 million Btu per barrel published in "Oxygenate Flexibility for Future Fuels," a paper presented by William J. Piel of the ARCO Chemical Company at the National Conference on Reformulated Gasolines and Clean Air Act Implementation, Washington, D.C., October 1991.

**Isobutane.** EIA adopted the Bureau of Mines thermal conversion factor of 3.974 million Btu per barrel as published in the *California Oil World and Petroleum Industry*, First Issue, April 1942.

**Jet Fuel, Kerosene-Type.** EIA adopted the Bureau of Mines thermal conversion factor of 5.670 million Btu per barrel for "Jet Fuel, Commercial" as published by the Texas Eastern Transmission Corporation in the report *Competition and Growth in American Energy Markets 1947-1985*, a 1968 release of historical and projected statistics.

**Jet Fuel, Naphtha-Type.** EIA adopted the Bureau of Mines thermal conversion factor of 5.355 million Btu per barrel for "Jet Fuel, Military" as published by the Texas Eastern Transmission Corporation in the report *Competition and Growth in American Energy Markets 1947-1985*, a 1968 release of historical and projected statistics.

**Kerosene.** EIA adopted the Bureau of Mines thermal conversion factor of 5.670 million Btu per barrel as reported in a Bureau of Mines internal memorandum, "Bureau of Mines Standard Average Heating Values of Various Fuels, Adopted January 3, 1950."

**Liquefied Petroleum Gases Consumption.** • 1949-1966: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum and Petroleum Products, 1956," Table 4 footnote, constant value of 4.011 million Btu per barrel. • 1967 forward: Calculated annually by EIA as the average of the thermal conversion factors for all liquefied petroleum gases consumed (see Table A1) weighted by the quantities consumed. The component products of liquefied petroleum gases are ethane (including ethylene), propane (including propylene), normal butane (including butylene), butane-propane mixtures, ethane-propane mixtures, and isobutane. For 1967-1980, quantities consumed are from EIA, Energy Data

Reports, “Petroleum Statement, Annual,” Table 1. For 1981 forward, quantities consumed are from EIA, *Petroleum Supply Annual*, Table 2.

**Lubricants.** EIA adopted the thermal conversion factor of 6.065 million Btu per barrel as estimated by the Bureau of Mines and first published in the *Petroleum Statement, Annual, 1956*.

**Miscellaneous Products.** EIA adopted the thermal conversion factor of 5.796 million Btu per barrel as estimated by the Bureau of Mines and first published in the *Petroleum Statement, Annual, 1956*.

**Motor Gasoline Consumption.** • 1949-1993: EIA adopted the Bureau of Mines thermal conversion factor of 5.253 million Btu per barrel for “Gasoline, Motor Fuel” as published by the Texas Eastern Transmission Corporation in Appendix V of *Competition and Growth in American Energy Markets 1947-1985*, a 1968 release of historical and projected statistics. • 1994 forward: EIA calculated national annual quantity-weighted average conversion factors for conventional, reformulated, and oxygenated motor gasolines (see Table A3). The factor for conventional motor gasoline is 5.253 million Btu per barrel, as used for previous years. The factors for reformulated and oxygenated gasolines, both currently 5.150 million Btu per barrel, are based on data published in Environmental Protection Agency, Office of Mobile Sources, National Vehicle and Fuel Emissions Laboratory report EPA 420-F-95-003, “Fuel Economy Impact Analysis of Reformulated Gasoline.” See **Fuel Ethanol (Blended Into Motor Gasoline)**.

**Natural Gas Plant Liquids Production.** Calculated annually by EIA as the average of the thermal conversion factors for each natural gas plant liquid produced weighted by the quantities produced.

**Natural Gasoline.** EIA adopted the thermal conversion factor of 4.620 million Btu per barrel as estimated by the Bureau of Mines and first published in the *Petroleum Statement, Annual, 1956*.

**Pentanes Plus.** EIA assumed the thermal conversion factor to be 4.620 million Btu or equal to that for natural gasoline. See **Natural Gasoline**.

**Petrochemical Feedstocks, Naphtha less than 401° F.** Assumed by EIA to be 5.248 million Btu per barrel, equal to the thermal conversion factor for special naphthas. See **Special Naphthas**.

**Petrochemical Feedstocks, Other Oils equal to or greater than 401° F.** Assumed by EIA to be 5.825 million Btu per barrel, equal to the thermal conversion factor for distillate fuel oil. See **Distillate Fuel Oil**.

**Petrochemical Feedstocks, Still Gas.** Assumed by EIA to be 6.000 million Btu per barrel, equal to the thermal conversion factor for still gas. See **Still Gas**.

**Petroleum Coke.** EIA adopted the thermal conversion factor of 6.024 million Btu per barrel as reported in Btu per short ton in the Bureau of Mines internal memorandum, “Bureau of Mines Standard Average Heating Values of Various Fuels, Adopted January 3, 1950.” The Bureau of Mines calculated this factor by dividing

30.120 million Btu per short ton, as given in the referenced Bureau of Mines internal memorandum, by 5.0 barrels per short ton, as given in the Bureau of Mines Form 6-1300-M and successor EIA forms.

**Petroleum Consumption, Commercial Sector.** Calculated annually by EIA as the average of the thermal conversion factors for all petroleum products consumed by the commercial sector weighted by the estimated quantities consumed by the commercial sector. The quantities of petroleum products consumed by the commercial sector are estimated in the State Energy Data System—see documentation at [http://www.eia.doe.gov/emeu/states/sep\\_use/notes/use\\_petrol.pdf](http://www.eia.doe.gov/emeu/states/sep_use/notes/use_petrol.pdf).

**Petroleum Consumption, Electric Power Sector.** Calculated annually by EIA as the average of the thermal conversion factors for all petroleum products consumed by the electric power sector weighted by the quantities consumed by the electric power sector. Data are from Form EIA-860, “Annual Electric Generator Report”; Form EIA-906, “Power Plant Report”; and predecessor forms.

**Petroleum Consumption, Industrial Sector.** Calculated annually by EIA as the average of the thermal conversion factors for all petroleum products consumed by the industrial sector weighted by the estimated quantities consumed by the industrial sector. The quantities of petroleum products consumed by the industrial sector are estimated in the State Energy Data System—see documentation at [http://www.eia.doe.gov/emeu/states/sep\\_use/notes/use\\_petrol.pdf](http://www.eia.doe.gov/emeu/states/sep_use/notes/use_petrol.pdf).

**Petroleum Consumption, Residential Sector.** Calculated annually by EIA as the average of the thermal conversion factors for all petroleum products consumed by the residential sector weighted by the estimated quantities consumed by the residential sector. The quantities of petroleum products consumed by the residential sector are estimated in the State Energy Data System—see documentation at [http://www.eia.doe.gov/emeu/states/sep\\_use/notes/use\\_petrol.pdf](http://www.eia.doe.gov/emeu/states/sep_use/notes/use_petrol.pdf).

**Petroleum Consumption, Total.** Calculated annually by EIA as the average of the thermal conversion factors for all petroleum products consumed weighted by the quantities consumed.

**Petroleum Consumption, Transportation Sector.** Calculated annually by EIA as the average of the thermal conversion factors for all petroleum products consumed by the transportation sector weighted by the estimated quantities consumed by the transportation sector. The quantities of petroleum products consumed by the transportation sector are estimated in the State Energy Data System—see documentation at [http://www.eia.doe.gov/emeu/states/sep\\_use/notes/use\\_petrol.pdf](http://www.eia.doe.gov/emeu/states/sep_use/notes/use_petrol.pdf).

**Petroleum Products Exports.** Calculated annually by EIA as the average of the thermal conversion factors for each petroleum product exported weighted by the quantities exported.

**Petroleum Products Imports.** Calculated annually by EIA as the average of the thermal conversion factors for each petroleum product imported weighted by the quantities imported.



**Plant Condensate.** Estimated to be 5.418 million Btu per barrel by EIA from data provided by McClanahan Consultants, Inc., Houston, Texas.

**Propane.** EIA adopted the Bureau of Mines thermal conversion factor of 3.836 million Btu per barrel as published in the *California Oil World and Petroleum Industry, First Issue*, April 1942.

**Residual Fuel Oil.** EIA adopted the thermal conversion factor of 6.287 million Btu per barrel as reported in the Bureau of Mines internal memorandum, "Bureau of Mines Standard Average Heating Values of Various Fuels, Adopted January 3, 1950."

**Road Oil.** EIA adopted the Bureau of Mines thermal conversion factor of 6.636 million Btu per barrel, which was assumed to be equal to that of asphalt (see **Asphalt**) and was first published by the Bureau of Mines in the *Petroleum Statement, Annual, 1970*.

**Special Naphthas.** EIA adopted the Bureau of Mines thermal conversion factor of 5.248 million Btu per barrel, which was assumed to be equal to that of the total gasoline (aviation and motor) factor and was first published in the *Petroleum Statement, Annual, 1970*.

**Still Gas.** EIA adopted the Bureau of Mines estimated thermal conversion factor of 6.000 million Btu per barrel, first published in the *Petroleum Statement, Annual, 1970*.

**Total Petroleum Exports.** Calculated annually by EIA as the average of the thermal conversion factors for crude oil and each petroleum product exported weighted by the quantities exported. See **Crude Oil Exports** and **Petroleum Products Exports**.

**Total Petroleum Imports.** Calculated annually by EIA as the average of the thermal conversion factors for each type of crude oil and petroleum product imported weighted by the quantities imported. See **Crude Oil Imports** and **Petroleum Products Imports**.

**Unfinished Oils.** EIA assumed the thermal conversion factor to be 5.825 million Btu per barrel or equal to that for distillate fuel oil (see **Distillate Fuel Oil**) and first published it in EIA's *Annual Report to Congress, Volume 3, 1977*.

**Unfractionated Stream.** EIA assumed the thermal conversion factor to be 5.418 million Btu per barrel or equal to that for plant condensate (see **Plant Condensate**) and first published it in EIA's *Annual Report to Congress, Volume 2, 1981*.

**Waxes.** EIA adopted the thermal conversion factor of 5.537 million Btu per barrel as estimated by the Bureau of Mines and first published in the *Petroleum Statement, Annual, 1956*.

## Approximate Heat Content of Natural Gas

**Natural Gas Consumption, Electric Power Sector.** Calculated annually by EIA by dividing the heat content of natural gas consumed by the electric power sector by the quantity consumed. Data are from Form EIA-860, "Annual Electric Generator Report"; Form EIA-906, "Power Plant Report"; and predecessor forms.

**Natural Gas Consumption, End-Use Sectors.** Calculated annually by EIA by dividing the heat content of natural gas consumed by the end-use sectors (residential, commercial, industrial, and transportation) by the quantity consumed. Data are from Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."

**Natural Gas Consumption, Total.** • 1949-1962: EIA adopted the thermal conversion factor of 1,035 Btu per cubic foot as estimated by the Bureau of Mines and first published in the *Petroleum Statement, Annual, 1956*. • 1963-1979: EIA adopted the thermal conversion factor calculated annually by the American Gas Association (AGA) and published in *Gas Facts*, an AGA annual publication. • 1980 forward: Calculated annually by EIA by dividing the total heat content of natural gas consumed by the total quantity consumed.

**Natural Gas Exports.** • 1949-1972: Assumed by EIA to be equal to the thermal conversion factor for dry natural gas consumed (see **Natural Gas Consumption, Total**). • 1973 forward: Calculated annually by EIA by dividing the heat content of natural gas exported by the quantity exported. For 1973-1995, data are from Form FPC-14, "Annual Report for Importers and Exporters of Natural Gas." Beginning in 1996, data are from U.S. Department of Energy, Office of Fossil Energy, *Natural Gas Imports and Exports*.

**Natural Gas Imports.** • 1949-1972: Assumed by EIA to be equal to the thermal conversion factor for dry natural gas consumed (see **Natural Gas Consumption, Total**). • 1973 forward: Calculated annually by EIA by dividing the heat content of natural gas imported by the quantity imported. For 1973-1995, data are from Form FPC-14, "Annual Report for Importers and Exporters of Natural Gas." Beginning in 1996, data are from U.S. Department of Energy, Office of Fossil Energy, *Natural Gas Imports and Exports*.

**Natural Gas Production, Dry.** Assumed by EIA to be equal to the thermal conversion factor for dry natural gas consumed. See **Natural Gas Consumption, Total**.

**Natural Gas Production, Marketed.** Calculated annually by EIA by dividing the heat content of dry natural gas produced (see **Natural Gas Production, Dry**) and liquids produced (see **Natural Gas Plant Liquids Production**) by the total quantity of marketed natural gas produced.

## Approximate Heat Content of Coal and Coal Coke

**Coal Coke Imports and Exports.** EIA adopted the Bureau of Mines estimate of 24.800 million Btu per short ton.

**Coal Consumption, Electric Power Sector.** Calculated annually by EIA by dividing the heat content of coal consumed by the electric power sector by the quantity consumed. Data are from Form EIA-860, “Annual Electric Generator Report”; Form EIA-906, “Power Plant Report”; and predecessor forms.

**Coal Consumption, Industrial Sector, Coke Plants.** Calculated annually by EIA by dividing the heat content of coal consumed by coke plants by the quantity consumed. Data are from Form EIA-5, “Quarterly Coal Consumption and Quality Report—Coke Plants.”

**Coal Consumption, Industrial Sector, Other.** Calculated annually by EIA by dividing the heat content of coal consumed by manufacturing plants by the quantity consumed. Data are from Form EIA-3, “Quarterly Coal Consumption and Quality Report—Manufacturing Plants.”

**Coal Consumption, Residential and Commercial Sectors.** Calculated annually by EIA by dividing the heat content of coal consumed by the residential and commercial sectors by the quantity consumed. Through 1999, data are from Form EIA-6, “Coal Distribution Report.” Beginning in 2000, data are for commercial combined-heat-and-power (CHP) plants from Form EIA-860, “Annual Electric Generator Report”; and Form EIA-906, “Power Plant Report.”

**Coal Consumption, Total.** Calculated annually by EIA by dividing the total heat content of coal consumed by all sectors by the total quantity consumed.

**Coal Exports.** Calculated annually by EIA by dividing the heat content of steam coal and metallurgical coal exported by the quantity exported. Data are from U.S. Department of Commerce, Bureau of the Census, “Monthly Report EM 545.”

**Coal Imports.** • 1949-1963: Calculated annually by EIA by dividing the heat content of coal imported by the quantity imported. • 1963 forward: Assumed by EIA to be 25.000 million Btu per short ton.

**Coal Production.** Calculated annually by EIA to balance the heat content of coal supply (production and imports) and the heat content of coal disposition (exports, stock change, and consumption).

