ANNEX 4 IPCC Reference Approach for Estimating CO_2 Emissions from Fossil Fuel Combustion

It is possible to estimate carbon dioxide (CO_2) emissions from fossil fuel consumption using alternative methodologies and different data sources than those described in Annex 2.1. For example, the UNFCCC reporting guidelines request that countries, in addition to their "bottom-up" sectoral methodology, complete a "top-down" Reference Approach for estimating CO_2 emissions from fossil fuel combustion. Section 1.3 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reporting Instructions* states, "If a detailed, Sectoral Approach for energy has been used for the estimation of CO_2 from fuel combustion you are still asked to complete…the Reference Approach…for verification purposes" (IPCC/UNEP/OECD/IEA 1997). This reference method estimates fossil fuel consumption by adjusting national aggregate fuel production data for imports, exports, and stock changes rather than relying on end-user consumption surveys. The basic principle is that once carbon-based fuels are brought into a national economy, they are either saved in some way (e.g., stored in products, kept in fuel stocks, or left unoxidized in ash) or combusted, and therefore the carbon in them is oxidized and released into the atmosphere. Accounting for actual consumption of fuels at the sectoral or sub-national level is not required. The following discussion provides the detailed calculations for estimating CO_2 emissions from fossil fuel combustion from the United States using the IPCC-recommended Reference Approach.

Step 1: Collect and Assemble Data in Proper Format

To ensure the comparability of national inventories, the IPCC has recommended that countries report energy data using the International Energy Agency (IEA) reporting convention. National energy statistics were collected in physical units from several EIA documents in order to obtain the necessary data on production, imports, exports, and stock changes.

It was necessary to make a number of modifications to these data to generate more accurate apparent consumption estimates of these fuels. The first modification adjusts for consumption of fossil fuel feedstocks accounted for in the Industrial Processes chapter, which include unspecified coal for coal coke used in iron and steel production, natural gas used for ammonia production, and petroleum coke used in the production of aluminum, ferroalloys, and titanium dioxide. The second modification adjusts for consumption of bunker fuels, which refer to quantities of fuels used for international transportation estimated separately from U.S. totals. The third modification consists of the addition of U.S. territories data that are typically excluded from the national aggregate energy statistics. The territories include Puerto Rico, U.S. Virgin Islands, Guam, American Samoa, Wake Island, and U.S. Pacific Islands. These data, as well as the production, import, export, and stock change statistics, are presented in Table 4-1.

The carbon content of fuel varies with the fuel's heat content. Therefore, for an accurate estimation of CO_2 emissions, fuel statistics were provided on an energy content basis (e.g., BTUs or joules). Because detailed fuel production statistics are typically provided in physical units (as in Table 4-1), they were converted to units of energy before CO_2 emissions were calculated. Fuel statistics were converted to their energy equivalents by using conversion factors provided by EIA. These factors and their data sources are displayed in Table 4-2. The resulting fuel type-specific energy data are provided in Table 4-3.

Step 2: Estimate Apparent Fuel Consumption

The next step of the IPCC Reference Approach is to estimate "apparent consumption" of fuels within the country. This requires a balance of primary fuels produced, plus imports, minus exports, and adjusting for stock changes. In this way, carbon enters an economy through energy production and imports (and decreases in fuel stocks) and is transferred out of the country through exports (and increases in fuel stocks). Thus, apparent

consumption of primary fuels (including crude oil, natural gas liquids, anthracite, bituminous, subbituminous and lignite coal, and natural gas) can be calculated as follows:

Apparent Consumption = Production + Imports - Exports - Stock Change

Flows of secondary fuels (e.g., gasoline, residual fuel, coke) should be added to primary apparent consumption. The production of secondary fuels, however, should be ignored in the calculations of apparent consumption since the carbon contained in these fuels is already accounted for in the supply of primary fuels from which they were derived (e.g., the estimate for apparent consumption of crude oil already contains the carbon from which gasoline would be refined). Flows of secondary fuels should therefore be calculated as follows:

Secondary Consumption = Imports - Exports - Stock Change

Note that this calculation can result in negative numbers for apparent consumption of secondary fuels. This result is perfectly acceptable since it merely indicates a net export or stock increase in the country of that fuel when domestic production is not considered.

