

Energy Consumption by Sector

Most of the data in this section of the *Monthly Energy Review (MER)* is developed from a group of energy-related surveys, typically called "supply surveys," conducted by the Energy Information Administration (EIA). Supply surveys are directed to suppliers and marketers of specific energy sources. They measure the quantities of specific energy sources produced, or the quantities supplied to the market, or both. The data obtained from EIA's supply surveys are integrated to yield the summary consumption statistics published in this section (and in Section 1) of the *MER*.

Users of EIA's energy consumption statistics should be aware of a second group of energy-related surveys, typically called "consumption surveys." Consumption surveys gather information on the types of energy consumed by end users of energy, along with the characteristics of those end users that can be associated with energy use. For example, the Manufacturing Energy Consumption Survey belongs to the consumption survey group because it collects information directly from end users (the manufacturing establishments). There are important differences between the supply and consumption surveys that need to be taken into account in any analysis that uses both data sources. For information on those differences, see *Energy Consumption by End-Use Sector, A Comparison of Measures by Consumption and Supply Surveys*, DOE/EIA-0533, Energy Information Administration, Washington, DC, April 6, 1990.

Note 1. Energy Consumption:

Primary Consumption: Consumption in the five energy-use sectors (residential, commercial, industrial, transportation, and electric power) consists of fossil fuels (coal, natural gas, and petroleum), some secondary energy derived from fossil fuels (supplemental gaseous fuels and coal coke net imports), nuclear electric power, pumped-storage hydroelectric power, renewable energy, and net imports of electricity. Renewable energy consumption is the end-use consumption of wood, waste, alcohol fuels, geothermal heat pump and direct use energy, solar thermal direct use and photovoltaic energy and net electricity generation from conventional hydroelectric power, wood, waste, geothermal, solar, and wind.

Total Consumption: In addition to primary consumption in the four end-use sectors (residential, commercial, industrial, and transportation), total consumption also includes retail sales of electricity and electrical system energy losses (see Note 12).

Note 2. Energy-Use Sectors: The five major economic sectors—residential, commercial, industrial, transportation, and electric power—are called energy-use sectors in this report. The first four sectors comprise the end-use sectors, that is, the point of final consumption of the energy. Energy

consumption is assigned to the five energy-use sectors, as closely as possible, by the following definitions:

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. For further explanation see:

<http://www.eia.doe.gov/neic/datadefinitions/Guideforwebres.htm>.

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. 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.

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 (North American Industry Classification System) 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); 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.

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 further information see:

<http://www.eia.doe.gov/neic/datadefinitions/Guideforwebtrans.htm>.

Electric Power Sector—An energy-consuming sector that consists of electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or

electricity and heat, to the public—i.e., North American Industry Classification System 22 plants.

Although the energy-use allocations are made according to these aggregations as closely as possible, some data are collected by using different classifications. For example, electric power facilities may classify commercial and industrial users by the quantity of electricity purchased rather than by the business activity of the purchaser. Natural gas used in agriculture, forestry, and fisheries was collected and reported in the commercial sector through 1995. Beginning with 1996 data, deliveries of natural gas for agriculture, forestry, fishing, and hunting are reported in the industrial sector instead. Another example is master-metered condominiums and apartments, and buildings with a combination of residential and commercial units. In many cases, the metering and billing practices cause residential energy usage of electricity, natural gas, or fuel oil to be included in the commercial sector. No adjustments for these discrepancies were made.

Note 3. Conversion Factors: See Appendix A.

Note 4. Coal: See Tables 6.2 and A5.

Note 5. Coal Coke Net Imports: Net imports means imports minus exports, and a minus sign indicates that exports are greater than imports. Coal coke net imports are included in the industrial sector.

Sources :

1973-1975: DOI, BOM, *Minerals Yearbook*, "Coke and Coal Chemicals" chapter.

1976-1980: EIA, *Energy Data Report*, "Coke and Coal Chemicals" annual.

1981: EIA, *Energy Data Report*, "Coke Plant Report," quarterly.

1982 forward: EIA, *Quarterly Coal Report*.

Note 6. Natural Gas: See Tables 4.4 and A4. For Section 2 calculations, lease and plant fuel consumption are included in the industrial sector, and pipeline fuel use of natural gas is included in the transportation sector. For 1973-1979, annual values for residential and commercial natural gas consumption are allocated to the months in proportion to the monthly sales data from the American Gas Association, "Monthly Gas Utility Statistical Report."

Note 7. Petroleum: Petroleum consumption in this section of the *Monthly Energy Review (MER)* is the series called "petroleum product supplied" from Section 3.