## Approximate Heat Rates for Electricity

**Electricity Net Generation, Fossil-Fueled Plants.** There is no generally accepted practice for measuring the thermal conversion rates for power plants that generate electricity from hydro, wind, photovoltaic, or solar thermal energy sources. Therefore, EIA calculates a rate factor that is equal to the prevailing annual average heat rate factor for fossil-fueled power plants in the United States. By using that factor, it is possible to evaluate fossil fuel requirements for replacing those sources during periods of interruption, such as droughts. The heat content of a kilowatthour of electricity produced, regardless of the generation process, is 3,412 Btu. • 1949-1955: The weighted annual average heat rate for fossil-fueled steam-electric power plants in the United States, as published by EIA in *Thermal-Electric Plant Construction Cost and Annual Production Expenses—1981* and *Steam-Electric Plant Construction Cost and Annual Production Expenses—1978*. • 1956-1988: The weighted annual average heat rate for fossil-fueled steam-electric power plants in the United States, as published in EIA, *Electric Plant Cost and Power Production Expenses 1991*, Table 9. • 1989 forward: Calculated annually by EIA by using the heat rate reported on Form EIA-860, “Annual Electric Generator Report” (and predecessor forms); and the generation on Form EIA-906, “Power Plant Report.”

**Electricity Net Generation, Geothermal Energy Plants.** • 1960-1981: Calculated annually by EIA by weighting the annual average heat rates of operating geothermal units by the installed nameplate capacities as reported on Form FPC-12, “Power System Statement.” • 1982 forward: Estimated annually by EIA on the basis of an informal survey of relevant plants.

**Electricity Net Generation, Nuclear Plants.** • 1957-1984: Calculated annually by dividing the total heat content consumed in nuclear generating units by the total (net) electricity generated by nuclear generating units. The heat content and electricity generation were reported on Form FERC-1, “Annual Report of Major Electric Utilities, Licensees, and Others”; Form EIA-412, “Annual Report of Public Electric Utilities”; and predecessor forms. For 1982, the factors were published in EIA, *Historical Plant Cost and Annual Production Expenses for Selected Electric Plants 1982*, page 215. For 1983 and 1984, the factors were published in EIA, *Electric Plant Cost and Power Production Expenses 1991*, Table 13. • 1985 forward: Calculated annually by EIA by using the heat rate reported on Form EIA-860, “Annual Electric Generator Report” (and predecessor forms); and the generation reported on Form EIA-906, “Power Plant Report.”

## Appendix B. Metric and Other Physical Conversion Factors

Data presented in the *Annual 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 ( $500 \text{ short tons} \times 0.9071847 \text{ metric tons/short ton} = 453.6 \text{ metric tons}$ ).

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 ( $10 \text{ barrels} \times 42 \text{ gallons/barrel} = 420 \text{ gallons}$ ).

**Table B1. Metric Conversion Factors**

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

<sup>a</sup>Exact conversion.

<sup>b</sup>Calculated by the Energy Information Administration.

<sup>c</sup>The Btu used in this table is the International Table Btu adopted by the Fifth International Conference on Properties of Steam, London, 1956.

<sup>d</sup>To 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: For related information, see <http://www.eia.doe.gov/emeu/aer/append.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 <sup>1</sup>	deka	da	10 <sup>-1</sup>	deci	d
10 <sup>2</sup>	hecto	h	10 <sup>-2</sup>	centi	c
10 <sup>3</sup>	kilo	k	10 <sup>-3</sup>	milli	m
10 <sup>6</sup>	mega	M	10 <sup>-6</sup>	micro	μ
10 <sup>9</sup>	giga	G	10 <sup>-9</sup>	nano	n
10 <sup>12</sup>	tera	T	10 <sup>-12</sup>	pico	p
10 <sup>15</sup>	peta	P	10 <sup>-15</sup>	femto	f
10 <sup>18</sup>	exa	E	10 <sup>-18</sup>	atto	a
10 <sup>21</sup>	zetta	Z	10 <sup>-21</sup>	zepto	z
10 <sup>24</sup>	yotta	Y	10 <sup>-24</sup>	yocto	y

Web Page: For related information, see <http://www.eia.doe.gov/emeu/aer/append.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	
<b>Petroleum</b>	1 barrel (bbl)	=	42 <sup>a</sup>	U.S. gallons (gal)
<b>Coal</b>	1 short ton	=	2,000 <sup>a</sup>	pounds (lb)
	1 long ton	=	2,240 <sup>a</sup>	pounds (lb)
	1 metric ton (t)	=	1,000 <sup>a</sup>	kilograms (kg)
<b>Wood</b>	1 cord (cd)	=	1.25 <sup>b</sup>	shorts tons
	1 cord (cd)	=	128 <sup>a</sup>	cubic feet (ft <sup>3</sup> )

<sup>a</sup>Exact conversion.

<sup>b</sup>Calculated by the Energy Information Administration.

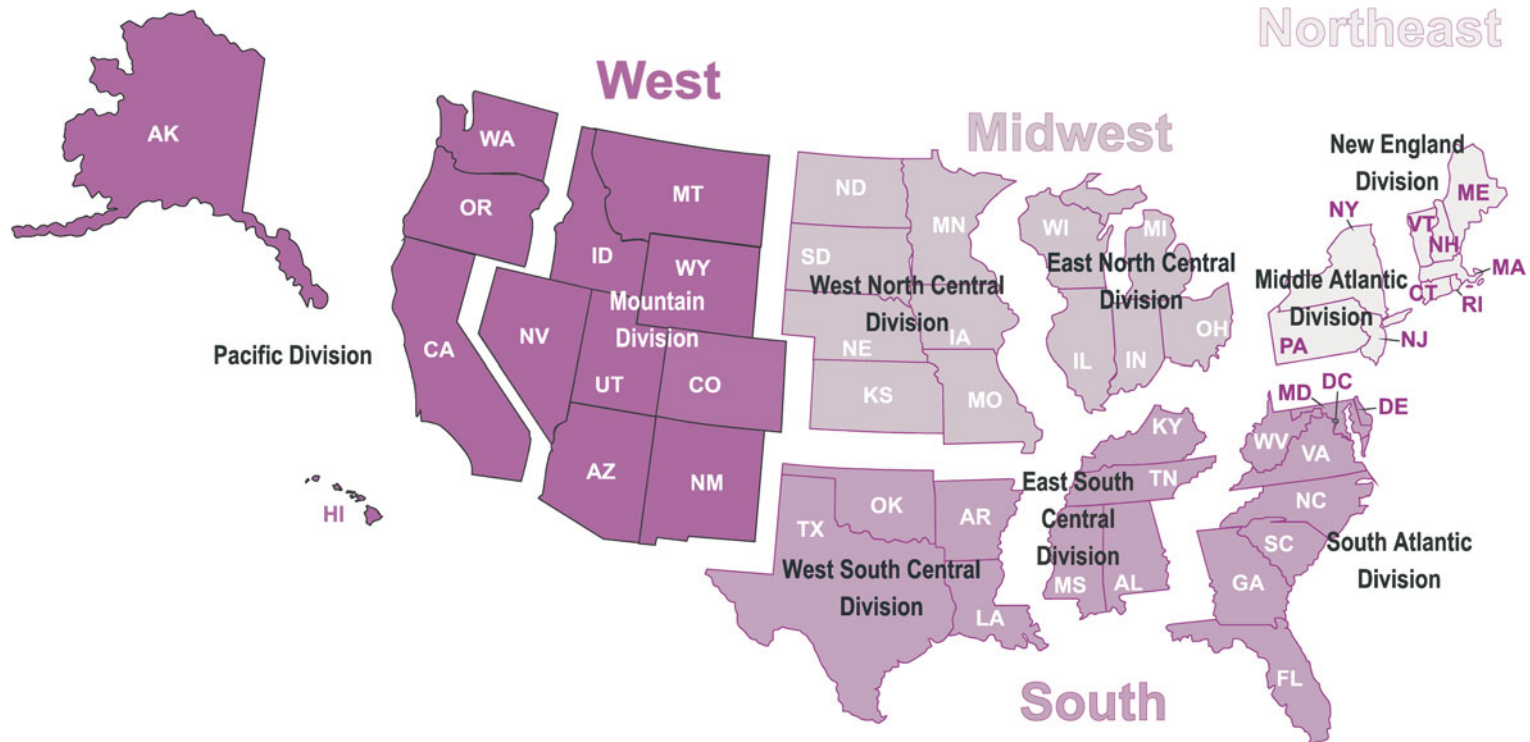
Web Page: For related information, see <http://www.eia.doe.gov/emeu/aer/append.html>.

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.



# Appendix C

## U.S. Census Regions and Divisions



Note: Map not to scale.

Source: Adapted from U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States 2003* (Washington, DC, December 2003).





# Appendix D

**Table D1. Population and U.S. Gross Domestic Product, Selected Years, 1949-2003**

Year	Population		U.S. Gross Domestic Product		
	United States <sup>1</sup>	World	Billion Nominal Dollars	Billion Chained (2000) Dollars	Implicit Price Deflator <sup>2</sup> (2000 = 1.00000)
	Million People				
1949	148.7	NA	R267.3	R1,634.6	R0.16352
1950	151.3	2,555.4	R293.8	R1,777.3	R0.16531
1955	165.1	2,780.0	R414.8	R2,212.8	R0.18743
1960	179.3	3,039.7	R526.4	R2,501.8	R0.21041
1965	193.5	3,346.2	R719.1	R3,191.1	R0.22535
1970	203.3	3,708.1	R1,038.5	R3,771.9	R0.27534
1971	206.8	3,785.7	R1,127.1	R3,898.6	R0.28911
1972	209.3	R3,862.3	R1,238.3	R4,105.0	R0.30166
1973	211.4	R3,938.5	R1,382.7	R4,341.5	R0.31849
1974	213.3	R4,014.1	R1,500.0	R4,319.6	R0.34725
1975	215.5	R4,087.3	R1,638.3	R4,311.2	R0.38002
1976	217.6	R4,159.1	R1,825.3	R4,540.9	R0.40196
1977	219.8	R4,231.4	R2,030.9	R4,750.5	R0.42752
1978	222.1	R4,303.5	R2,294.7	R5,015.0	R0.45757
1979	224.6	R4,378.6	R2,563.3	R5,173.4	R0.49548
1980	226.5	R4,454.3	R2,789.5	R5,161.7	R0.54043
1981	229.5	R4,530.1	R3,128.4	R5,291.7	R0.59119
1982	231.7	R4,610.2	R3,255.0	R5,189.3	R0.62726
1983	233.8	R4,690.5	R3,536.7	R5,423.8	R0.65207
1984	235.8	R4,769.8	R3,933.2	R5,813.6	R0.67655
1985	237.9	R4,850.4	R4,220.3	R6,053.7	R0.69713
1986	240.1	R4,932.7	R4,462.8	R6,263.6	R0.71250
1987	242.3	R5,017.9	R4,739.5	R6,475.1	R0.73196
1988	244.5	R5,103.5	R5,103.8	R6,742.7	R0.75694
1989	246.8	R5,189.2	R5,484.4	R6,981.4	R0.78556
1990	248.8	R5,275.9	R5,803.1	R7,112.5	R0.81590
1991	253.0	R5,359.8	R5,995.9	R7,100.5	R0.84444
1992	256.5	R5,443.8	R6,337.7	R7,336.6	R0.86385
1993	259.9	R5,525.2	R6,657.4	R7,532.7	R0.88381
1994	263.1	R5,605.4	R7,072.2	R7,835.5	R0.90259
1995	266.3	R5,686.0	R7,397.7	R8,031.7	R0.92106
1996	269.4	R5,765.2	R7,816.9	R8,328.9	R0.93852
1997	272.6	R5,844.9	R8,304.3	R8,703.5	R0.95414
1998	275.9	R5,923.7	R8,747.0	R9,066.9	R0.96472
1999	279.0	R6,002.0	R9,268.4	R9,470.3	R0.97868
2000	281.4	R6,079.0	R9,817.0	R9,817.0	R1.00000
2001	R285.1	R6,154.3	R10,100.8	R9,866.6	R1.02373
2002	R288.0	R6,228.6	R10,480.8	R10,083.0	R1.03945
2003	290.8	6,302.5	10,987.9	10,398.0	1.05673

<sup>1</sup> Resident population of the 50 States and the District of Columbia estimated for July 1 of each year, except for the April 1 decennial census counts.

<sup>2</sup> See Glossary.

R=Revised. NA=Not available.

Note: See "Chained Dollars" in the Glossary.

Web Pages: • For data not shown for 1951-1969, see <http://www.eia.doe.gov/emeu/aer/Append.html>.

• For related information, see <http://www.census.gov/> and <http://www.bea.doc.gov/>.

Sources: **U.S. Population:** • 1949-1989—Department of Commerce (DOC), U.S. Bureau of the Census, Current Population Reports Series P-25, November 1998. • 1990 forward—DOC, U.S. Bureau of the Census, State Population Estimates. **World Population:** • 1950 forward—DOC, U.S. Bureau of the Census, International Database. **U.S. Gross Domestic Product:** • 1949 forward—DOC, Bureau of Economic Analysis, National Income and Product Accounts (March 25, 2004), Tables 1.1.5, 1.1.6, and 1.1.9.