Next, the apparent consumption and secondary consumption need to be adjusted for feedstock uses of fuels accounted for in the Industrial Processes chapter, international bunker fuels, and U.S. territory fuel consumption. Bunker fuels and feedstocks accounted for in the Industrial Processes chapter are subtracted from these estimates, while fuel consumption in U.S. territories is added.

The IPCC Reference Approach calls for estimating apparent fuel consumption before converting to a common energy unit. However, certain primary fuels in the United States (e.g., natural gas and steam coal) have separate conversion factors for production, imports, exports, and stock changes. In these cases, it is not appropriate to multiply apparent consumption by a single conversion factor since each of its components have different heat contents. Therefore, United States fuel statistics were converted to their heat equivalents before estimating apparent consumption. Results are provided in Table 4-2.

Step 3: Estimate Carbon Emissions

Once apparent consumption is estimated, the remaining calculations are virtually identical to those for the "bottom-up" Sectoral Approach (see Annex 2.1). That is:

- Potential CO_2 emissions were estimated using fuel-specific carbon coefficients (see Table 4-3).[1]
- The carbon in products from non-energy uses of fossil fuels (e.g., plastics or asphalt) was then estimated and subtracted (see Table 4-4).
- Finally, to obtain actual CO_2 emissions, net emissions were adjusted for any carbon that remained unoxidized as a result of incomplete combustion (e.g., carbon contained in ash or soot).[2]

Step 4: Convert to CO_2 Emissions

Because the IPCC reporting guidelines recommend that countries report greenhouse gas emissions on a full molecular weight basis, the final step in estimating CO_2 emissions from fossil fuel consumption was converting from units of carbon to units of CO_2. Actual carbon emissions were multiplied by the molecular-to-atomic weight ratio of CO_2 to carbon (44/12) to obtain total carbon dioxide emitted from fossil fuel combustion in teragrams (Tg). The results are contained in Table 4-5.

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[1] Carbon coefficients from EIA were used wherever possible. Because EIA did not provide coefficients for coal, the IPCC-recommended emission factors were used in the top-down calculations for these fuels. See notes in Table 4-4 for more specific source information.

[2] For the portion of carbon that is unoxidized during coal combustion, the IPCC suggests a global average value of 2 percent. However, because combustion technologies in the United States are more efficient, the United States inventory uses 1 percent in its calculations for petroleum and coal and 0.5 percent for natural gas.

Comparison Between Sectoral and Reference Approaches

These two alternative approaches can both produce reliable estimates that are comparable within a few percent. The major difference between methodologies employed by each approach lies in the energy data used to derive carbon emissions (i.e., the actual surveyed consumption for the Sectoral Approach versus apparent consumption derived for the Reference Approach). In theory, both approaches should yield identical results. In practice, however, slight discrepancies occur. For the United States, these differences are discussed below.

Differences in Total Amount of Energy Consumed

Table 4-7 summarizes the differences between the Reference and Sectoral approaches in estimating total energy consumption in the United States. Although theoretically the two methods should arrive at the same estimate for U.S. energy consumption, the Reference Approach provides an energy total that is 0.3 percent higher than the Sectoral Approach for 2002. The greatest difference lies in the higher estimate of petroleum consumption with the Reference Approach (2.2 percent).