The sources for petroleum product supplied by product are:

1973-1975: DOI, BOM, *Mineral Industry Surveys*, "Petroleum Statement, Annual."

1976-1980: EIA, *Energy Data Reports*, "Petroleum Statement, Annual."

1981-2003: EIA, *Petroleum Supply Annual*.

2004 forward: EIA, *Petroleum Supply Monthly*.

Energy-use allocation procedures by individual product are as follows:

Aviation Gasoline—All consumption of aviation gasoline is assigned to the transportation sector.

Asphalt—All consumption of asphalt is assigned to the industrial sector.

Distillate Fuel—Distillate fuel consumption is assigned to the sectors as follows:

Distillate Fuel Consumed by the Electric Power Sector, All Time Periods—For 1973-1979, consumption of distillate fuel is assumed to be the amount of petroleum (minus small amounts of kerosene and kerosene-type jet fuel deliveries) consumed in gas turbine and internal combustion plants. For 1980 forward, consumption of distillate fuel is assumed to be the amount of light oil (minus small amounts of kerosene deliveries through 1982) consumed by the electric power sector. See Table 7.3e.

Distillate Fuel Consumed by End-Use Sectors, Annually Through 2000—The aggregate end-use amount is total distillate fuel supplied minus the amount consumed for electric power. The end-use total consumed annually is allocated into the individual end-use sectors (residential, commercial, industrial, and transportation) in proportion to each sector's share of "adjusted sales" as reported in EIA's *Fuel Oil and Kerosene Sales (Sales)* report series (DOE/EIA-0535), which is based primarily on data collected by Form EIA-821, previously Form EIA-172. "Adjusted sales" are sales that have been adjusted to equal EIA distillate fuel product supplied.

Following are notes on the individual sector groupings:

Since 1979, the residential sector adjusted sales total is directly from the *Sales* reports. Prior to 1979, each year's sales subtotal of the heating plus industrial category is split into residential, commercial, and industrial (including farm) in proportion to the 1979 shares.

Since 1979, the commercial sector adjusted sales total is directly from the *Sales* reports. Prior to 1979, each year's sales subtotal of the heating plus industrial category is split into residential, commercial, and industrial (including farm) in proportion to the 1979 shares.

Since 1979, the industrial sector adjusted sales total is the sum of the adjusted sales for industrial, farm, oil company, off-highway diesel, and all other uses. Prior to 1979, each year's sales subtotal of the heating plus industrial category is split into residential, commercial, and industrial (including farm) in proportion to the 1979 shares, and this estimated industrial portion is added to oil company, off-highway diesel, and all other uses.

The transportation sector adjusted sales total is the sum of the adjusted sales for railroad, vessel bunkering, on-highway diesel, and military uses for all years.

Distillate Fuel Consumed by End-Use Sectors, Monthly Through 2000—Residential and commercial monthly consumption is estimated by allocating the annual estimates, which are described above, into the months in proportion to each month's share of the year's sales of No. 2 heating oil. The years' sales totals are from the following sources: for 1973-1980, the Ethyl Corporation, *Monthly Report of Heating Oil Sales*; for 1981 and 1982, the American Petroleum Institute, *Monthly Report of Heating Oil Sales*; and for 1983 forward, EIA, Form EIA-782A, "Refiners'/Gas Plant Operators' Monthly Petroleum Product Sales Report," No. 2 Fuel Oil Sales to End Users and for Resale.

The transportation highway use portion is allocated into the months in proportion to each month's share of the year's total sales for highway use as reported by the Federal Highway Administration's Table MF-25, "Private and Commercial Highway Use of Special Fuels by Months." After 1993, the sales-for-highway-use data are no longer available as a monthly series; the 1993 data are used for allocating succeeding year's totals into months. The remaining transportation use of distillate fuel (i.e., for railroads, vessel bunkering, and military use) is evenly distributed over the months, adjusted for the number of days per month.

Industrial monthly estimates are calculated as the difference between the sum of the estimates for residential, commercial, transportation, and electric power sectors and total distillate fuel consumption.

Distillate Fuel Consumed by End-Use Sectors, 2001 Forward—Each month's end-use consumption total is disaggregated into the individual sectors in proportion to the share that each sector held of the total in the same month in 2000. Annual values are the sum of the monthly values.

Jet Fuel—Through 1982, small amounts of kerosene-type jet fuel were consumed by the electric power sector. Kerosene-type jet fuel deliveries to the electric power sector as reported on the Form FERC-423 (formerly Form FPC-423) were used as estimates of this consumption. All remaining jet fuel (kerosene-type and naphtha-type) is consumed by the transportation sector.