# Appendix E

**Table E1. Estimated Energy Consumption in the United States, Selected Years, 1635-1945**  
(Quadrillion Btu)

Year	Fossil Fuels				Renewable Energy			Electricity Net Imports	Total
	Coal	Natural Gas	Petroleum	Total	Conventional Hydroelectric Power	Wood <sup>1</sup>	Total		
1635	NA	—	—	—	—	(s)	(s)	—	(s)
1645	NA	—	—	—	—	0.001	0.001	—	0.001
1655	NA	—	—	—	—	0.002	0.002	—	0.002
1665	NA	—	—	—	—	0.005	0.005	—	0.005
1675	NA	—	—	—	—	0.007	0.007	—	0.007
1685	NA	—	—	—	—	0.009	0.009	—	0.009
1695	NA	—	—	—	—	0.014	0.014	—	0.014
1705	NA	—	—	—	—	0.022	0.022	—	0.022
1715	NA	—	—	—	—	0.037	0.037	—	0.037
1725	NA	—	—	—	—	0.056	0.056	—	0.056
1735	NA	—	—	—	—	0.080	0.080	—	0.080
1745	NA	—	—	—	—	0.112	0.112	—	0.112
1755	NA	—	—	—	—	0.155	0.155	—	0.155
1765	NA	—	—	—	—	0.200	0.200	—	0.200
1775	NA	—	—	—	—	0.249	0.249	—	0.249
1785	NA	—	—	—	—	0.310	0.310	—	0.310
1795	NA	—	—	—	—	0.402	0.402	—	0.402
1805	NA	—	—	—	—	0.537	0.537	—	0.537
1815	NA	—	—	—	—	0.714	0.714	—	0.714
1825	NA	—	—	—	—	0.960	0.960	—	0.960
1835	NA	—	—	—	—	1.305	1.305	—	1.305
1845	NA	—	—	—	—	1.757	1.757	—	1.757
1850	0.219	—	—	0.219	—	2.138	2.138	—	2.357
1855	0.421	—	—	0.421	—	2.389	2.389	—	2.810
1860	0.518	—	0.003	0.521	—	2.641	2.641	—	3.162
1865	0.632	—	0.010	0.642	—	2.767	2.767	—	3.409
1870	1.048	—	0.011	1.059	—	2.893	2.893	—	3.952
1875	1.440	—	0.011	1.451	—	2.872	2.872	—	4.323
1880	2.054	—	0.096	2.150	—	2.851	2.851	—	5.001
1885	2.840	0.082	0.040	2.962	—	2.683	2.683	—	5.645
1890	4.062	0.257	0.156	4.475	0.022	2.515	2.537	—	7.012
1895	4.950	0.147	0.168	5.265	0.090	2.306	2.396	—	7.661
1900	6.841	0.252	0.229	7.322	0.250	2.015	2.265	—	9.587
1905	10.001	0.372	0.610	10.983	0.386	1.843	2.229	—	13.212
1910	12.714	0.540	1.007	14.261	0.539	1.765	2.304	—	16.565
1915	13.294	0.673	1.418	15.385	0.659	1.688	2.347	0.002	17.734
1920	15.504	0.813	2.676	18.993	0.738	1.610	2.348	0.003	21.344
1925	14.706	1.191	4.280	20.177	0.668	1.533	2.201	0.004	22.382
1930	13.639	1.932	5.897	21.468	0.752	1.455	2.207	0.005	23.680
1935	10.634	1.919	5.675	18.228	0.806	1.397	2.203	0.005	20.436
1940	12.535	2.665	7.760	22.960	0.880	1.358	2.238	0.007	25.205
1945	15.972	3.871	10.110	29.953	1.442	<sup>1</sup> 1.261	2.703	0.009	32.665

<sup>1</sup> There is a discontinuity in the "Wood" time series between 1945 and 1949. Through 1945, data are for fuelwood only; beginning in 1949, data also include wood-derived fuel and wood byproducts burned as fuel. NA=Not available. — = Not applicable. (s)=Less than 0.0005 quadrillion Btu.

Notes: • For years not shown, there are no data available. • See Tables 1.3 and 10.1 for continuation of these data series from 1949 forward. • See Note, "Geographic Coverage of Statistics for 1635-1945," at end of section.

Sources: **Coal, Natural Gas, and Petroleum:** *Energy in the American Economy, 1850-1975*, Table VII. **Conventional Hydroelectric Power:** *Energy in the American Economy, 1850-1975*, Table II. **Wood:** • 1635-1845: U.S. Department of Agriculture Circular No. 641, *Fuel Wood Used in the United States*

1630-1930, February 1942. This source estimates fuelwood consumption in cords per decade, which were converted to Btu using the conversion factor of 20 million Btu per cord. The annual average value for each decade was assigned to the fifth year of the decade on the assumption that annual use was likely to increase during any given decade and the average annual value was more likely to reflect mid-decade yearly consumption than use at either the beginning or end of the decade. Values thus begin in 1635 and are plotted at 10-year intervals. • 1850-1945: *Energy in the American Economy, 1850-1975*, Table VII. **Electricity Net Imports:** *Energy in the American Economy, 1850-1975*, Tables I and VI. Calculated as the difference between hydroelectric consumption and hydroelectric production times 3,412 Btu per kilowatthour.

## Appendix E

**Note: Geographic Coverage of statistics for 1635-1945.** Table E1 presents estimates of U.S. energy consumption by energy source for a period that begins a century and a half before the original 13 colonies formed a political union and continues through the decades during which the United States was still expanding territorially. The question thus arises, what exactly is meant by “U.S. consumption” of an energy source for those years when the United States did not formally exist or consisted of less territory than is now encompassed by the 50 States and the District of Columbia?

The documents used to assemble the estimates, and (as far as possible) the sources of those documents, were reviewed carefully for clues to geographic coverage. For most energy sources, the extent of coverage expanded more rapidly than the Nation, defined as all the official States and the District of Columbia. Estimates or measurements of consumption of each energy source generally appear to follow settlement patterns. That is, they were made for areas of the continent that were settled enough to have economically significant consumption even though those areas were not to become States for years. The wood data series, for example, begins in 1635 and includes 12 of the original colonies (excepting Georgia), as well

as Maine, Vermont, and the area that would become the District of Columbia. By the time the series reaches 1810, the rest of the continental States are all included, though the last of the 48 States to achieve statehood did not do so until 1912. Likewise, the coal data series begins in 1850 but includes consumption in areas, such as Utah and Washington (State), which were significant coal-producing regions but had not yet attained statehood. (Note: No data were available on State-level historical coal consumption. The coal data shown in Table E1 through 1945 describe *apparent* consumption, i.e., production plus imports minus exports. The geographic coverage for coal was therefore based on a tally of coal-*producing* States listed in various historical issues of *Minerals Yearbook*. It is likely that coal was consumed in States where it was not mined in significant quantities.)

By energy source, the extent of coverage can be summarized as follows: • **Coal**—35 coal-producing States by 1885. • **Natural Gas**—All 48 contiguous States, the District of Columbia, and Alaska by 1885. • **Petroleum**—All 48 contiguous States, the District of Columbia, and Alaska by 1885. • **Conventional Hydroelectric Power**—Coverage for 1890 and 1895 is uncertain, but probably the 48 contiguous States and the District of Columbia. Coverage for 1900 through 1945 is the 48 contiguous States, and the District of Columbia. • **Wood**—All 48 contiguous States and the District of Columbia by 1810.

# Glossary

**Alcohol:** The family name of a group of organic chemical compounds composed of carbon, **hydrogen**, and oxygen. The series of molecules vary in chain length and are composed of a **hydrocarbon** plus a hydroxyl group:  $\text{CH}_3\text{-(CH}_2\text{)}_n\text{-OH}$  (e.g., **methanol**, **ethanol**, and tertiary butyl alcohol). See **Fuel Ethanol**.

**Alternative Fuel:** As defined pursuant to the Energy Policy Act of 1992 (EPACT), **methanol**, denatured **ethanol**, and other **alcohols**, separately or in mixtures of 85 percent by volume or more (or other percentage not less than 70 as determined by DOE rule) with **motor gasoline** or other fuels, **compressed natural gas** (CNG), **liquefied natural gas** (LNG), **liquefied petroleum gases** (LPG), **hydrogen**, coal-derived liquid fuels, fuels other than alcohols derived from biological materials, **electricity**, or any other fuel determined to be substantially not **petroleum** and yielding substantial energy security benefits and substantial environmental benefits.

**Alternative-Fueled Vehicle (AFV):** A vehicle either designed and manufactured by an original equipment manufacturer or a converted vehicle designed to operate in either dual-fuel, flexible-fuel, or dedicated modes on fuels other than **motor gasoline** or **diesel fuel**. This does not include a conventional vehicle that is limited to operation on blended or **reformulated motor gasoline** fuels.

**Anthracite:** The highest rank of **coal**; used primarily for residential and commercial **space heating**. It is a hard, brittle, and black lustrous coal, often referred to as hard coal, containing a high percentage of fixed carbon and a low percentage of volatile matter. The moisture content of fresh-mined anthracite generally is less than 15 percent. The heat content of anthracite ranges from 22 to 28 million **Btu** per **short ton** on a moist, mineral-matter-free basis. The heat content of anthracite consumed in the United States averages 25 million Btu per short ton, on the as-received basis (i.e., containing both inherent moisture and mineral matter). *Note:* Since the 1980's, anthracite refuse or mine waste has been used for steam-electric power generation. This fuel typically has a heat content of 15 million Btu per short ton or less. See **Coal Rank**.

**Anthracite Culm:** Waste from Pennsylvania **anthracite** preparation plants, consisting of coarse rock fragments containing as much as 30 percent small-sized **coal**; sometimes defined as including very fine coal particles called silt. Its heat value ranges from 8 to 17 million **Btu** per **short ton**.

**Anthropogenic:** Made or generated by a human or caused by human activity. The term is used in the context of global **climate change** to refer to gaseous emissions that are the result of human activities, as well as other potentially climate-altering activities, such as deforestation.

**API:** The American Petroleum Institute, a trade association.

**API Gravity:** American Petroleum Institute measure of specific gravity of **crude oil** or condensate in degrees. An arbitrary scale expressing the gravity or density of liquid **petroleum products**. The measuring scale is calibrated in terms of degrees API; it is calculated as follows:

Degrees API =  $(141.5 / \text{sp.gr.}60 \text{ deg.F}/60 \text{ deg.F}) - 131.5$ .

**Asphalt:** A dark-brown to black cement-like material obtained by **petroleum** processing and containing bitumens as the predominant component; used primarily for road construction. It includes crude asphalt as well as the following finished products: cements, fluxes, the asphalt content of emulsions (exclusive of water), and petroleum distillates blended with asphalt to make cutback asphalts. *Note:* The conversion factor for asphalt is 5.5 **barrels** per **short ton**.

**ASTM:** The acronym for the American Society for Testing and Materials.

**Aviation Gasoline Blending Components:** **Naphthas** that will be used for blending or compounding into finished **aviation gasoline** (e.g., straight run gasoline, alkylate, reformate, benzene, toluene, and xylene). Excludes **oxygenates** (**alcohols**, **ethers**), **butane**, and **pentanes plus**. Oxygenates are reported as **other hydrocarbons**, **hydrogen**, and **oxygenates**.

**Aviation Gasoline, Finished:** A complex mixture of relatively volatile **hydrocarbons** with or without small quantities of additives, blended to form a fuel suitable for use in aviation reciprocating engines. Fuel specifications are provided in ASTM Specification D910 and Military Specification MIL-G-5572. *Note:* Data on blending components are not counted in data on finished aviation gasoline. See **Jet Fuel**; **Jet Fuel, Kerosene-Type**; and **Jet Fuel, Naphtha-Type**.

**Barrel (Petroleum):** A unit of volume equal to 42 U.S. gallons.

**Barrels per Calendar Day:** The amount of input that a distillation facility can process under usual operating conditions. The amount is expressed in terms of capacity during a 24-hour period and reduces the maximum processing capability of all units at the facility under continuous operation to account for the following limitations that may delay, interrupt, or slow down production: 1) the capability of downstream processing units to absorb the output of **crude oil** processing facilities of a given refinery (no reduction is necessary for intermediate streams that are distributed to other than downstream facilities as part of a refinery's normal operation); 2) the types and grades of inputs to be processed; 3) the types and grades of products expected to be manufactured; 4) the environmental constraints associated with refinery operations; 5) the reduction of capacity for scheduled downtime due to such conditions as routine inspection, maintenance, repairs, and turnaround; and 6) the reduction of capacity for unscheduled downtime due to such conditions as mechanical problems, repairs, and slowdowns.

**Base Gas:** The volume of gas needed as a permanent inventory to maintain adequate underground storage reservoir pressures and deliverability rates throughout the withdrawal season. All native gas is included in the base gas volume.

**Biodiesel:** Any liquid biofuel suitable as a **diesel fuel** substitute or diesel fuel additive or extender. Biodiesel can be made from transesterification of oils of vegetables such as soybeans, rapeseed, or sunflowers (end product known as methyl ester) or from animal tallow (end product known as methyl tallowate). Biodiesel can also be made by transesterification of **hydrocarbons** produced by the Fisher-Tropsch process from agricultural byproducts such as rice hulls.

**Bituminous Coal:** A dense **coal**, usually black, sometimes dark brown, often with well-defined bands of bright and dull material, used primarily as fuel in steam-electric power generation, with substantial quantities also used for heat and power applications in manufacturing and making **coke**. Bituminous coal is the most abundant coal in active U.S. mining regions. Its moisture content usually is less than 20 percent. The heat content of bituminous coal ranges from 21 to 30 million **Btu** per **short ton** on a moist, mineral-matter-free basis. The heat content of bituminous coal consumed in the United States averages 24 million Btu per short ton, on the as-received basis (i.e., containing both inherent moisture and mineral matter). See **Coal Rank**.

**Black Liquor (Pulping Liquor):** The alkaline spent liquor removed from the digesters in the process of chemically pulping wood. After evaporation, the liquor is burned as a fuel in a recovery furnace that permits the recovery of certain basic chemicals.

**British Thermal Unit (Btu):** The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water

has its greatest density (approximately 39 degrees Fahrenheit). See **Heat Content of a Quantity of Fuel, Gross**, and **Heat Content of a Quantity of Fuel, Net**.

**Btu:** See **British Thermal Unit**.

**Bunker Fuels:** Fuel supplied to ships and aircraft, both domestic and foreign, consisting primarily of **residual fuel oil** and **distillate fuel oil** for ships and **kerosene-type jet fuel** for aircraft. The term "international bunker fuels" is used to denote the consumption of fuel for international transport activities. *Note:* For the purposes of **greenhouse gas** emissions inventories, data on emissions from combustion of international bunker fuels are subtracted from national emissions totals. Historically, bunker fuels have meant only ship fuel.

**Butane:** A normally gaseous straight-chain or branched-chain **hydrocarbon** ( $C_4H_{10}$ ) extracted from **natural gas** or **refinery gas** streams. It includes isobutane and normal butane and is designated in ASTM Specification D1835 and Gas Processors Association Specifications for commercial butane.

*Isobutane:* A normally gaseous branched-chain hydrocarbon. It is a colorless paraffinic gas that boils at a temperature of 10.9 degrees Fahrenheit. It is extracted from natural gas or refinery gas streams.

*Normal Butane:* A normally gaseous straight-chain hydrocarbon. It is a colorless paraffinic gas that boils at a temperature of 31.1 degrees Fahrenheit. It is extracted from natural gas or refinery gas streams.

**Butylene:** An olefinic **hydrocarbon** ( $C_4H_8$ ) recovered from refinery processes.

**Capacity:** See **Generator Capacity**.

**Capacity Factor:** See **Generator Capacity Factor**.

**Carbon Dioxide:** A colorless, odorless, non-poisonous gas ( $CO_2$ ) that is a normal part of Earth's atmosphere. Carbon dioxide is a product of **fossil-fuel** combustion as well as other processes. It is considered a **greenhouse gas** as it traps heat (infrared energy) radiated by the Earth into the atmosphere and thereby contributes to the potential for **global warming**. The **global warming potential** (GWP) of other greenhouse gases is measured in relation to that of carbon dioxide, which by international scientific convention is assigned a value of one (1).