There are several potential sources for the discrepancies in consumption estimates:

- *Product Definitions.* The fuel categories in the Reference Approach are different from those used in the Sectoral Approach, particularly for petroleum. For example, the Reference Approach estimates apparent consumption for crude oil. Crude oil is not typically consumed directly, but refined into other products. As a result, the United States does not focus on estimating the energy content of the various grades of crude oil, but rather estimating the energy content of the various products resulting from crude oil refining. The United States does not believe that estimating apparent consumption for crude oil, and the resulting energy content of the crude oil, is the most reliable method for the United States to estimate its energy consumption. Other differences in product definitions include using sector-specific coal statistics in the Sectoral Approach (i.e., residential, commercial, industrial coking, industrial other, and transportation coal), while the Reference Approach characterizes coal by rank (i.e. anthracite, bituminous, etc.). Also, the liquefied petroleum gas (LPG) statistics used in the bottom-up calculations are actually a composite category composed of natural gas liquids (NGL) and LPG.
- *Heat Equivalents.* It can be difficult to obtain heat equivalents for certain fuel types, particularly for categories such as "crude oil" where the key statistics are derived from thousands of producers in the United States and abroad. For heat equivalents by coal rank, it was necessary to refer back to EIA's *State Energy Data Report 1992* (1994) because this information is no longer published.
- *Possible inconsistencies in U.S. Energy Data.* The United States has not focused its energy data collection efforts on obtaining the type of aggregated information used in the Reference Approach. Rather, the United States believes that its emphasis on collection of detailed energy consumption data is a more accurate methodology for the United States to obtain reliable energy data. Therefore, top-down statistics used in the Reference Approach may not be as accurately collected as bottom-up statistics applied to the Sectoral Approach.
- *Balancing Item.* The Reference Approach uses *apparent* consumption estimates while the Sectoral Approach uses *reported* consumption estimates. While these numbers should be equal, there always seems to be a slight difference that is often accounted for in energy statistics as a "balancing item."

Differences in Estimated CO_2 Emissions

Given these differences in energy consumption data, the next step for each methodology involved estimating emissions of CO_2. Table 4-8 summarizes the differences between the two methods in estimated carbon emissions.

As mentioned above, for 2002, the Reference Approach resulted in a 0.3 percent higher estimate of energy consumption in the United States than the Sectoral Approach. The resulting emissions estimate for the Reference Approach was 0.9 percent higher. Estimates of coal and natural gas emissions using each approach yield very similar values (within 0.5 percent), though petroleum emission estimates from the Reference Approach are slightly higher (2.4 percent) than the Sectoral Approach. Potential reasons for these differences may include:

- *Product Definitions.* Coal data is aggregated differently in each methodology, as noted above. The format used for the Sectoral Approach likely results in more accurate estimates than in the Reference Approach. Also, the Reference Approach relies on a "crude oil" category for determining petroleum-related emissions. Given the many sources of crude oil in the United States, it is not an easy matter to track potential differences in carbon content between many different sources of crude, particularly since information on the carbon content of crude oil is not regularly collected.
- *Carbon Coefficients.* The Reference Approach relies on several default carbon coefficients by rank provided by IPCC (IPCC/UNEP/OECD/IEA 1997), while the Sectoral Approach uses annually updated category-specific coefficients by sector that are likely to be more accurate. Also, as noted above, the carbon coefficient for crude oil is more uncertain than that for specific secondary petroleum products, given the many sources and grades of crude oil consumed in the United States.

Although the two approaches produce similar results, the United States believes that the "bottom-up" Sectoral Approach provides a more accurate assessment of CO_2 emissions at the fuel level. This improvement in accuracy is largely a result of the data collection techniques used in the United States, where there has been more emphasis on obtaining the detailed products-based information used in the Sectoral Approach than obtaining the aggregated energy flow data used in the Reference Approach. The United States believes that it is valuable to understand both methods.

