**Renewable Energy**

**Note. Renewable Energy Production and Consumption.** In Tables 1.1, 1.3, and 10.1, renewable energy consumption consists of: conventional hydroelectricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6); geothermal electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), and geothermal heat pump and geothermal direct use energy; solar thermal and photovoltaic electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6), and solar thermal direct use energy; wind electricity net generation (converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6); wood and wood-derived fuels consumption; biomass waste (municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural byproducts, and other biomass) consumption; fuel ethanol (minus denaturant), biodiesel, renewable diesel fuel, and other biofuels consumption; and losses and co-products from the production of fuel ethanol and biodiesel. In Tables 1.1, 1.2, and 10.1, renewable energy production is assumed to equal consumption for all renewable energy sources except wood and biofuels; plus wood production (which is the sum of wood consumption and densified biomass exports); plus biofuels production (which comprises fuel ethanol feedstock, biodiesel feedstock, renewable diesel fuel production, and other biofuels production).

**Table 10.2a Sources**

*Residential Sector, Geothermal*
2012 forward: Annual estimates assumed by EIA to be equal to that of 2011.
(For 1989 forward, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

*Residential Sector, Solar*
1989 forward: Residential sector solar consumption is the sum of the values for "Small-Scale Solar Energy Consumption: Heat" (which includes solar thermal direct use energy in the residential, commercial, and industrial sectors) from Table 10.5 and "Small-Scale Solar Energy Consumption: Electricity, Residential Sector" from Table 10.5.

*Residential Sector, Wood*
1980–2008: Annual estimates are based on EIA, Form EIA-457, "Residential Energy Consumption Survey"; and National Oceanic and Atmospheric Administration regional heating degree-day data.
2009 forward: Annual estimates based on EIA, Form EIA-457, “Residential Energy Consumption Survey”; and residential wood consumption growth rates from EIA's *Annual Energy Outlook* data system.
(For 1973 forward, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

*Residential Sector, Total Renewable Energy*
1949–1988: Residential sector total renewable energy consumption is equal to residential sector wood consumption.
1989 forward: Residential sector total renewable energy consumption is the sum of the residential sector consumption values for geothermal, solar, and wood.

*Commercial Sector, Hydroelectric Power*
1989 forward: Commercial sector conventional hydroelectricity net generation data from EIA, Form EIA-923, "Power Plant Operations Report," and predecessor forms, are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.
Commercial Sector, Geothermal Heat Pump and Direct Use Energy

2012 forward: Annual estimates assumed by EIA to be equal to that of 2011.

(For 1989 forward, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

Commercial Sector, Geothermal Electricity Net Generation
December 2018 forward: Commercial sector geothermal electricity net generation data from EIA, Form EIA-923, “Power Plant Operations Report,” are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Commercial Sector, Geothermal Total
1989–November 2018: Commercial sector geothermal total consumption is equal to commercial sector heat pump and direct use energy.

December 2018 forward: Commercial sector geothermal total consumption is the sum of the commercial sector values for geothermal heat pump and direct use energy, and geothermal electricity net generation.

Commercial Sector, Solar
1989 forward: Commercial sector solar consumption is the sum of the values for "Small-Scale Solar Energy Consumption: Electricity, Commercial Sector" from Table 10.5 and "Utility-Scale Solar Energy Consumption: Electricity, Commercial Sector" from Table 10.5.

Commercial Sector, Wind
2009 forward: Commercial sector wind electricity net generation data from EIA, Form EIA-923, "Power Plant Operations Report," are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Commercial Sector, Wood


1984: Annual estimate assumed by EIA to be equal to that of 1983.

1985–1988: Annual estimates interpolated by EIA.

(For 1973–1988, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

1989 forward: Monthly/annual commercial sector combined-heat-and-power (CHP) wood consumption data are from EIA, Form EIA-923, "Power Plant Operations Report," and predecessor forms. Annual estimates for commercial sector non-CHP wood consumption are based on EIA, Form EIA-871, "Commercial Buildings Energy Consumption Survey" (for 2014–2016, the annual estimates are based on commercial sector biomass consumption growth rates from EIA's Annual Energy Outlook data system; for 2017 forward, annual estimates are assumed by EIA to be equal to that of 2016). For 1989 forward, monthly estimates for commercial sector non-CHP wood consumption are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month. Commercial sector total wood consumption is the sum of commercial sector CHP and non-CHP wood consumption.