**Carbon Dioxide Equivalent:** The amount of **carbon dioxide** by weight emitted into the atmosphere that would produce the same estimated radiative forcing as a given weight of another radiatively active gas. Carbon dioxide equivalents are computed by multiplying the weight of the gas being measured (for example, **methane**) by its estimated **global warming potential** (which is 21 for methane). "Carbon

equivalent units” are defined as carbon dioxide equivalents multiplied by the carbon content of carbon dioxide (i.e., 12/44).

**Chained Dollars:** A measure used to express **real prices**. Real prices are those that have been adjusted to remove the effect of changes in the purchasing power of the dollar; they usually reflect buying power relative to a reference year. Prior to 1996, real prices were expressed in constant dollars, a measure based on the weights of goods and services in a single year, usually a recent year. In 1996, the U.S. Department of Commerce introduced the chained-dollar measure. The new measure is based on the average weights of goods and services in successive pairs of years. It is “chained” because the second year in each pair, with its weights, becomes the first year of the next pair. The advantage of using the chained-dollar measure is that it is more closely related to any given period covered and is therefore subject to less distortion over time.

**Chlorofluorocarbon (CFC):** Any of various compounds consisting of carbon, **hydrogen**, chlorine, and fluorine used as refrigerants. CFCs are now thought to be harmful to the Earth’s atmosphere.

**City Gate:** A point or measuring station at which a distribution gas utility receives gas from a **natural gas pipeline** company or transmission system.

**Climate Change:** A term used to refer to all forms of climatic inconsistency, but especially to significant change from one prevailing climatic condition to another. In some cases, “climate change” has been used synonymously with the term “**global warming**”; scientists, however, tend to use the term in a wider sense to include natural changes in climate as well as climatic cooling.

**Coal:** A readily combustible black or brownish-black rock whose composition, including inherent moisture, consists of more than 50 percent by weight and more than 70 percent by volume of carbonaceous material. It is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time. See **Coal Rank**.

**Coal Coke:** See **Coke, Coal**.

**Coal Rank:** The classification of **coals** according to their degree of progressive alteration from lignite to anthracite. In the United States, the standard ranks of coal include **lignite**, **subbituminous coal**, **bituminous coal**, and **anthracite** and are based on fixed carbon, volatile matter, heating value, and agglomerating (or caking) properties.

**Coal Stocks:** **Coal** quantities that are held in storage for future use and disposition. *Note:* When coal data are collected for a particular reporting period (month, quarter, or year), coal stocks are commonly measured as of the last day of this period.

**Coke, Coal:** A solid carbonaceous residue derived from low-ash, low-sulfur **bituminous coal** from which the volatile constituents are driven off by baking in an oven at temperatures as high as 2,000 degrees Fahrenheit so that the fixed carbon and residual ash are fused together. Coke is used as a fuel and as a reducing agent in smelting iron ore in a blast furnace. Coke from coal is gray, hard, and porous and has a heating value of 24.8 million **Btu** per **short ton**.

**Coke, Petroleum:** A residue high in carbon content and low in **hydrogen** that is the final product of thermal decomposition in the condensation process in cracking. This product is reported as marketable coke or catalyst coke. The conversion is 5 **barrels** (of 42 U.S. gallons each) per **short ton**. Coke from **petroleum** has a heating value of 6.024 million **Btu** per barrel.

**Combined-Heat-and-Power (CHP) Plant:** A plant designed to produce both heat and **electricity**. If one or more units of the plant is a CHP unit, then the whole plant is designated as a CHP plant. *Note:* This term is being used in place of the term “cogenerator” that was used by EIA in the past. CHP better describes the facilities because some of the plants included do not produce heat and power in a sequential fashion and, as a result, do not meet the legal definition of cogeneration specified in the Public Utility Regulatory Policies Act (PURPA). See **Electricity-Only Plant**.

**Commercial Building:** A building with more than 50 percent of its floorspace used for commercial activities. Commercial buildings include, but are not limited to, stores, offices, schools, churches, gymnasiums, libraries, museums, hospitals, clinics, warehouses, and jails. Government buildings are included, except buildings on military bases or reservations.

**Commercial Sector:** An **energy**-consuming sector that consists of service-providing facilities and equipment of: businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters. It also includes sewage treatment facilities. Common uses of energy associated with this sector include **space heating**, water heating, air conditioning, lighting, refrigeration, cooking, and running a wide variety of other equipment. *Note:* This sector includes **generators** that produce **electricity** and/or **useful thermal output** primarily to support the activities of the above-mentioned commercial establishments. Various EIA programs differ in sectoral coverage—for more information see <http://www.eia.doe.gov/neic/datadefinitions/Guideforwebcom.htm>. See **End-Use Sectors** and **Energy-Use Sectors**.

**Completion (Crude Oil/Natural Gas Production):** The term refers to the installation of permanent equipment for the production of **crude oil** or **natural gas**. If a **well** is equipped to produce only crude oil or natural gas from one zone or reservoir, the definition of a “well” (classified as a **crude oil well** or **natural gas well**) and the definition of a “completion” are identical. However, if a well is equipped to produce

crude oil and/or natural gas separately from more than one reservoir, a “well” is not synonymous with a “completion.”

**Compressed Natural Gas (CNG):** **Natural gas** compressed to a volume and density that is practical as a portable fuel supply (even when compressed, natural gas is not a liquid).

**Conventional Hydroelectric Power:** See **Hydroelectric Power, Conventional**.

**Conventional Motor Gasoline:** See **Motor Gasoline, Conventional**.

**Conversion Factor:** A number that translates units of one system into corresponding values of another system. Conversion factors can be used to translate physical units of measure for various fuels into **Btu** equivalents.

**Cooling Tower:** A common type of environmental equipment installed at **electric power plants** used to transfer heat, produced by burning fuel, to the atmosphere. Cooling towers are installed where there is insufficient cooling water available or where waste heat discharged into cooling water would affect marine life.

**Criteria Pollutant:** A pollutant determined to be hazardous to human health and regulated under the Environmental Protection Agency’s (EPA) National Ambient Air Quality Standards. The 1970 amendments to the Clean Air Act require EPA to describe the health and welfare impacts of a pollutant as the “criteria” for inclusion in the regulatory regime.

**Crude Oil:** A mixture of **hydrocarbons** that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Depending upon the characteristics of the crude stream, it may also include: 1) small amounts of hydrocarbons that exist in gaseous phase in natural underground reservoirs but are liquid at atmospheric pressure after being recovered from oil well (casinghead) gas in lease separators and are subsequently commingled with the crude stream without being separately measured. Lease condensate recovered as a liquid from **natural gas wells** in lease or field separation facilities and later mixed into the crude stream is also included; 2) small amounts of nonhydrocarbons produced with the oil, such as sulfur and various metals; and 3) drip gases, and liquid hydrocarbons produced from tar sands, gilsonite, and oil shale. Liquids produced at natural gas processing plants are excluded. Crude oil is refined to produce a wide array of **petroleum products**, including heating oils; gasoline, **diesel** and **jet fuels**; **lubricants**; **asphalt**; **ethane**, **propane**, and **butane**; and many other products used for their **energy** or chemical content.

**Crude Oil Domestic First Purchase Price:** The marketed first sales price of domestic **crude oil**, consistent with the removal price defined by the provisions of

the Windfall Profits Tax on Domestic Crude Oil (Public Law 96-223, Sec. 4998 [c]).

**Crude Oil Landed Cost:** The price of **crude oil** at the port of discharge, including charges associated with purchasing, transporting, and insuring a cargo from the purchase point to the port of discharge. The cost does not include charges incurred at the discharge port (e.g., import tariffs or fees, wharfage charges, and demurrage).

**Crude Oil Refiner Acquisition Cost:** The cost of **crude oil** to the refiner, including transportation and other fees. The composite cost is the weighted average of domestic and imported crude oil costs. The refiner acquisition cost does not include the cost of crude oil purchased for the **Strategic Petroleum Reserve**.

**Crude Oil Refinery Input:** The total **crude oil** put into processing units at refineries.

**Crude Oil Stocks:** Stocks of **crude oil** and **lease condensate** held at refineries, in **petroleum pipelines**, at pipeline terminals, and on leases.

**Crude Oil Used Directly:** **Crude oil** consumed as fuel by **petroleum pipelines** and on crude oil leases.

**Crude Oil Well:** A **well** completed for the production of **crude oil** from one or more crude oil zones or reservoirs. Wells producing both crude oil and **natural gas** are classified as crude oil wells.

**Cubic Foot (Natural Gas)** The amount of **natural gas** contained at standard temperature and pressure (60 degrees Fahrenheit and 14.73 pounds standard per square inch) in a cube whose edges are one foot long.

**Degree-Day Normals:** Simple arithmetic averages of monthly or annual **degree-days** over a long period of time (usually the 30-year period 1971–2000). The averages may be simple degree-day normals or population-weighted degree-day normals.

**Degree-Days, Cooling (CDD):** A measure of how warm a location is over a period of time relative to a base temperature, most commonly specified as 65 degrees Fahrenheit. The measure is computed for each day by subtracting the base temperature (65 degrees) from the average of the day’s high and low temperatures, with negative values set equal to zero. Each day’s cooling degree-days are summed to create a cooling degree-day measure for a specified reference period. Cooling degree-days are used in energy analysis as an indicator of air conditioning energy requirements or use.

**Degree-Days, Heating (HDD):** A measure of how cold a location is over a period of time relative to a base temperature, most commonly specified as 65 degrees



Fahrenheit. The measure is computed for each day by subtracting the average of the day's high and low temperatures from the base temperature (65 degrees), with negative values set equal to zero. Each day's heating degree-days are summed to create a heating degree-day measure for a specified reference period. Heating degree-days are used in energy analysis as an indicator of space heating energy requirements or use.

**Degree-Days, Population-Weighted:** Heating or cooling **degree-days** weighted by the population of the area in which the degree-days are recorded. To compute State population-weighted degree-days, each State is divided into from one to nine climatically homogeneous divisions, which are assigned weights based on the ratio of the population of the division to the total population of the State. Degree-day readings for each division are multiplied by the corresponding population weight for each division and those products are then summed to arrive at the State population-weighted degree-day figure. To compute national population-weighted degree-days, the Nation is divided into nine Census regions, each comprising from three to eight States, which are assigned weights based on the ratio of the population of the region to the total population of the Nation. Degree-day readings for each region are multiplied by the corresponding population weight for each region and those products are then summed to arrive at the national population-weighted degree-day figure.

**Demand-Side Management:** The planning, implementation, and monitoring of **electric utility** activities designed to encourage consumers to modify patterns of **electricity** usage, including the timing and level of electricity demand.

**Demonstrated Reserve Base (Coal):** A collective term for the sum of **coal** in both measured and indicated resource categories of reliability, representing 100 percent of the in-place coal in those categories as of a certain date. Includes beds of **bituminous coal** and **anthracite** 28 or more inches thick and beds of **subbituminous coal** 60 or more inches thick that can occur at depths of as much as 1,000 feet. Includes beds of **lignite** 60 or more inches thick that can be surface mined. Includes also thinner and/or deeper beds that currently are being mined or for which there is evidence that they could be mined commercially at a given time. Represents that portion of the identified coal resource from which reserves are calculated.

**Development Well:** A well drilled within the proved area of a **crude oil** or **natural gas** reservoir to the depth of a stratigraphic horizon known to be productive.

**Diesel Fuel:** A fuel composed of **distillate fuel oils** obtained in petroleum refining operation or blends of such distillate fuel oils with **residual fuel oil** used in motor vehicles. The boiling point and specific gravity are higher for diesel fuels than for gasoline.

**Distillate Fuel Oil:** A general classification for one of the **petroleum** fractions produced in conventional distillation operations. It includes **diesel fuels** and fuel

oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on-highway diesel engines, such as those found in cars and trucks, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for **space heating** and **electricity generation**.

**Distillation Unit (Atmospheric):** The primary distillation unit that processes **crude oil** (including mixtures of **other hydrocarbons**) at approximately atmospheric conditions. It includes a pipe still for vaporizing the crude oil and a **fractionation** tower for separating the vaporized hydrocarbon components in the crude oil into fractions with different boiling ranges. This is done by continuously vaporizing and condensing the components to separate higher boiling point material. The selected boiling ranges are set by the processing scheme, the properties of the crude oil, and the product specifications.

**District Heat:** Steam or hot water from an outside source used as an **energy source** in a building. The steam or hot water is produced in a central plant and is piped into the building. District heat may be purchased from a utility or provided by a physical plant in a separate building that is part of the same facility (for example, a hospital complex or university).

**Dry Hole:** An **exploratory well** or **development well** found to be incapable of producing either **crude oil** or **natural gas** in sufficient quantities to justify completion as a **crude oil well** or **natural gas well**.

**Dry Natural Gas:** See **Natural Gas, Dry**.

**Dry Natural Gas Production:** See **Natural Gas (Dry) Production**.

**Dual-Fired Unit:** A **generating unit** that can produce **electricity** using two or more input fuels. In some of these units, only the primary fuel can be used continuously; the alternate fuel(s) can be used only as a start-up fuel or in emergencies.

**Eastern Europe and Former U.S.S.R.:** Includes Albania, Azerbaijan, Belarus, Bulgaria, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Slovakia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. See **U.S.S.R.**

**Electric Energy:** The ability of an electric current to produce work, heat, light, or other forms of **energy**. It is measured in **kilowatthours**.

**Electric Power Plant:** A station containing **prime movers**, electric **generators**, and auxiliary equipment for converting mechanical, chemical, and/or fission **energy** into **electricity**.

**Electric Power Sector:** An energy-consuming sector that consists of **electricity-only** and **combined-heat-and-power (CHP)** plants within the NAICS (North American Industry Classification System) 22 category whose primary business is to sell **electricity**, or electricity and heat, to the public. *Note:* This sector includes **electric utilities** and **independent power producers**. See **Energy-Use Sectors**.

**Electric Utility:** A corporation, person, agency, authority, or other legal entity or instrumentality aligned with distribution facilities for delivery of **electric energy** for use primarily by the public. Included are investor-owned electric utilities, municipal and State utilities, Federal electric utilities, and rural electric cooperatives. A few entities that are tariff based and corporately aligned with companies that own distribution facilities are also included. Electric utilities are included in the **electric power sector**. *Note:* Due to the issuance of FERC Order 888 that required traditional electric utilities to functionally unbundle their generation, transmission, and distribution operations, “electric utility” currently has inconsistent interpretations from State to State. See **Electric Power Sector**.

**Electrical System Energy Losses:** The amount of **energy** lost during generation, transmission, and distribution of **electricity**, including plant and unaccounted-for uses.

**Electricity:** A form of **energy** characterized by the presence and motion of elementary charged particles generated by friction, induction, or chemical change.

**Electricity Generation:** The process of producing **electric energy**, or the amount of electric energy produced by transforming other forms of **energy**; commonly expressed in **kilowatthours** (kWh) or megawatthours (MWh). See **Electricity Generation, Gross** and **Electricity Generation, Net**.