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Table 4-1: 2002 U.S. Energy Statistics (Physical Units)

Fuel Category (Units)	Fuel Type	Production	Imports	Exports	Stock Change	Adjustment	Bunkers	U.S. Territories
Solid Fuels (Thousand Short Tons)	Anthracite Coal	1,311	a	a	a			
	Bituminous Coal	565,690	a	a	a			
	Sub-bituminous Coal	444,717	a	a	a			
	Lignite	82,088	a	a	a			
	Coke		3,096	594	(375)			
	Unspecified Coal		16,875	39,601	(963)	22,441		441
Gas Fuels (Million Cubic Feet)	Natural Gas	18,516,746	4,007,516	516,233	(447,391)	271,675		22,485
Liquid Fuels (Thousand Barrels)	Crude Oil	2,097,124	3,336,175	3,296	14,484			
	Nat Gas Liquids and LRGs	686,288	72,487	24,444	(14,987)			2,147
	Other Liquids	45,832	285,726	23,964	(14,119)			
	Motor Gasoline	106,576	181,894	45,315	443			35,493
	Aviation Gasoline		231	0	(98)			
	Kerosene		1,883	6,763	75			415
	Jet Fuel		39,225	5,600	(2,774)		148,468	
	Distillate Fuel		97,603	40,976	(10,428)		12,057	12,543
	Residual Fuel		90,896	64,698	(9,714)		46,112	20,722
	Naphtha for petrochemical feedstocks		22,998	0	(4)			
	Petroleum Coke		6,847	123,126	38	5,436		
	Other Oil for petrochemical feedstocks		53,416	0	(179)			
	Special Naphthas		6,045	5,314	32			
	Lubricants		2,165	12,134	(1,742)			388
	Waxes		1,017	1,245	284			
	Asphalt/Road Oil		9,891	2,115	639			
	Still Gas		0	0	0			
	Misc. Products		39	85	(389)			25,169

[a] Included in Unspecified Coal

Data Sources: Solid and Gas Fuels – EIA (2003); Liquid Fuels - EIA (1995-2003).

Table 4-2: Conversion Factors to Energy Units (Heat Equivalents)

Fuel Category (Units)	Fuel Type	Production	Imports	Exports	Stock Change	Adjustment	Bunkers	U.S. Territories
Solid Fuels (Million Btu/Short Ton)	Anthracite Coal	22.57						
	Bituminous Coal	23.89						
	Sub-bituminous Coal	17.14						
	Lignite	12.87						
	Coke		24.80	24.80	24.80			
	Unspecified		25.00	26.12	21.07	27.43		25.14
Natural Gas (BTU/Cubic Foot)		1,027	1,023	1,010	1,027	1,027		
Liquid Fuels (Million Btu/Barrel)	Crude Oil	5.80	5.98	5.80	5.80		5.80	5.80
	Nat Gas Liquids and LRGs	3.73	3.73	3.73	3.73		3.73	3.73
	Other Liquids	5.83	5.83	5.83	5.83		5.83	5.83
	Motor Gasoline	5.25	5.25	5.25	5.25		5.25	5.25
	Aviation Gasoline		5.05	5.05	5.05		5.05	5.05
	Kerosene		5.67	5.67	5.67		5.67	5.67
	Jet Fuel		5.67	5.67	5.67		5.67	5.67
	Distillate Fuel		5.83	5.83	5.83		5.83	5.83
	Residual Oil		6.29	6.29	6.29		6.29	6.29
	Naphtha for petrochemical feedstocks		5.25	5.25	5.25		5.25	5.25
	Petroleum Coke		6.02	6.02	6.02	6.02	6.02	6.02
	Other Oil for petrochemical feedstocks		5.83	5.83	5.83		5.83	5.83
	Special Naphthas		5.25	5.25	5.25		5.25	5.25
	Lubricants		6.07	6.07	6.07		6.07	6.07
	Waxes		5.54	5.54	5.54		5.54	5.54
	Asphalt/Road Oil		6.64	6.64	6.64		6.64	6.64
	Still Gas		6.00	6.00	6.00		6.00	6.00
	Misc. Products		5.80	5.80	5.80		5.80	5.80

Data Sources: Coal and lignite production – EIA (1994); Unspecified Solid Fuels - EIA (2003b); Coke, Natural Gas and Petroleum Products – EIA (2003a).