Commercial Sector, Biomass Waste
1989 forward: Table 7.4c.

Commercial Sector, Fuel Ethanol (Minus Denaturant)
1981 forward: The commercial sector share of motor gasoline consumption is equal to commercial sector motor gasoline consumption from Table 3.7a divided by motor gasoline product supplied from Table 3.5. Commercial sector fuel ethanol (minus denaturant) consumption is equal to fuel ethanol (minus denaturant) consumption from Table 10.3 multiplied by the commercial sector share of motor gasoline consumption. Note that there is a discontinuity in this time.
series between 2014 and 2015 due to a change in the method for allocating motor gasoline consumption to the end-use sectors; beginning in 2015, the commercial and industrial sector shares of fuel ethanol consumption are larger than in 2014, while the transportation sector share is smaller.

**Commercial Sector, Total Biomass**
1949–1980: Commercial sector total biomass consumption is equal to commercial sector wood consumption.

1981–1988: Commercial sector total biomass consumption is the sum of the commercial sector consumption values for wood and fuel ethanol (minus denaturant).

1989 forward: Commercial sector total biomass consumption is the sum of the commercial sector consumption values for wood, waste, and fuel ethanol (minus denaturant).

**Commercial Sector, Total Renewable Energy**
1949–1988: Commercial sector total renewable energy consumption is equal to commercial sector total biomass consumption.

1989–2007: Commercial sector total renewable energy consumption is the sum of the commercial sector consumption values for conventional hydroelectric power, geothermal, and total biomass.

2008: Commercial sector total renewable energy consumption is the sum of the commercial sector consumption values for conventional hydroelectric power, geothermal, solar, and total biomass.

2009 forward: Commercial sector total renewable energy is the sum of the commercial sector consumption values for conventional hydroelectric power, geothermal, solar, wind, and total biomass.

**Table 10.2b Sources**

**Industrial Sector, Hydroelectric Power**
1949 forward: Industrial sector conventional hydroelectricity net generation data from Table 7.2c are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

**Industrial Sector, Geothermal**

2010 forward: Annual estimates assumed by EIA to be equal to that of 2009.

(For 1989 forward, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

**Industrial Sector, Solar**
1989 forward: Industrial sector solar consumption is the sum of the values for "Small-Scale Solar Energy Consumption: Electricity, Industrial Sector" from Table 10.5 and "Utility-Scale Solar Energy Consumption: Electricity, Industrial Sector" from Table 10.6.

**Industrial Sector, Wind**
2011 forward: Industrial sector wind electricity net generation data from EIA, Form EIA-923, "Power Plant Operations Report," are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

**Industrial Sector, Wood**


1985 and 1986: Annual estimates interpolated by EIA.

1988: Annual estimate interpolated by EIA.

(For 1973–1988, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

1989 forward: Monthly/annual industrial sector combined-heat-and-power (CHP) wood consumption data are from EIA, Form EIA-923, "Power Plant Operations Report," and predecessor forms. Annual estimates for industrial sector non-CHP wood consumption are based on EIA, Form EIA-846, "Manufacturing Energy Consumption Survey" (for 2019 forward, the annual estimates are assumed by EIA to be equal to that of 2018). For 1989 forward, monthly estimates for industrial sector non-CHP wood consumption are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month. Industrial sector total wood consumption is the sum of industrial sector CHP and non-CHP wood consumption.

*Industrial Sector, Biomass Waste*

1981: Annual estimate is calculated as total waste consumption (from EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8) minus electric power sector waste consumption (from MER Table 10.2c).

1982 and 1983: Annual estimates are calculated as total waste consumption (based on *Estimates of U.S. Biofuels Consumption 1990*, Table 8) minus electric power sector waste consumption (from MER, Table 10.2c).

1984: Annual estimate is calculated as total waste consumption (from EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8) minus electric power sector waste consumption (from MER, Table 10.2c).

1985 and 1986: Annual estimates interpolated by EIA.

1987: Annual estimate is calculated as total waste consumption (from EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 8) minus electric power sector waste consumption (from MER, Table 10.2c).