**Electricity Generation, Gross:** The total amount of **electric energy** produced by **generating units** and measured at the generating terminal.

**Electricity Generation, Net:** The amount of **gross electricity generation** less the **electric energy** consumed at the generating station(s) for station service or auxiliaries. *Note:* Electricity required for pumping at **hydroelectric pumped-storage** plants is regarded as station use and is deducted from gross generation.

**Electricity Retail Sales:** The amount of **electricity** sold by **electric utilities** and other **energy service providers** to customers purchasing electricity for their own use and not for resale. These sales are usually grouped by classes of service, such as residential, commercial, industrial, and other. “Other” sales include sales for public street and highway lighting and other sales to public authorities and railways, and interdepartmental sales.

**Electricity-Only Plant:** A plant designed to produce **electricity** only. See **Combined-Heat-and-Power (CHP) Plant**.

**Emissions:** **Anthropogenic** releases of gases to the atmosphere. In the context of global **climate change**, they consist of radiatively important **greenhouse gases** (e.g., the release of **carbon dioxide** during fuel combustion).

**End-Use Sectors:** The **residential, commercial, industrial, and transportation** sectors of the economy. See **Energy-Use Sectors**.

**Energy:** The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world’s convertible energy comes from **fossil fuels** that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. **Electric energy** is usually measured in **kilowatthours**, while heat energy is usually measured in **British thermal units**.

**Energy Consumption:** The use of **energy** as a source of heat or power or as an input in the manufacturing process.

**Energy Expenditures:** The money spent directly by consumers to purchase **energy**. Expenditures equal the amount of energy used by the consumer times the price per unit paid by the consumer.

**Energy Service Provider:** An **energy** entity that provides service to a retail or end-use customer.

**Energy Source:** Any substance or natural phenomenon that can be consumed or transformed to supply heat or power. Examples include **petroleum, coal, natural gas, nuclear, wood, waste, electricity, wind, geothermal, sunlight (solar energy), water movement, and hydrogen** in fuel cells.

**Energy-Use Sectors:** A group of major **energy-consuming** components of U.S. society developed to measure and analyze energy use. The sectors most commonly referred to in EIA are: **residential, commercial, industrial, transportation, and electric power**.

**Ethane:** A normally gaseous straight-chain **hydrocarbon** (C<sub>2</sub>H<sub>6</sub>). It is a colorless, paraffinic gas that boils at a temperature of -127.48 degrees Fahrenheit. It is extracted from **natural gas** and **refinery gas** streams.

**Ether:** The family name applied to a group of organic chemical compounds composed of carbon, **hydrogen**, and oxygen, and which are characterized by an

oxygen atom attached to two carbon atoms (for example, **methyl tertiary butyl ether**).

**Ethanol:** See **Fuel Ethanol**.

**Ethyl Tertiary Butyl Ether (ETBE):** A colorless, flammable, oxygenated hydrocarbon blend stock,  $(\text{CH}_3)_3\text{COC}_2\text{H}_5$ , formed by the catalytic etherification of **isobutylene** with **ethanol**. See **Oxygenates**.

**Ethylene:** An olefinic **hydrocarbon** recovered from refinery processes or petrochemical processes. Ethylene is used as a **petrochemical feedstock** for numerous chemical applications and the production of consumer goods.

**Exploratory Well:** A well drilled to find and produce **crude oil** or **natural gas** in an area previously considered unproductive, to find a new reservoir in a known field (i.e., one previously producing crude oil or natural gas in another reservoir), or to extend the limit of a known crude oil or natural gas reservoir.

**Exports:** Shipments of goods from within the 50 States and the District of Columbia to U.S. possessions and territories or to foreign countries.

**Extraction Loss:** The reduction in volume of **natural gas** due to the removal of **natural gas liquid** constituents such as **ethane**, **propane**, and **butane** at natural gas processing plants.

**Federal Energy Administration (FEA):** A predecessor of the Energy Information Administration.

**Federal Energy Regulatory Commission (FERC):** The Federal agency with jurisdiction over interstate **electricity** sales, wholesale electric rates, hydroelectric licensing, **natural gas** pricing, **petroleum pipeline** rates, and **natural gas pipeline** certification. FERC is an independent regulatory agency within the Department of Energy and is the successor to the Federal Power Commission.

**Federal Power Commission (FPC):** The predecessor agency of the **Federal Energy Regulatory Commission**. The Federal Power Commission was created by an Act of Congress under the Federal Water Power Act on June 10, 1920. It was charged originally with regulating the electric power and **natural gas** industries. It was abolished on September 30, 1977, when the Department of Energy was created. Its functions were divided between the Department of Energy and the Federal Energy Regulatory Commission, an independent regulatory agency.

**Financial Reporting System (FRS):** The Energy Information Administration's statutory requirement to identify major **energy**-producing companies and develop and implement a data-reporting program for energy financial and operating information from these companies. Companies are selected if they are within the top 50

publicly-owned U.S. **crude oil** producers that have at least 1 percent of either production or reserves of **crude oil**, **natural gas**, **coal**, or **uranium** in the United States, or 1 percent of either refining capacity or **petroleum product** sales in the United States.

**Finished Motor Gasoline:** See **Motor Gasoline, Finished**.

**First Purchase Price:** See **Crude Oil Domestic First Purchase Price**.

**First Use:** Manufacturing establishments' consumption of the **energy** that was originally produced offsite or was produced onsite from input materials not classified as energy.

**Fiscal Year:** The U.S. Government's fiscal year runs from October 1 through September 30. The fiscal year is designated by the calendar year in which it ends; e.g., fiscal year 2003 began on October 1, 2002, and ended on September 30, 2003.

**Flared Natural Gas:** See **Natural Gas, Flared**.

**F.O.B.:** See **Free on Board**.

**Footage Drilled:** Total footage for **wells** in various categories, as reported for any specified period, includes (1) the deepest total depth (length of well bores) of all wells drilled from the surface, (2) the total of all bypassed footage drilled in connection with reported wells, and (3) all new footage drilled for directional sidetrack wells. Footage reported for directional sidetrack wells does not include footage in the common bore, which is reported as footage for the original well. In the case of old wells drilled deeper, the reported footage is that which was drilled below the total depth of the old well.

**Former U.S.S.R.:** See **U.S.S.R.**

**Forward Costs (Uranium):** The operating and capital costs that will be incurred in any future production of **uranium** from in-place reserves. Included are costs for labor, materials, power and fuel, royalties, payroll taxes, insurance, and general and administrative costs that are dependent upon the quantity of production and, thus, applicable as variable costs of production. Excluded from forward costs are prior expenditures, if any, incurred for property acquisition, exploration, mine development, and mill construction, as well as income taxes, profit, and the cost of money. *Note:* By use of forward costing, estimates of reserves for **uranium ore** deposits in differing geological settings can be aggregated and reported as the maximum amount that can theoretically be extracted to recover the specified costs of **uranium oxide** production under the listed forward cost categories.

**Fossil Fuel:** An **energy source** formed in the Earth's crust from decayed organic material, such as **petroleum, coal, and natural gas**.

**Fossil-Fueled Steam-Electric Power Plant:** An **electric power plant** in which the **prime mover** is a turbine rotated by high-pressure steam produced in a boiler by heat from burning **fossil fuels**.

**Fractionation:** The process by which saturated **hydrocarbons** are removed from **natural gas** and separated into distinct parts, or "fractions" such as **propane, butane, and ethane**.

**Free Alongside Ship (F.A.S.):** The value of a commodity at the port of exportation, generally including the purchase price plus all charges incurred in placing the commodity alongside the carrier at the port of exportation.

**Free on Board (F.O.B.):** A sales transaction in which the seller makes the product available for pick up at a specified port or terminal at a specified price and the buyer pays for the subsequent transportation and insurance.

**Free on Board (F.O.B.) Rail/Barge Price:** The **free on board** price of coal at the point of first sale. It excludes freight or shipping and insurance costs.

**Fuel Ethanol:** An anhydrous, denatured aliphatic **alcohol** (C<sub>2</sub>H<sub>5</sub>OH) intended for **motor gasoline blending**. See **Oxygenates**.

**Full-Power Operation:** Operation of a nuclear **generating unit** at 100 percent of its design capacity. Full-power operation precedes commercial operation.

**Gasohol:** A blend of **finished motor gasoline** containing **alcohol** (generally **ethanol** but sometimes **methanol**) at a concentration between 5.7 percent and 10 percent by volume. See **Oxygenates**.

**Generating Unit:** Any combination of physically connected **generators**, reactors, boilers, combustion turbines, or other **prime movers** operated together to produce electric power.

**Generator:** A machine that converts mechanical **energy** into **electric energy**.

**Generator Capacity:** The maximum output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, adjusted for ambient conditions. See **Generator Nameplate (Installed) Capacity** and **Generator Net Summer Capacity**.

**Generator Capacity Factor:** The ratio of the **electric energy** produced by a **generating unit** for a given period of time to the electric energy that could have been produced at continuous full-power operation during the same period.

**Generator Nameplate (Installed) Capacity:** The maximum rated output of a **generator, prime mover, or other electric power production equipment** under specific conditions designated by the manufacturer. Installed generator nameplate capacity is commonly expressed in megawatts (MW) and is usually indicated on a nameplate physically attached to the generator.

**Generator Net Summer Capacity:** The maximum output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, as demonstrated by a multi-hour test, at the time of summer peak demand (period of May 1 through October 31). This output reflects a reduction in capacity due to electricity use for station service or auxiliaries.

**Geothermal Energy:** Hot water or steam extracted from geothermal reservoirs in the Earth's crust and used for geothermal heat pumps, water heating, or **electricity generation**.

**Global Warming:** An increase in the near-surface temperature of the Earth. Global warming has occurred in the distant past as the result of natural influences, but the term is today most often used to refer to the warming some scientists predict will occur as a result of increased **anthropogenic** emissions of **greenhouse gases**. See **Climate Change**.

**Global Warming Potential (GWP):** An index used to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emission of one kilogram of a **greenhouse gas** to that from the emission of one kilogram of **carbon dioxide** over a period of time, such as 100 years.

**Greenhouse Gases:** Those gases, such as water vapor, **carbon dioxide**, nitrous oxide, **methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride**, that are transparent to solar (short-wave) radiation but opaque to long-wave radiation, thus preventing long-wave radiant energy from leaving the Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.

**Gross Domestic Product (GDP):** The total value of goods and services produced by labor and property located in the United States. As long as the labor and property are located in the United States, the supplier (that is, the workers and, for property, the owners) may be either U.S. residents or residents of foreign countries.

**Gross Domestic Product (GDP) Implicit Price Deflator:** A measure used to convert **nominal prices** to **real prices**. See **Chained Dollars**.

**Gross Electricity Generation:** See **Electricity Generation, Gross**.

**Gross Withdrawals:** See **Natural Gas Gross Withdrawals**.

**Gross Input to Atmospheric Crude Oil Distillation Units:** Total input to atmospheric crude oil distillation units. Includes all **crude oil**, **lease condensate**, **natural gas plant liquids**, **unfinished oils**, **liquefied refinery gases**, slop oils, and other liquid **hydrocarbons** produced from tar sands, gilsonite, and oil shale.

**Heat Content of a Quantity of Fuel, Gross:** The total amount of heat released when a fuel is burned. **Coal**, **crude oil**, and **natural gas** all include chemical compounds of carbon and **hydrogen**. When those fuels are burned, the carbon and hydrogen combine with oxygen in the air to produce **carbon dioxide** and water. Some of the **energy** released in burning goes into transforming the water into steam and is usually lost. The amount of heat spent in transforming the water into steam is counted as part of gross heat content but is not counted as part of net content. Gross heat content is also referred to as the higher heating value. Btu **conversion factors** typically used by the Energy Information Administration represent gross heat content.

**Heat Content of a Quantity of Fuel, Net:** The amount of usable heat **energy** released when a fuel is burned under conditions similar to those in which it is normally used. Net heat content is also referred to as the lower heating value. Btu **conversion factors** typically used by the Energy Information Administration represent gross heat content.

**Household:** A family, an individual, or a group of up to nine unrelated persons occupying the same housing unit. "Occupy" means the housing unit was the person's usual or permanent place of residence.

**Housing Unit:** A house, an apartment, a group of rooms, or a single room if it is either occupied or intended for occupancy as separate living quarters by a family, an individual, or a group of one to nine unrelated persons. Separate living quarters means the occupants (1) live and eat separately from other persons in the house or apartment and (2) have direct access from the outside of the buildings or through a common hall--that is, they can get to it without going through someone else's living quarters. Housing units do not include group quarters such as prisons or nursing homes where ten or more unrelated persons live. A common dining area used by residents is an indication of group quarters. Hotel and motel rooms are considered housing units if occupied as the usual or permanent place of residence.

**Hydrocarbon:** An organic chemical compound of **hydrogen** and carbon in the gaseous, liquid, or solid phase. The molecular structure of hydrocarbon compounds varies from the simplest (**methane**, a constituent of **natural gas**) to the very heavy and very complex.

**Hydroelectric Power:** The production of **electricity** from the kinetic **energy** of falling water. See **Hydroelectric Power, Conventional** and **Hydroelectric Pumped Storage**.

**Hydroelectric Power, Conventional:** **Hydroelectric power** generated from flowing water that is not created by **hydroelectric pumped storage**.

**Hydroelectric Pumped Storage:** **Hydroelectric power** that is generated during peak load periods by using water previously pumped into an elevated storage reservoir during off-peak periods when excess generating capacity is available to do so. When additional generating capacity is needed, the water can be released from the reservoir through a conduit to turbine **generators** located in an **electric power plant** at a lower level.

**Hydrofluorocarbons (HFCs):** A group of man-made chemicals composed of one or two carbon atoms and varying numbers of **hydrogen** and fluorine atoms. Most HFCs have 100-year **global warming potentials** in the thousands.

**Hydrogen (H):** The lightest of all gases, hydrogen occurs chiefly in combination with oxygen in water. It also exists in acids, bases, **alcohols**, **petroleum**, and other **hydrocarbons**.

**Implicit Price Deflator:** See **Chained Dollars**.

**Imports:** Receipts of goods into the 50 States and the District of Columbia from U.S. possessions and territories or from foreign countries.

**Independent Power Producer:** A corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public, and that is not an **electric utility**. Independent power producers are included in the **electric power sector**.

**Indicated Resources, Coal:** **Coal** for which estimates of the **coal rank**, quality, and quantity are based partly on sample analyses and measurements and partly on reasonable geologic projections. Indicated resources are computed partly from specified measurements and partly from projection of visible data for a reasonable distance on the basis of geologic evidence. The points of observation are 1/2 to 1 1/2 miles apart. Indicated coal is projected to extend as a 1/2-mile-wide belt that lies more than 1/4 mile from the outcrop or points of observation or measurement.