Table 4-3: 2002 Apparent Consumption of Fossil Fuels (TBtu)

Fuel Category	Fuel Type	Production	Imports	Exports	Stock Change	Adjustment	Bunkers	U.S. Territories	Apparent Consumption
Solid Fuels	Anthracite Coal	29.6							29.6
	Bituminous Coal	13,514.3							13,514.3
	Sub-bituminous Coal	7,622.4							7,622.4
	Lignite	1,056.1							1,056.1
	Coke		76.8	14.7	(9.3)				71.3
	Unspecified		421.9	1,034.3	(20.3)	615.5		11.1	(1,196.5)
Gas Fuels	Natural Gas	19,016.7	4,099.7	521.4	(459.5)	279.0			22,775.5
Liquid Fuels	Crude Oil	12,163.3	19,937.0	19.1	84.0				31,997.2
	Nat Gas Liquids and LRGs	2,559.9	270.4	91.2	(55.9)			8.0	2,803.0
	Other Liquids	267.0	1,664.4	139.6	(82.2)				1,874.0
	Motor Gasoline	559.8	955.5	238.0	2.3			186.4	1,461.4
	Aviation Gasoline		1.2	0.0	(0.5)				1.7
	Kerosene		10.7	38.3	0.4			2.4	(25.7)
	Jet Fuel		222.4	31.8	(15.7)		841.8		(635.4)
	Distillate Fuel		568.5	238.7	(60.7)		70.2	73.1	393.4
	Residual Oil		571.5	406.8	(61.1)		289.9	130.3	66.2
	Naphtha for petrochemical feedstocks		120.7	0.0	(0.0)				120.7
	Petroleum Coke		41.2	741.7	0.2	69.3			(770.0)
	Other Oil for petrochemical feedstocks		311.1	0.0	(1.0)				312.2
	Special Naphthas		31.7	27.9	0.2				3.7
	Lubricants		13.1	73.6	(10.6)			2.4	(47.5)
	Waxes		5.6	6.9	1.6				(2.8)
	Asphalt/Road Oil		65.6	14.0	4.2				47.4
	Still Gas		0.0	0.0	0.0				0.0
	Misc. Products		0.2	0.5	(2.3)			145.9	147.9
Total		56,789.2	29,389.2	3,638.5	(686.2)	963.8	1,202.0	559.5	81,619.9

Note: Totals may not sum due to independent rounding.

Table 4-4: 2002 Potential Carbon Dioxide Emissions

Fuel Category	Fuel Type	Apparent Consumption (QBtu)	Carbon Coefficients (Tg Carbon/QBtu)	Potential Emissions (Tg CO_2 Eq.)
Solid Fuels	Anthracite Coal	0.030	26.86	2.9
	Bituminous Coal	13.514	25.86	1,281.4
	Sub-bituminous Coal	7.622	26.26	733.9
	Lignite	1.056	27.66	107.1
	Coke	0.071	25.56	6.7
	Unspecified	(1.196)	25.34	(111.1)
Gas Fuels	Natural Gas	22.775	14.47	1,208.4
Liquid Fuels	Crude Oil	31.997	20.23	2,373.4
	Nat Gas Liquids and LRGs	2.803	16.99	174.6
	Other Liquids	1.874	20.23	139.0
	Motor Gasoline	1.461	19.34	103.6
	Aviation Gasoline	0.002	18.87	0.1
	Kerosene	(0.026)	19.72	(1.9)
	Jet Fuel	(0.635)	19.33	(45.0)
	Distillate Fuel	0.393	19.95	28.8
	Residual Oil	0.066	21.49	5.2
	Naphtha for petrochemical feedstocks	0.121	18.14	8.0
	Petroleum Coke	(0.770)	27.85	(78.6)
	Other Oil for petrochemical feedstocks	0.312	19.95	22.8
	Special Naphthas	0.004	19.86	0.3
	Lubricants	(0.048)	20.24	(3.5)
	Waxes	(0.003)	19.81	(0.2)
	Asphalt/Road Oil	0.047	20.62	3.6
	Still Gas	0.000	17.51	0.0
	Misc. Products	0.148	20.23	11.0
Total				5,970.5

Data Sources: Coal and Lignite – IPCC (1997); Unspecified Solid Fuels, Natural Gas and Liquid Fuels - EIA (2003a).
Note: Totals may not sum due to independent rounding.