Kerosene—Kerosene product supplied is allocated into the individual end-use sectors (residential, commercial, and industrial) in proportion to each sector's share of "sales" as reported in EIA's *Fuel Oil and Kerosene Sales (Sales)* report series (DOE/EIA-0535), which is based primarily on data collected by Form EIA-821, previously Form EIA-172.

Since 1979, the residential sector sales total is directly from the *Sales* reports. Prior to 1979, each year's sales category called "heating" is split into residential, commercial, and industrial in proportion to the 1979 shares.

Since 1979, the commercial sector sales total is directly from the *Sales* reports. Prior to 1979, each year's sales category called "heating" is split into residential, commercial, and industrial in proportion to the 1979 shares.

Since 1979, the industrial sector sales total is the sum of the adjusted sales for industrial, farm, and all other uses. Prior to 1979, each year's sales category called "heating" is split into residential, commercial and industrial in proportion to the 1979 shares, and this estimated industrial (including farm) portion is added to all other uses.

Liquefied Petroleum Gases (LPG)—The annual shares of LPG's total consumption that are estimated to be used by each sector are applied to each month's total LPG consumption to create monthly sector consumption estimates. The annual sector shares are calculated as described below.

Sales of LPG to the residential and commercial sector are converted from thousand gallons per year to thousand barrels per year and are assumed to be the annual consumption of LPG by the sector.

The quantity of LPG sold each year for consumption in internal combustion engines is allocated between the transportation and industrial sectors on the basis of data for special fuels used on highways published by the U.S. Department of Transportation, Federal Highway Administration, in *Highway Statistics*. The allocations of LPG sold for internal combustion engine use to the transportation sector range from a low of 20 percent (in 2001) to a high of 73 percent (in 1994).

LPG consumed annually by the industrial sector is estimated as the difference between LPG total supplied and the estimated consumption of LPG by the sum of the residential and commercial sector and the transportation sector. The industrial sector includes LPG used by chemical plants as raw materials or solvents and used in the production of synthetic rubber; refinery fuel use; use as synthetic natural gas feedstock and use in secondary recovery projects; all farm use; LPG sold to gas utility companies for distribution through the mains; and a portion of the use of LPG as an internal combustion engine fuel.

Sources of the annual sales data for creating annual energy shares are:

1973-1982: EIA's "Sales of Liquefied Petroleum Gases and Ethane" reports, based primarily on data collected by Form EIA-174.

1983: End-use consumption estimates for 1983 are based on 1982 end-use consumption because the collection of data under Form EIA-174 was discontinued after data year 1982. 1984-forward: American Petroleum Institute (API), "Sales of Natural Gas Liquids and Liquefied Refinery Gases," which is based on an LPG sales survey jointly sponsored by API, the Gas Processors Association, and the National Liquefied Petroleum Gas Association. EIA adjusts the data

to remove quantities of pentanes plus and to estimate withheld values.

Lubricants—The consumption of lubricants is allocated to the industrial and transportation sectors for all months according to proportions developed from annual sales of lubricants to the two sectors from U.S. Department of Commerce, Bureau of the Census, *Current Industrial Reports*, "Sales of Lubricating and Industrial Oils and Greases." The 1973 shares are applied to 1973 and 1974; the 1975 shares are applied to 1975 and 1976; and the 1977 shares are applied to 1977 forward.

Motor Gasoline—The total monthly consumption of motor gasoline is allocated to the sectors in proportion to aggregations of annual sales categories created on the basis of the U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, Tables MF-21, MF-24, and MF-25, as follows:

Commercial sales are the sum of sales for public non-highway use and miscellaneous and unclassified uses.

Industrial sales are the sum of sales for agriculture, construction, and industrial and commercial use as classified in the *Highway Statistics*.

Transportation sales are the sum of sales for highway use (minus the sales of special fuels, which are primarily diesel fuel and are accounted for in the transportation sector of distillate fuel) and sales for marine use.

Petroleum Coke—A portion of petroleum coke is consumed by electric utilities, as reported on Form EIA-759, "Monthly Power Plant Report" (formerly Form FPC-4). The remaining petroleum coke is assigned to the industrial sector.