**Industrial Sector:** An **energy**-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing (NAICS codes 31-33); agriculture, forestry, fishing, and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); **natural gas** distribution (NAICS code 2212); water supply and irrigation systems (NAICS code 22131); and construction (NAICS code 23). Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products. *Note:* This sector includes **generators** that produce **electricity** and/or **useful thermal output** primarily to support the above-mentioned industrial activities. Various EIA programs differ in sectoral coverage—for more information see <http://www.eia.doe.gov/neic/datadefinitions/Guideforwebind.htm>. See **End-Use Sectors** and **Energy-Use Sectors**.

**Isobutane:** See **Butane**.

**Isobutylene:** An olefinic **hydrocarbon** recovered from refinery processes or petrochemical processes.

**Isopentane:** A saturated branched-chain **hydrocarbon** obtained by **fractionation** of **natural gasoline** or isomerization of normal pentane.

**Jet Fuel:** A refined petroleum product used in jet aircraft engines. See **Jet Fuel, Kerosene-Type** and **Jet Fuel, Naphtha-Type**.

**Jet Fuel, Kerosene-Type:** A **kerosene**-based product with a maximum distillation temperature of 400 degrees Fahrenheit at the 10-percent recovery point and a final maximum boiling point of 572 degrees Fahrenheit and meeting ASTM Specification 1655 and Military Specifications MIL-T-5624P and MIL-T-83133D (Grades JP-5 and JP-8). It is used for commercial and military turbojet and turboprop aircraft engines.

**Jet Fuel, Naphtha-Type:** A fuel in the heavy **naphtha** boiling range, with an average gravity of 52.8° API, 20 to 90 percent distillation temperature of 290 to 470 degrees Fahrenheit, and meeting Military Specification MIL-T-5624L (Grade JP-4). It is used primarily for military turbojet and turboprop aircraft engines because it has a lower freeze point than other aviation fuels and meets engine requirements at high altitudes and speeds.

**Kerosene:** A light **petroleum** distillate that is used in space heaters, cook stoves, and water heaters and is suitable for use as a light source when burned in wick-fed lamps. Kerosene has a maximum distillation temperature of 400 degrees Fahrenheit at the 10-percent recovery point, a final boiling point of 572 degrees Fahrenheit, and a minimum flash point of 100 degrees Fahrenheit. Included are No. 1-K and No.

2-K, the two grades recognized by ASTM Specification D3699 as well as all other grades of kerosene called range or stove oil, which have properties similar to those of No. 1 fuel oil. See **Jet Fuel, Kerosene-Type**.

**Kerosene-Type Jet Fuel:** See **Jet Fuel, Kerosene-Type**.

**Kilowatt:** A unit of electrical power equal to 1,000 **watts**.

**Kilowatthour (kWh):** A measure of **electricity** defined as a unit of work or **energy**, measured as 1 **kilowatt** (1,000 **watts**) of power expended for 1 hour. One kilowatthour is equivalent to 3,412 **Btu**. See **Watthour**.

**Landed Cost:** See **Crude Oil Landed Cost**.

**Lease and Plant Fuel:** **Natural gas** used in **well**, field, and lease operations (such as natural gas used in drilling operations, heaters, dehydrators, and field compressors) and used as fuel in natural gas processing plants.

**Lease Condensate:** A mixture consisting primarily of pentanes and heavier **hydrocarbons** which is recovered as a liquid from **natural gas** in lease separation facilities. This category excludes **natural gas plant liquids**, such as **butane** and **propane**, which are recovered at downstream natural gas processing plants or facilities.

**Lignite:** The lowest rank of **coal**, often referred to as brown coal, used almost exclusively as fuel for steam-electric power generation. It is brownish-black and has a high inherent moisture content, sometimes as high as 45 percent. The heat content of lignite ranges from 9 to 17 million **Btu per short ton** on a moist, mineral-matter-free basis. The heat content of lignite consumed in the United States averages 13 million Btu per short ton, on the as-received basis (i.e., containing both inherent moisture and mineral matter). See **Coal Rank**.

**Liquefied Natural Gas (LNG):** **Natural gas** (primarily **methane**) that has been liquefied by reducing its temperature to -260 degrees Fahrenheit at atmospheric pressure.

**Liquefied Petroleum Gases (LPG):** A group of **hydrocarbon**-based gases derived from **crude oil** refining or **natural gas fractionation**. They include **ethane**, **ethylene**, **propane**, **propylene**, **normal butane**, **butylene**, **isobutane**, and **isobutylene**. For convenience of transportation, these gases are liquefied through pressurization.

**Liquefied Refinery Gases (LRG):** **Liquefied petroleum gases** fractionated from refinery or **still gases**. Through compression and/or refrigeration, they are retained in the liquid state. The reported categories are **ethane/ethylene**, **propane/propylene**, **normal butane/butylene**, and **isobutane**. Excludes still gas.

**Losses:** See **Electrical System Energy Losses**.

**Low-Power Testing:** The period of time between a nuclear **generating unit's** initial fuel loading date and the issuance of its operating (full-power) license. The maximum level of operation during that period is 5 percent of the unit's design thermal rating.

**Lubricants:** Substances used to reduce friction between bearing surfaces or incorporated into other materials used as processing aids in the manufacture of other products, or used as carriers of other materials. **Petroleum** lubricants may be produced either from distillates or residues. Lubricants include all grades of lubricating oils, from spindle oil to cylinder oil, and those used in greases.

**Manufacturing:** An energy-consuming subsector of the **industrial sector** that consists of all facilities and equipment engaged in the mechanical, physical, chemical, or electronic transformation of materials, substances, or components into new products. Assembly of component parts of products is included, except for that which is included in construction.

**Measured Resources, Coal:** **Coal** resources for which estimates of the **coal rank**, quality, and quantity have been computed, within a margin of error of less than 20 percent, from sample analyses and measurements from closely spaced and geologically well known sample sites. Measured resources are computed from dimensions revealed in outcrops, trenches, mine workings, and drill holes. The points of observation and measurement are so closely spaced and the thickness and extent of coals are so well defined that the tonnage is judged to be accurate within 20 percent. Although the spacing of the point of observation necessary to demonstrate continuity of the coal differs from region to region, according to the character of the coalbeds, the points of observation are no greater than ½ mile apart. Measured coal is projected to extend as a belt ¼ mile wide from the outcrop or points of observation or measurement.

**Methane:** A colorless, flammable, odorless **hydrocarbon** gas (CH<sub>4</sub>), which is the major component of **natural gas**. It is also an important source of **hydrogen** in various industrial processes.

**Methanol:** A light, volatile **alcohol** (CH<sub>3</sub>OH) eligible for **motor gasoline blending**. See **Oxygenates**.

**Methyl Tertiary Butyl Ether (MTBE):** An ether, (CH<sub>3</sub>)<sub>3</sub>COCH<sub>3</sub>, intended for **motor gasoline blending**. See **Oxygenates**.

**Miscellaneous Petroleum Products:** All finished **petroleum products** not classified elsewhere—for example, petrolatum, lube refining byproducts (aromatic

extracts and tars), absorption oils, ram-jet fuel, petroleum rocket fuels, synthetic natural gas feedstocks, and specialty oils.

**Motor Gasoline Blending:** Mechanical mixing of **motor gasoline blending components** and **oxygenates** as required, to produce **finished motor gasoline**. Finished motor gasoline may be further mixed with other motor gasoline blending components or oxygenates, resulting in increased volumes of finished motor gasoline and/or changes in the formulation of finished motor gasoline (e.g., **conventional motor gasoline** mixed with **MTBE** to produce **oxygenated motor gasoline**).

**Motor Gasoline Blending Components:** **Naphthas** (e.g., straight-run gasoline, alkylate, reformate, benzene, toluene, xylene) used for blending or compounding into **finished motor gasoline**. These components include reformulated gasoline blendstock for oxygenate blending (RBOB) but exclude **oxygenates (alcohols, ethers), butane, and pentanes plus**. *Note:* Oxygenates are reported as individual components and are included in the total for **other hydrocarbons, hydrogen, and oxygenates**.

**Motor Gasoline, Conventional:** **Finished motor gasoline** not included in the **oxygenated** or **reformulated** motor gasoline categories. *Note:* This category excludes reformulated gasoline blendstock for oxygenate blending (RBOB) as well as other blendstock. Conventional motor gasoline can be leaded or unleaded; regular, midgrade, or premium. See **Motor Gasoline Grades**.

**Motor Gasoline, Finished:** A complex mixture of relatively volatile **hydrocarbons** with or without small quantities of additives, blended to form a fuel suitable for use in spark-ignition. Motor gasoline, as defined in ASTM Specification D-4814 or Federal Specification VV-G-1690C, is characterized as having a boiling range of 122°F to 158°F at the 10-percent recovery point to 365°F to 374°F at the 90-percent recovery point. "Motor gasoline" includes **conventional motor gasoline**, all types of **oxygenated motor gasoline** including **gasohol**, and **reformulated motor gasoline**, but excludes **aviation gasoline**. *Note:* Volumetric data on **motor gasoline blending components**, as well as **oxygenates**, are not counted in data on finished motor gasoline until the blending components are blended into the gasoline.

**Motor Gasoline Grades:** The classification of gasoline by octane ratings. Each type of gasoline (**conventional, oxygenated, and reformulated**; leaded or unleaded) is classified by three grades: regular, midgrade, and premium. *Note:* Motor gasoline sales are reported by grade in accordance with their classification at the time of sale. In general, automotive octane requirements are lower at high altitudes. Therefore, in some areas of the United States, such as the Rocky Mountain States, the octane ratings for the gasoline grades may be 2 or more octane points lower.

*Regular Gasoline:* Gasoline having an antiknock index, i.e., octane rating, greater than or equal to 85 and less than 88.

*Midgrade Gasoline:* Gasoline having an antiknock index, i.e., octane rating, greater than or equal to 88 and less than or equal to 90.

*Premium Gasoline:* Gasoline having an antiknock index, i.e., octane rating, greater than 90.

**Motor Gasoline, Oxygenated:** Finished motor gasoline other than reformulated motor gasoline, having an oxygen content of 2.7 percent or higher by weight and required by the U.S. Environmental Protection Agency (EPA) to be sold in areas designated by EPA as carbon monoxide (CO) nonattainment areas. *Note:* Oxygenated gasoline excludes reformulated gasoline, oxygenated fuels program reformulated gasoline (OPRG), and reformulated gasoline blendstock for oxygenated blending (RBOB). It can be formulated for regular, midgrade, or premium grade. See **Motor Gasoline Grades**.

**Motor Gasoline, Reformulated:** Finished motor gasoline formulated for use in motor vehicles, the composition and properties of which meet the requirements of the reformulated gasoline regulations promulgated by the U.S. Environmental Protection Agency under Section 211(k) of the Clean Air Act. *Note:* This category includes oxygenated fuels program reformulated gasoline (OPRG) but excludes reformulated gasoline blendstock for oxygenate blending (RBOB). It can be formulated for regular, midgrade, and premium grades. See **Motor Gasoline Grades**.

**MTBE:** See **Methyl Tertiary Butyl Ether**.

**NAICS:** See **North American Industry Classification System**.

**Naphtha:** A generic term applied to a petroleum fraction with an approximate boiling range between 122 and 400° F.

**Naphtha-Type Jet Fuel:** See **Jet Fuel, Naphtha-Type**.

**Natural Gas:** A gaseous mixture of hydrocarbon compounds, primarily methane, used as a fuel for electricity generation and in a variety of ways in buildings, and as raw material input and fuel for industrial processes.

**Natural Gas, Dry:** Natural gas which remains after: 1) the liquefiable hydrocarbon portion has been removed from the gas stream (i.e., gas after lease, field, and/or plant separation); and 2) any volumes of nonhydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable. *Note:* Dry natural gas is also known as consumer-grade natural gas. The parameters

for measurement are cubic feet at 60 degrees Fahrenheit and 14.73 pounds per square inch absolute.

**Natural Gas (Dry) Production:** The process of producing consumer-grade natural gas. Natural gas withdrawn from reservoirs is reduced by volumes used at the production (lease) site and by processing losses. Volumes used at the production site include 1) the volume returned to reservoirs in cycling, repressuring of oil reservoirs, and conservation operations; and 2) vented natural gas and flared natural gas. Processing losses include 1) nonhydrocarbon gases (e.g., water vapor, carbon dioxide, helium, hydrogen sulfide, and nitrogen) removed from the gas stream; and 2) gas converted to liquid form, such as lease condensate and natural gas plant liquids. Volumes of dry gas withdrawn from gas storage reservoirs are not considered part of production. Dry natural gas production equals natural gas marketed production less extraction loss.

**Natural Gas, Flared:** Natural gas burned in flares on the base site or at gas processing plants.

**Natural Gas Gross Withdrawals:** Full well stream volume of produced natural gas, excluding lease condensate separated at the lease.

**Natural Gas Liquids (NGL):** A general term for all liquid products separated from natural gas in gas processing or cycling plants. They include natural gas plant liquids and lease condensate.

**Natural Gas Marketed Production:** Natural gas gross withdrawals from production reservoirs, less gas used for reservoir repressuring; nonhydrocarbon gases removed in treating or processing operations; and quantities of vented natural gas and flared natural gas. Includes all quantities of natural gas used in field and processing operations.

**Natural Gas Pipeline:** A continuous pipe conduit, complete with such equipment as valves, compressor stations, communications systems, and meters, for transporting natural gas and/or supplemental gaseous fuels from one point to another, usually from a point in or beyond the producing field or processing plant to another pipeline or to points of utilization. Also refers to a company operating such facilities.

**Natural Gas Plant Liquids (NGPL):** Those hydrocarbons in natural gas that are separated as liquids at downstream gas processing plants, fractionating and cycling plants, and in some instances at field facilities. Lease condensate is excluded. Products obtained include liquefied petroleum gases and pentanes plus.



**Natural Gas, Vented:** Natural gas released into the air on the production site or at processing plants.

**Natural Gas Well:** A well completed for the production of natural gas from one or more natural gas zones or reservoirs. (Wells producing both crude oil and natural gas are classified as crude oil wells.)

**Natural Gas Wellhead Price:** Price of natural gas calculated by dividing the total reported value at the wellhead by the total quantity produced as reported by the appropriate agencies of individual producing States and the U.S. Mineral Management Service. The price includes all costs prior to shipment from the lease, including gathering and compression costs, in addition to State production, severance, and similar charges.

**Natural Gasoline:** A mixture of hydrocarbons (mostly pentanes and heavier) extracted from natural gas that meets vapor pressure, end-point, and other specifications for natural gasoline set by the Gas Processors Association. Includes isopentane, which is a saturated branch-chain hydrocarbon obtained by fractionation of natural gasoline or isomerization of normal pentane.