Table 4-5: 2002 Non-Energy Carbon Stored in Products

Fuel Type	Consumption for Non-Energy Use (TBtu)	Carbon Coefficients (Tg Carbon/QBtu)	Carbon Content (Tg Carbon)	Exported Product (Tg Carbon)	Adjusted Carbon Content (Tg Carbon)	Fraction Sequestered	Carbon Stored (Tg CO_2 Eq.)
Coal	0.3	25.56	0.0		0.0	0.75	0.0
Natural Gas	339.2	14.47	4.9	0.3	4.6	0.67	11.5
Asphalt & Road Oil	1,240.0	20.62	25.6		25.6	1.00	93.7
LPG	1,690.6	16.81	28.4	1.3	27.1	0.67	66.8
Lubricants	336.7	20.24	6.8		6.8	0.09	2.3
Pentanes Plus	171.4	18.24	3.1	0.1	3.0	0.67	7.4
Petrochemical Feedstocks	a	a	a		a	a	55.1
Petroleum Coke	156.6	27.85	4.4		4.4	0.50	8.0
Special Naphtha	100.1	19.86	2.0		2.0	0.00	0.0
Waxes/Misc.	a	a	a		a	a	14.7
Misc. U.S. Territories Petroleum	a	a	a		a	a	1.1
Total							260.6

[a] Values for Misc. U.S. Territories Petroleum, Petrochemical Feedstocks and Waxes/Misc. are not shown because these categories are aggregates of numerous smaller components.
Note: Totals may not sum due to independent rounding.

Table 4-6: 2002 Reference Approach CO_2 Emissions from Fossil Fuel Consumption (Tg CO_2 Eq. unless otherwise noted)

Fuel Category	Potential Emissions	Carbon Sequestered	Net Emissions	Fraction Oxidized	Total Emissions
Coal	2,020.9	0.0	2,020.9	99.0%	2,000.7
Petroleum	2,741.2	249.1	2,492.1	99.0%	2,467.2
Natural Gas	1,208.4	11.5	1,196.9	99.5%	1,191.0
Total	5,970.5	260.6	5,709.9	-	5,658.8

Note: Totals may not sum due to independent rounding.

Table 4-7: Energy Consumption in the United States by Estimating Approach (TBtu)*

Approach	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sectoral	66,547.4	66,273.5	67,702.7	69,025.3	70,128.1	71,099.4	73,588.0	74,435.3	74,618.7	75,585.7	78,234.0	76,800.4	77,319.8
Coal	18,035.2	18,001.4	18,183.7	18,928.2	19,021.8	19,188.0	20,122.7	20,614.2	20,799.1	20,818.8	21,765.3	21,075.4	21,471.1
Natural Gas	19,057.7	19,475.3	20,191.7	20,700.0	21,101.1	22,068.0	22,468.6	22,576.0	22,113.4	22,264.9	23,245.3	22,281.0	22,526.5
Petroleum	29,454.4	28,796.9	29,327.3	29,397.2	30,005.1	29,843.5	30,996.7	31,245.1	31,706.2	32,502.0	33,223.4	33,444.0	33,322.2
Reference (Apparent)	66,656.4	65,182.2	66,685.5	68,321.9	69,702.1	70,488.1	72,890.5	74,366.5	74,193.0	75,173.8	77,761.5	77,231.6	77,585.1
Coal	18,387.5	17,480.5	17,792.7	18,310.6	18,763.1	18,571.4	19,539.0	20,253.1	20,090.2	20,207.6	20,938.5	21,056.3	21,097.1
Natural Gas	19,459.0	19,485.6	20,196.9	20,710.1	21,110.6	22,081.0	22,482.1	22,592.6	22,107.8	22,278.5	23,252.9	22,270.2	22,436.3
Petroleum	28,809.9	28,216.1	28,695.9	29,301.2	29,828.4	29,835.6	30,869.5	31,520.9	31,995.0	32,687.6	33,570.2	33,905.1	34,051.7
Difference	0.2%	-1.6%	-1.5%	-1.0%	-0.6%	-0.9%	-0.9%	-0.1%	-0.6%	-0.5%	-0.6%	0.6%	0.3%
Coal	2.0%	-2.9%	-2.2%	-3.3%	-1.4%	-3.2%	-2.9%	-1.8%	-3.4%	-2.9%	-3.8%	-0.1%	-1.7%
Natural Gas	2.1%	0.1%	+	+	+	0.1%	0.1%	0.1%	+	0.1%	+	+	-0.4%
Petroleum	-2.2%	-2.0%	-2.2%	-0.3%	-0.6%	+	-0.4%	0.9%	0.9%	0.6%	1.0%	1.4%	2.2%