Residual Fuel—Residual fuel consumption is assigned to the sectors as follows:

Residual Fuel Consumed by the Electric Power Sector, All Time Periods—For 1973-1979, consumption of residual fuel is assumed to be the amount of petroleum consumed in steam-electric power plants. For 1980 forward, consumption of residual fuel is assumed to be the amount of heavy oil consumed by the electric power sector. Source: Table 7.3e

Residual Fuel Consumed by End-Use Sectors, Annually Through 2000—The aggregate end-use amount is total residual fuel supplied minus the amount consumed for electric power. The end-use total consumed annually is allocated into the individual end-use sectors (commercial, industrial, and transportation) in proportion to each sector's share of "adjusted sales" as reported in EIA's *Fuel Oil and Kerosene Sales (Sales)* report series (DOE/EIA-535), which is based primarily on data collected by Form EIA-821, previously Form EIA-172). "Adjusted sales" are sales that have been adjusted to equal EIA residual fuel product supplied.

Following are notes on the individual sector groupings:

Since 1979, commercial sales data are directly from the *Sales* reports. Prior to 1979, each year's sales subtotal of the heating plus industrial category is split into commercial and industrial in proportion to the 1979 shares.

Since 1979, industrial sales data are the sum of sales for industrial, oil company, and all other uses. Prior to 1979, each year's sales subtotal of the heating plus industrial category is split into commercial and industrial in proportion to the 1979 shares, and this estimated industrial portion is added to oil company and all other uses.

Transportation sales are the sum of sales for railroad, vessel bunkering, and military uses for all years.

Residual Fuel Consumed by End-Use Sectors, Monthly Through 2000—Commercial monthly consumption is estimated by allocating the annual estimates, which are described above, into the months in proportion to each month's share of the year's sales of No. 2 heating oil. The years' sales totals are from the following sources: for 1973-1980, the Ethyl Corporation, *Monthly Report of Heating Oil Sales*; for 1981 and 1982, the American Petroleum Institute, *Monthly Report of Heating Oil Sales*; and for 1983-1996, EIA, Form EIA-782A, "Refiners/Gas Plant Operators' Monthly Petroleum Product Sales Report," No. 2 Fuel Oil Sales to End Users and for Resale.

Transportation monthly estimates are made by evenly distributing the annual sector estimate over the months, adjusting for the number of days per month.

Industrial monthly estimates are calculated as the difference between the sum of the estimates for commercial, transportation, and electric power sectors and total residual fuel consumption.

Residual Fuel Consumption by End-Use Sectors, 2001 Forward—Each month's end-use consumption total is disaggregated into the individual sectors in proportion to the share that each sector held of the total in the same month in 2000. Annual values are the sum of the monthly values.

Road Oil—All consumption of road oil is assigned to the industrial sector.

All Other Petroleum Products—Consumption of all remaining petroleum products is assigned to the industrial sector.

Note 8. Nuclear Electric Power: See Tables 8.1 and A6. Nuclear electric power is included in the electric power sector.

Note 9. Hydroelectric Pumped Storage: See Tables 7.2a and A6. Pumped-storage hydroelectric power is included in the electric power sector.

Note 10. Renewable Energy: See Tables 10.2a-10.2c. End-use consumption of wood, waste, alcohol fuels, geothermal heat pump and direct use energy, and solar thermal direct use and photovoltaic energy is included in the end-use sectors. Included in the electric power sector are: net electricity generation from conventional hydroelectric power, wood, waste, geothermal, solar, and wind.

Note 11. Electricity: End-use consumption of electricity is based on retail sales of electricity in Table 7.5. "Other," which is primarily for use in government buildings, is added to the commercial sector, except for approximately 5 percent used by railroads and railways and attributed to the transportation sector. Kilowatthours are converted to Btu at the rate of 3,412 Btu per kilowatthour.

Note 12. Electrical System Energy Losses: Electrical system energy losses are calculated as the difference between total primary consumption by the electric power sector-see Table 2.6-and the total energy content of the retail sales of electricity-see Tables 7.5 and A6. Most of these losses occur at steam-electric power plants (conventional

and nuclear) in the conversion of heat energy into mechanical energy to turn electric generators. The loss is a thermodynamically necessary feature of the steam-electric cycle. Part of the energy input-to-output losses is a result of imputing fossil energy equivalent inputs for hydroelectric and other energy sources, since there is no generally accepted practice for measuring those thermal conversion rates. In addition to conversion losses, other losses include power plant use of electricity, transmission and distribution of electricity from power plants to end-use consumers (also called "line losses"), and unaccounted for electricity. Total losses are allocated to the end-use sectors in proportion to each sector's share of total electricity sales. Overall, approximately 67 percent of total energy input is lost in conversion; of electricity generated, approximately 5 percent is lost in plant use and 9 percent is lost in transmission and distribution. Calculated electrical system energy losses may be less than actual losses, because primary consumption does not include the energy equivalent of utility purchases of electricity from non-electric utilities and from Canada and Mexico, although they are included in electricity sales.