**NERC:** See North American Electric Reliability Council.

**Net Electricity Generation:** See Electricity Generation, Net.

**Net Summer Capacity:** See Generator Net Summer Capacity.

**Neutral Zone:** A 6,200 square-mile area shared equally between Kuwait and Saudi Arabia under a 1992 agreement.

**Nitrogen Oxides (No<sub>x</sub>):** Compounds of nitrogen and oxygen produced by the burning of fossil fuels.

**Nominal Dollars:** A measure used to express nominal price.

**Nominal Price:** The price paid for a product or service at the time of the transaction. Nominal prices are those that have not been adjusted to remove the effect of changes in the purchasing power of the dollar; they reflect buying power in the year in which the transaction occurred.

**Noncoincident Peak Load:** The sum of two or more peak loads on individual systems that do not occur in the same time interval. Meaningful only in the context of loads within a limited period of time, such as day, week, month, a heating or cooling season, and usually for not more than 1 year.

**Nonhydrocarbon Gases:** Typical nonhydrocarbon gases that may be present in reservoir natural gas, such as carbon dioxide, helium, hydrogen sulfide, and nitrogen.

**Normal Butane:** See Butane.

**North American Electric Reliability Council (NERC):** A council formed in 1968 by the electric utility industry to promote the reliability and adequacy of bulk power supply in the electric utility systems of North America. NERC consists of regional reliability councils and encompasses essentially all the power regions of the contiguous United States, Canada, and Mexico. See the various NERC Regional Reliability Councils at <http://www.eia.doe.gov/neic/pubstyle/nerc.htm>.

**North American Industry Classification System (NAICS):** A coding system developed jointly by the United States, Canada, and Mexico to classify businesses and industries according to the type of economic activity in which they are engaged. NAICS replaces the Standard Industrial Classification (SIC) codes.

**Nuclear Electric Power (Nuclear Power):** Electricity generated by the use of the thermal energy released from the fission of nuclear fuel in a reactor.

**Nuclear Electric Power Plant:** A single-unit or multiunit facility in which heat produced in one or more reactors by the fissioning of nuclear fuel is used to drive one or more steam turbines.

**Nuclear Reactor:** An apparatus in which a nuclear fission chain reaction can be initiated, controlled, and sustained at a specific rate. A reactor includes fuel (fissionable material), moderating material to control the rate of fission, a heavy-walled pressure vessel to house reactor components, shielding to protect personnel, a system to conduct heat away from the reactor, and instrumentation for monitoring and controlling the reactor's systems.

**OECD:** See Organization for Economic Cooperation and Development.

**Offshore:** That geographic area that lies seaward of the coastline. In general, the coastline is the line of ordinary low water along with that portion of the coast that is in direct contact with the open sea or the line marking the seaward limit of inland water. If a State agency uses a different basis for classifying onshore and offshore areas, the State classification is used (e.g., Cook Inlet in Alaska is classified as offshore; for Louisiana, the coastline is defined as the Chapman Line, as modified by subsequent adjudication).

**Oil:** See Crude Oil.

**Operable Nuclear Unit:** In the United States, a nuclear **generating unit** that has completed low-power testing and is in possession of a full-power operating license issued by the Nuclear Regulatory Commission.

**Operable Refineries:** Refineries that were in one of the following three categories at the beginning of a given year: in operation; not in operation and not under active repair, but capable of being placed into operation within 30 days; or not in operation, but under active repair that could be completed within 90 days.

**Operating Income:** Operating revenues less operating expenses. Excludes items of other revenue and expense, such as equity in earnings of unconsolidated affiliates, dividends, interest income and expense, income taxes, extraordinary items, and cumulative effect of accounting changes.

**Organization for Economic Cooperation and Development (OECD):** An international organization helping governments tackle the economic, social and governance challenges of a globalized economy. Its membership comprises about 30 member countries. With active relationships with some 70 other countries, non-governmental organizations (NGOs) and civil society, it has a global reach. For details about the organization, see <http://www.oecd.org>.

**Organization of Petroleum Exporting Countries (OPEC):** Countries that have organized for the purpose of negotiating with oil companies on matters of oil production, prices, and future concession rights. Current members (as of the date of writing this definition) are Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela. See OPEC's site at <http://www.opec.org> for more information.

**Other Hydrocarbons:** Materials received by a refinery and consumed as a raw material. Includes **hydrogen**, coal tar derivatives, gilsonite, and **natural gas** received by the refinery for reforming into hydrogen. Natural gas to be used as fuel is excluded.

**Oxygenated Motor Gasoline:** See **Motor Gasoline, Oxygenated**.

**Oxygenates:** Substances which, when added to **motor gasoline**, increase the amount of oxygen in that gasoline blend. **Ethanol**, **methyl tertiary butyl ether (MTBE)**, **ethyl tertiary butyl ether (ETBE)**, and **methanol** are common oxygenates. See **Motor Gasoline, Oxygenated**.

**Ozone:** A molecule made up of three atoms of oxygen. Occurs naturally in the stratosphere and provides a protective layer shielding the Earth from harmful ultraviolet radiation. In the troposphere, it is a chemical oxidant, a greenhouse gas, and a major component of photochemical smog.

**PAD Districts:** Petroleum Administration for Defense Districts. Geographic aggregations of the 50 States and the District of Columbia into five districts for the Petroleum Administration for Defense in 1950. The districts were originally instituted for economic and geographic reasons as Petroleum Administration for War (PAW) Districts, which were established in 1942.

**Particulate Collectors:** Equipment used to remove fly ash from the combustion gases of a boiler plant before discharge to the atmosphere. Particulate collectors include electrostatic precipitators, mechanical collectors (cyclones, fabric filters [baghouses]), and wet scrubbers.

**Pentanes Plus:** A mixture of **hydrocarbons**, mostly pentanes and heavier, extracted from **natural gas**. Includes **isopentane**, **natural gasoline**, and **plant condensate**.

**Perfluorocarbons (PFCs):** A group of man-made chemicals composed of one or two carbon atoms and four to six fluorine atoms, containing no chlorine. PFCs have no commercial uses and are emitted as a byproduct of aluminum smelting and semiconductor manufacturing. PFCs have very high 100-year **global warming potentials** and are very long-lived in the atmosphere.

**Petrochemical Feedstocks:** Chemical feedstocks derived from **petroleum** principally for the manufacture of chemicals, synthetic rubber, and a variety of plastics.

**Petroleum:** A broadly defined class of liquid **hydrocarbon** mixtures. Included are **crude oil**, **lease condensate**, **unfinished oils**, refined products obtained from the processing of crude oil, and **natural gas plant liquids**. *Note:* Volumes of finished **petroleum products** include nonhydrocarbon compounds, such as additives and detergents, after they have been blended into the products.

**Petroleum Coke:** See **Coke, Petroleum**.

**Petroleum Consumption:** The sum of all refined **petroleum products supplied**. For each refined petroleum product, the amount supplied is calculated by adding production and imports, then subtracting changes in primary stocks (net withdrawals are a plus quantity and net additions are a minus quantity) and exports.

**Petroleum Imports:** Imports of **petroleum** into the 50 States and the District of Columbia from foreign countries and from Puerto Rico, the Virgin Islands, and other U.S. territories and possessions. Included are imports for the **Strategic Petroleum Reserve** and withdrawals from bonded warehouses for onshore consumption, offshore bunker use, and military use. Excluded are receipts of foreign petroleum into bonded warehouses and into U.S. territories and U.S. Foreign Trade Zones.

**Petroleum Pipeline:** Crude oil and product pipelines used to transport **crude oil** and **petroleum products**, respectively (including interstate, intrastate, and intra-company pipelines), within the 50 States and the District of Columbia.

**Petroleum Products:** Petroleum products are obtained from the processing of **crude oil** (including **lease condensate**), **natural gas**, and other **hydrocarbon** compounds. Petroleum products include **unfinished oils**, **liquefied petroleum gases**, **pentanes plus**, **aviation gasoline**, **motor gasoline**, **naphtha-type jet fuel**, **kerosene-type jet fuel**, **kerosene**, **distillate fuel oil**, **residual fuel oil**, **petrochemical feedstocks**, **special naphthas**, **lubricants**, **waxes**, **petroleum coke**, **asphalt**, **road oil**, **still gas**, and **miscellaneous petroleum products**.

**Petroleum Products Supplied:** An approximate measure of consumption. It measures the disappearance of the **petroleum products** from primary sources, i.e., refineries, blending plants, and bulk terminals. In general, products supplied in any given period are computed as follows: field production, plus imports, plus **unaccounted-for crude oil** (plus net receipts when calculated on a PAD District basis) minus stock change, minus crude oil losses, minus refinery inputs, and minus exports. See also **Petroleum Consumption**.

**Petroleum Stocks, Primary:** For individual **petroleum products**, quantities that are held at refineries, in **petroleum pipelines**, and at bulk terminals that have a capacity of 50,000 barrels or more, or that are in transit thereto. Stocks held by product retailers and resellers, as well as tertiary stocks held at the point of consumption, are excluded. Stocks of individual products held at gas processing plants are excluded from individual product estimates but are included in other oil estimates and total.

**Photovoltaic Energy:** Direct-current **electricity** generated from sunlight through solid-state semiconductor devices that have no moving parts.

**Photovoltaic Module:** An integrated assembly of interconnected photovoltaic cells designed to deliver a selected level of working voltage and current at its output terminals, packaged for protection against environmental degradation, and suited for incorporation in photovoltaic power systems.

**Pipeline Fuel:** **Natural gas** consumed in the operation of pipelines, primarily in compressors.

**Plant Condensate:** One of the **natural gas liquids**, mostly pentanes and heavier **hydrocarbons**, recovered and separated as liquids at gas inlet separators or scrubbers in processing plants.

**Primary Consumption:** Includes consumption of **coal**, **natural gas**, **petroleum**, **nuclear electric power**, **hydroelectric power**, **wood**, **waste**, **alcohol** fuels, **geothermal**, **solar**, **wind**, net imports of **coal coke**, and net imports of **electricity**.

**Prime Mover:** The engine, turbine, water wheel, or similar machine that drives an electric **generator**; or, for reporting purposes, a device that converts **energy** to **electricity** directly.

**Process Fuel:** All **energy** consumed in the acquisition, processing, and transportation of energy. Quantifiable process fuel includes three categories: natural gas lease and plant operations, **natural gas pipeline** operations, and oil refinery operations.

**Processing Gain:** The volumetric amount by which total output is greater than input for a given period of time. This difference is due to the processing of **crude oil** into **petroleum products** which, in total, have a lower specific gravity than the crude oil processed.

**Processing Loss:** The volumetric amount by which total refinery output is less than input for a given period of time. This difference is due to the processing of **crude oil** into **petroleum products** which, in total, have a higher specific gravity than the crude oil processed.

**Processing Plant (Natural Gas):** A surface installation designed to separate and recover **natural gas liquids** from a stream of produced **natural gas** through the processes of condensation, absorption, refrigeration, or other methods, and to control the quality of natural gas marketed or returned to oil or gas reservoirs for pressure maintenance, repressuring, or cycling.

**Propane:** A normally gaseous straight-chain **hydrocarbon** ( $C_3H_8$ ). It is a colorless paraffinic gas that boils at a temperature of -43.67 degrees Fahrenheit. It is extracted from **natural gas** or **refinery gas** streams. It includes all products designated in ASTM Specification D1835 and Gas Processors Association Specifications for commercial propane and HD-5 propane.

**Propylene:** An olefinic **hydrocarbon** ( $C_3H_6$ ) recovered from refinery processes or petrochemical processes.

**Proved Reserves, Crude Oil:** The estimated quantities of all liquids defined as **crude oil** that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.

**Proved Reserves, Lease Condensate:** The volumes of **lease condensate** expected to be recovered in future years in conjunction with the production of proved

reserves of **natural gas** based on the recovery efficiency of lease and/or field separation facilities installed.

**Proved Reserves, Natural Gas:** The estimated quantities of **natural gas** that analysis of geological and engineering data demonstrates with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.

**Proved Reserves, Natural Gas Liquids:** Those volumes of **natural gas liquids** (including **lease condensate**) demonstrated with reasonable certainty to be separable in the future from proved **natural gas** reserves, under existing economic and operating conditions.

**Pumped Storage:** See **Hydroelectric Pumped Storage**.

**Real Price:** A price that has been adjusted to remove the effect of changes in the purchasing power of the dollar. Real prices, which are expressed in constant dollars, usually reflect buying power relative to a base year. See **Chained Dollars**.

**Refiner Acquisition Cost of Crude Oil:** See **Crude Oil Refiner Acquisition Cost**.

**Refinery Gas:** See **Still Gas**.

**Refinery Input:** The raw materials and intermediate materials processed at refineries to produce finished **petroleum products**. They include **crude oil**, products of natural gas processing plants, **unfinished oils**, **other hydrocarbons** and **alcohol**, **motor gasoline blending components** and **aviation gasoline blending components**, and finished **petroleum products**.

**Refinery Output:** The total amount of **petroleum products** produced at a refinery. Includes **petroleum** consumed by the refinery.

**Refinery (Petroleum):** An installation that manufactures finished **petroleum products** from **crude oil**, **unfinished oils**, **natural gas liquids**, **other hydrocarbons**, and **alcohol**.

**Reformulated Motor Gasoline:** See **Motor Gasoline, Reformulated**.

**Renewable Energy:** Energy obtained from sources that are essentially inexhaustible (unlike, for example, **fossil fuels**, which are in finite supply). Renewable sources of energy include **conventional hydroelectric power**, **wood**, **waste**, **alcohol** fuels, **geothermal**, **solar**, and **wind**.

**Replacement Fuel:** The portion of any motor fuel that is **methanol**, **ethanol**, or other **alcohols**, **natural gas**, **liquefied petroleum gases**, **hydrogen**, coal-derived

liquid fuels, **electricity** (including electricity from **solar energy**), **ethers**, **biodiesel**, or any other fuel the Secretary of Energy determines, by rule, is substantially not **petroleum** and would yield substantial energy security benefits and substantial environmental benefits.

**Repressuring:** The injection of gas into **crude oil** or **natural gas** formations to effect greater ultimate recovery.

**Residential Sector:** An **energy**-consuming sector that consists of living quarters for private households. Common uses of energy associated with this sector include **space heating**, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances. The residential sector excludes institutional living quarters. *Note:* Various EIA programs differ in sectoral coverage—for further explanation see <http://www.eia.doe.gov/neic/datadefinitions/Guideforwebres.htm>. See **End-Use Sectors** and **Energy-Use Sectors**.