* Includes U.S. territories

+ Does not exceed 0.05%

Note: Totals may not sum due to independent rounding.

Table 4-8: CO_2 Emissions from Fossil Fuel Combustion by Estimating Approach (Tg CO_2 Eq.)

Approach	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sectoral	4,814.3	4,783.6	4,883.8	4,997.9	5,076.0	5,119.8	5,309.7	5,383.6	5,412.0	5,488.4	5,673.2	5,558.4	5,610.6
Coal	1,681.4	1,679.1	1,696.6	1,766.7	1,776.6	1,793.8	1,880.7	1,927.8	1,945.0	1,946.6	2,034.9	1,968.7	2,005.6
Natural Gas	1,014.8	1,036.7	1,072.8	1,099.9	1,122.6	1,172.9	1,193.9	1,200.6	1,177.3	1,183.4	1,235.3	1,182.9	1,195.7
Petroleum	2,118.0	2,067.9	2,114.4	2,131.3	2,176.9	2,153.2	2,235.1	2,255.2	2,289.7	2,358.4	2,403.0	2,406.9	2,409.4
Reference (Apparent)	4,880.6	4,747.7	4,855.0	4,975.0	5,076.1	5,110.8	5,300.3	5,417.2	5,419.0	5,490.7	5,661.6	5,644.2	5,658.8
Coal	1,746.9	1,657.8	1,687.1	1,735.1	1,778.8	1,761.3	1,852.3	1,919.2	1,906.4	1,919.5	1,985.6	1,998.6	2,000.7
Natural Gas	1,036.0	1,037.3	1,073.1	1,100.5	1,123.1	1,173.6	1,194.6	1,201.5	1,177.0	1,184.2	1,235.7	1,182.3	1,191.0
Petroleum	2,097.7	2,052.7	2,094.8	2,139.4	2,174.2	2,175.9	2,253.4	2,296.5	2,335.6	2,387.1	2,440.3	2,463.3	2,467.2
Difference	1.4%	-0.8%	-0.6%	-0.5%	+	-0.2%	-0.2%	0.6%	0.1%	+	-0.2%	1.5%	0.9%
Coal	3.9%	-1.3%	-0.6%	-1.8%	0.1%	-1.8%	-1.5%	-0.4%	-2.0%	-1.4%	-2.4%	1.5%	-0.2%
Natural Gas	2.1%	0.1%	+	+	+	0.1%	0.1%	0.1%	+	0.1%	+	+	-0.4%
Petroleum	-1.0%	-0.7%	-0.9%	0.4%	-0.1%	1.1%	0.8%	1.8%	2.0%	1.2%	1.6%	2.3%	2.4%

+ Does not exceed 0.05%

Note: Totals may not sum due to independent rounding. Includes U.S. territories.