**Residual Fuel Oil:** The heavier oils, known as No. 5 and No. 6 fuel oils, that remain after the **distillate fuel oils** and lighter **hydrocarbons** are distilled away in refinery operations. It conforms to ASTM Specifications D396 and D975 and Federal Specification VV-F-815C. No. 5, a residual fuel oil of medium viscosity, is also known as Navy Special and is defined in Military Specification MIL-F-859E, including Amendment 2 (NATO Symbol F-770). It is used in steam-powered vessels in government service and inshore **electric power plants**. No. 6 fuel oil includes Bunker C fuel oil and is used for **electricity generation**, **space heating**, **vessel bunkering**, and various industrial purposes.

**Road Oil:** Any heavy **petroleum** oil, including residual asphaltic oil, used as a dust palliative and surface treatment on roads and highways. It is generally produced in six grades, from 0, the most liquid, to 5, the most viscous.

**Rotary Rig:** A machine used for drilling wells that employs a rotating tube attached to a bit for boring holes through rock.

**Royalty Interest:** An interest in a mineral property provided through a royalty contract.

**Short Ton (Coal):** A unit of weight equal to 2,000 pounds.

**Solar Energy:** See **Solar Thermal Energy** and **Photovoltaic Energy**.

**Solar Thermal Collector:** A device designed to receive solar radiation and convert it to thermal **energy**. Normally, a solar thermal collector includes a frame, glazing, and an absorber, together with appropriate insulation. The heat collected by the solar thermal collector may be used immediately or stored for later use. Solar

collectors are used for **space heating**, domestic hot water heating, and heating swimming pools, hot tubs, or spas.

**Solar Thermal Energy:** The radiant **energy** of the sun that can be converted into other forms of energy, such as heat or **electricity**.

**Space Heating:** The use of **energy** to generate heat for warmth in housing units using space-heating equipment. The equipment could be the main space-heating equipment or secondary space-heating equipment. It does not include the use of energy to operate appliances (such as lights, televisions, and refrigerators) that give off heat as a byproduct.

**Special Naphthas:** All finished **petroleum products** within the **naphtha** boiling range that are used as paint thinners, cleaners, or solvents. Those products are refined to a specified flash point. Special naphthas include all commercial hexane and cleaning solvents conforming to ASTM Specifications D1836 and D484, respectively. Naphthas to be blended or marketed as **motor gasoline** or **aviation gasoline** or that are to be used as **petrochemical feedstocks** or synthetic natural gas (SNG) feedstocks are excluded.

**Spent Liquor:** The liquid residue left after an industrial process; can be a component of waste materials used as fuel.

**Spot Market Price:** See **Spot Price**.

**Spot Price:** The price for a one-time open market transaction for immediate delivery of the specific quantity of product at a specific location where the commodity is purchased “on the spot” at current market rates.

**Steam-Electric Power Plant:** An **electric power plant** in which the **prime mover** is a steam turbine. The steam used to drive the turbine is produced in a boiler where **fossil fuels** are burned.

**Still Gas (Refinery Gas):** Any form or mixture of gases produced in refineries by distillation, cracking, reforming, and other processes. The principal constituents are **methane**, **ethane**, **ethylene**, **normal butane**, **butylene**, **propane**, **propylene**, etc. Still gas is used as a refinery fuel and a **petrochemical feedstock**. The conversion factor is 6 million **Btu** per fuel oil equivalent **barrel**.

**Stocks:** Inventories of fuel stored for future use. See **Crude Oil Stocks**, **Coal Stocks**, and **Petroleum Stocks, Primary**.

**Strategic Petroleum Reserve (SPR):** **Petroleum** stocks maintained by the Federal Government for use during periods of major supply interruption.

**Subbituminous Coal:** A **coal** with properties ranging from those of **lignite** to those of **bituminous coal** and used primarily as fuel for steam-electric power generation. It may be dull, dark brown to black, soft and crumbly, at the lower end of the range, to bright, jet black, hard, and relatively strong, at the upper end. Subbituminous coal contains 20 to 30 percent inherent moisture by weight. The heat content of subbituminous coal ranges from 17 to 24 million **Btu** per **short ton** on a moist, mineral-matter-free basis. The heat content of subbituminous coal consumed in the United States averages 17 to 18 million **Btu** per short ton, on the as-received basis (i.e., containing both inherent moisture and mineral matter). See **Coal Rank**.

**Sulfur Dioxide (SO<sub>2</sub>):** A toxic, irritating, colorless gas soluble in water, **alcohol**, and **ether**. Used as a chemical intermediate, in paper pulping and ore refining, and as a solvent.

**Sulfur Hexafluoride (SF<sub>6</sub>):** A colorless gas soluble in **alcohol** and **ether**, and slightly less soluble in water. It is used as a dielectric in electronics. It possesses the highest 100-year **global warming potential** of any gas (23,900).

**Supplemental Gaseous Fuels:** Any gaseous substance introduced into or commingled with **natural gas** that increases the volume available for disposition. Such substances include, but are not limited to, propane-air, **refinery gas**, coke-oven gas, manufactured gas, biomass gas, or air or inerts added for **Btu** stabilization.

**Synthetic Coal:** **Coal** that has been processed by a coal synfuel plant; and coal-based fuels such as briquettes, pellets, or extrusions, which are formed by binding materials and processes that recycle material.

**Synthetic Natural Gas (SNG):** (Also referred to as substitute natural gas.) A manufactured product, chemically similar in most respects to **natural gas**, resulting from the conversion or reforming of **petroleum hydrocarbons** that may easily be substituted for or interchanged with pipeline-quality natural gas.

**Thermal Conversion Factor:** See **Conversion Factor**.

**Transportation Sector:** An **energy-consuming** sector that consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another. Included are automobiles; trucks; buses; motorcycles; trains, subways, and other rail vehicles; aircraft; and ships, barges, and other waterborne vehicles. Vehicles whose primary purpose is not transportation (e.g., construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts) are classified in the sector of their primary use. *Note:* Various EIA programs differ in sectoral coverage—for more information see <http://www.eia.doe.gov/neic/datadefinitions/Guideforwebtrans.htm>. See **End-Use Sectors** and **Energy-Use Sectors**.

**Unaccounted-for Crude Oil:** Represents the arithmetic difference between the calculated supply and the calculated disposition of **crude oil**. The calculated supply is the sum of crude oil production plus imports minus changes in crude oil stocks. The calculated disposition of crude oil is the sum of crude oil input to refineries, crude oil exports, crude oil burned as fuel, and crude oil losses.

**Unaccounted-for Natural Gas:** Represents differences between the sum of the components of **natural gas** supply and the sum of components of natural gas disposition. These differences may be due to quantities lost or to the effects of data reporting problems. Reporting problems include differences due to the net result of conversions of flow data metered at varying temperatures and pressure bases and converted to a standard temperature and pressure base; the effect of variations in company accounting and billing practices; differences between billing cycle and calendar-period time frames; and imbalances resulting from the merger of data reporting systems that vary in scope, format, definitions, and type of respondents.

**Underground Natural Gas Storage:** The use of sub-surface facilities for storing **natural gas** that has been transferred from its original location. The facilities are usually hollowed-out salt domes, geological reservoirs (depleted **crude oil** or natural gas fields) or water-bearing sands topped by an impermeable cap rock (aquifer).

**Undiscovered Recoverable Reserves (Crude Oil and Natural Gas):** Those economic resources of **crude oil** and **natural gas**, yet undiscovered, that are estimated to exist in favorable geologic settings.

**Unfinished Oils:** All oils requiring further processing, except those requiring only mechanical blending. Unfinished oils are produced by partial refining of **crude oil** and include **naphthas** and lighter oils, **kerosene** and light gas oils, heavy gas oils, and residuum.

**Unfractionated Stream:** Mixtures of unsegregated **natural gas liquid** components, excluding those in **plant condensate**. This product is extracted from **natural gas**.

**United States:** The 50 States and the District of Columbia. *Note:* The United States has varying degrees of jurisdiction over a number of territories and other political entities outside the 50 States and the District of Columbia, including Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, Johnston Atoll, Midway Islands, Wake Island, and the Northern Mariana Islands. EIA data programs may include data from some or all of these areas in U.S. Totals. For these programs, data products will contain notes explaining the extent of geographic coverage included under the term "United States."

**Uranium:** A heavy, naturally radioactive, metallic element (atomic number 92). Its two principally occurring isotopes are uranium-235 and uranium-238. Uranium-235

is indispensable to the nuclear industry because it is the only isotope existing in nature, to any appreciable extent, that is fissionable by thermal neutrons. Uranium-238 is also important because it absorbs neutrons to produce a radioactive isotope that subsequently decays to the isotope plutonium-239, which also is fissionable by thermal neutrons.

**Uranium Concentrate:** A yellow or brown powder obtained by the milling of **uranium ore**, processing of in situ leach mining solutions, or as a byproduct of phosphoric acid production. See **Uranium Oxide**.

**Uranium Ore:** Rock containing **uranium** mineralization in concentrations that can be mined economically, typically one to four pounds of  $U_3O_8$  per ton or 0.05 percent to 0.2 percent  $U_3O_8$ . See **Uranium Oxide**.

**Uranium Oxide:** **Uranium concentrate** or **yellowcake**. Abbreviated as  $U_3O_8$ .

**Uranium Resource Categories:** Three categories of **uranium** resources defined by the international community to reflect differing levels of confidence in the existence of the resources. Reasonably assured resources (RAR), estimated additional resources (EAR), and speculative resources (SR) are described below.

*Reasonably assured resources (RAR):* **Uranium** that occurs in known mineral deposits of such size, grade, and configuration that it could be recovered within the given production cost ranges, with currently proven mining and processing technology. Estimates of tonnage and grade are based on specific sample data and measurements of the deposits and on knowledge of deposit characteristics. *Note:* RAR corresponds to DOE's uranium reserves category.

*Estimated additional resources (EAR):* **Uranium** in addition to RAR that is expected to occur, mostly on the basis of geological evidence, in extensions of well-explored deposits, in little-explored deposits, and in undiscovered deposits believed to exist along well-defined geological trends with known deposits. This uranium can subsequently be recovered within the given cost ranges. Estimates of tonnage and grade are based on available sampling data and on knowledge of the deposit characteristics, as determined in the best-known parts of the deposit or in similar deposits. *Note:* EAR corresponds to DOE's probable potential resources category.

*Speculative resources (SR):* **Uranium** in addition to EAR that is thought to exist, mostly on the basis of indirect evidence and geological extrapolations, in deposits discoverable with existing exploration techniques. The location of deposits in this category can generally be specified only as being somewhere within given regions or geological trends. The estimates in this category are less reliable than estimates of RAR and EAR. *Note:*

SR corresponds to the combination of DOE's possible potential resources and speculative potential resources categories.

**Useful Thermal Output:** The thermal **energy** made available in a **combined-heat-and-power** system for use in any industrial or commercial process, heating or cooling application, or delivered to other end users, i.e., total thermal energy made available for processes and applications other than **electricity generation**.

**U.S.S.R.:** The Union of Soviet Socialist Republics consisted of 15 constituent republics: Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. As a political entity, the U.S.S.R. ceased to exist as of December 31, 1991.

**Vented Natural Gas:** See **Natural Gas, Vented**.

**Vessel Bunkering:** Includes sales for the fueling of commercial or private boats, such as pleasure craft, fishing boats, tugboats, and ocean-going vessels, including vessels operated by oil companies. Excluded are volumes sold to the U.S. Armed Forces.

**Waste Coal:** Usable **coal** material that is a byproduct of previous processing operations or is recaptured from what would otherwise be refuse. Examples include **anthracite culm**, bituminous gob, fine coal, lignite waste, coal recovered from a refuse bank or slurry dam, and coal recovered by dredging.

**Waste Energy:** Municipal solid waste, landfill gas, **methane**, digester gas, liquid acetonitrile waste, tall oil, waste alcohol, medical waste, paper pellets, sludge waste, solid byproducts, tires, agricultural byproducts, closed loop biomass, fish oil, and straw used as fuel.

**Watt (W):** The unit of electrical power equal to one ampere under a pressure of one volt. A watt is equal to 1/746 horsepower.

**Watthour (Wh):** The **electric energy** unit of measure equal to one **watt** of power supplied to, or taken from, an electric circuit steadily for one hour.

**Waxes:** Solid or semi-solid materials derived from **petroleum** distillates or residues by such treatments as chilling, precipitating with a solvent, or de-oiling. It is a light-colored, more-or-less translucent crystalline mass, slightly greasy to the touch, consisting of a mixture of solid hydrocarbons in which the paraffin series predominates. Includes all marketable wax, whether crude scale or fully refined. The three grades included are microcrystalline, crystalline-fully refined, and crystalline-other. The conversion factor is 280 pounds per 42 U.S. gallons per barrel.

**Well:** A hole drilled in the Earth for the purpose of (1) finding or producing **crude oil** or **natural gas**; or (2) producing services related to the production of crude oil or natural gas. See **Completion (Crude Oil/Natural Gas Production)**, **Crude Oil Well**, **Development Well**, **Dry Hole**, **Exploratory Well**, and **Natural Gas Well**.

**Wellhead:** The point at which the **crude oil** (and/or **natural gas**) exits the ground. Following historical precedent, the volume and price for crude oil production are labeled as "wellhead," even though the cost and volume are now generally measured at the lease boundary. In the context of domestic crude price data, the term "wellhead" is the generic term used to reference the production site or lease property.

**Wellhead Price:** The value of **crude oil** or **natural gas** at the mouth of the well. See **Natural Gas Wellhead Price**.

**Well Servicing Unit:** Truck-mounted equipment generally used for downhole services after a **well** is drilled. Services include well completions and recompletions, maintenance, repairs, workovers, and well plugging and abandonments. Jobs range from minor operations, such as pulling the rods and rod pumps out of a **crude oil well**, to major workovers, such as milling out and repairing collapsed casing. Well depth and characteristics determine the type of equipment used.

**Western Europe:** Includes Austria, Belgium, Bosnia and Herzegovina, Croatia, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Macedonia (The Former Yugoslav Republic of), Malta, Netherlands, Norway, Portugal, Serbia and Montenegro, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

**Wind Energy:** **Energy** present in wind motion that can be converted to mechanical energy for driving pumps, mills, and electric power **generators**. Wind pushes against sails, vanes, or blades radiating from a central rotating shaft.

**Wood Energy:** Wood and wood products used as fuel, including round wood (cord wood), limb wood, wood chips, bark, sawdust, forest residues, charcoal, pulp waste, and spent pulping liquor.

**Working Gas:** The volume of gas in the reservoir that is in addition to the cushion or **base gas**. It may or may not be completely withdrawn during any particular withdrawal season. Conditions permitting, the total working capacity could be used more than once during any season.

**Yellowcake:** A natural **uranium concentrate** that takes its name from its color and texture. Yellowcake typically contains 70 to 90 percent U<sub>3</sub>O<sub>8</sub> (**uranium oxide**) by weight. It is used as feedstock for **uranium** fuel enrichment and fuel pellet fabrication.