1988: Annual estimate interpolated by EIA.

(For 1973–1988, monthly estimates are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month.)

1989 forward: Monthly/annual industrial sector combined-heat-and-power (CHP) consumption data are from Table 7.4c. Annual estimates for industrial sector non-CHP waste consumption are based on information presented in Government Advisory Associates, *Resource Recovery Yearbook* and *Methane Recovery Yearbook*, and information provided by the U.S. Environmental Protection Agency, Landfill Methane Outreach Program (for 2014 forward, the annual estimates are assumed by EIA to be equal to that of 2013). For 1989 forward, monthly estimates for industrial sector non-CHP waste consumption are created by dividing the annual estimates by the number of days in the year and then multiplying by the number of days in the month. Industrial sector total waste consumption is the sum of industrial sector CHP and non-CHP waste consumption.

*Industrial Sector, Fuel Ethanol (Minus Denaturant)*

1981 forward: The industrial sector share of motor gasoline consumption is equal to industrial sector motor gasoline consumption from Table 3.7b divided by motor gasoline product supplied from Table 3.5. Industrial sector fuel ethanol (minus denaturant) consumption is equal to fuel ethanol (minus denaturant) consumption from Table 10.3 multiplied by the industrial sector share of motor gasoline consumption. Note that there is a discontinuity in this time series between 2014 and 2015 due to a change in the method for allocating motor gasoline consumption to the end-use sectors; beginning in 2015, the commercial and industrial sector shares of fuel ethanol consumption are larger than in 2014, while the transportation sector share is smaller.

*Industrial Sector, Biomass Losses and Co-products*

1981 forward: Calculated as fuel ethanol losses and co-products from Table 10.3 plus biodiesel losses and co-products from Table 10.4a.
Industrial Sector, Total Biomass
1949–1980: Industrial sector total biomass consumption is equal to industrial sector wood consumption.

1981 forward: Industrial sector total biomass consumption is the sum of the industrial sector consumption values for wood, waste, fuel ethanol (minus denaturant), and biomass losses and co-products.

Industrial Sector, Total Renewable Energy
1949–1988: Industrial sector total renewable energy consumption is the sum of the industrial sector consumption values for conventional hydroelectric power and total biomass.

1989–2009: Industrial sector total renewable energy consumption is the sum of the industrial sector consumption values for conventional hydroelectric power, geothermal, and total biomass.

2010: Industrial sector total renewable energy consumption is the sum of the industrial sector consumption values for conventional hydroelectric power, geothermal, solar, and total biomass.

2011 forward: Industrial sector total renewable energy consumption is the sum of the industrial sector consumption values for conventional hydroelectric power, geothermal, solar, wind, and total biomass.

Table 10.2c Sources

Transportation Sector, Fuel Ethanol (Minus Denaturant)
1981 forward: The transportation sector share of motor gasoline consumption is equal to transportation sector motor gasoline consumption from Table 3.7c divided by motor gasoline product supplied from Table 3.5. Transportation sector fuel ethanol (minus denaturant) consumption is equal to fuel ethanol (minus denaturant) consumption from Table 10.3 multiplied by the transportation sector share of motor gasoline consumption. Note that there is a discontinuity in this time series between 2014 and 2015 due to a change in the method for allocating motor gasoline consumption to the end-use sectors; beginning in 2015, the commercial and industrial sector shares of fuel ethanol consumption are larger than in 2014, while the transportation sector share is smaller.

Transportation Sector, Biodiesel
2001 forward: Transportation sector biodiesel consumption is assumed to equal total biodiesel consumption from Table 10.4a.

Transportation Sector, Renewable Diesel Fuel
2011 forward: Transportation sector renewable diesel fuel consumption is assumed to equal total renewable diesel fuel consumption from Table 10.4b.

Transportation Sector, Other Biofuels
2014 forward: Transportation sector other biofuels consumption is assumed to equal total other biofuels consumption from Table 10.4c.

Transportation Sector, Total Renewable Energy
1981–2000: Transportation sector total renewable energy consumption is equal to transportation sector fuel ethanol (minus denaturant) consumption.

2001–2010: Transportation sector total renewable energy consumption is the sum of the transportation sector consumption values for fuel ethanol (minus denaturant) and biodiesel.

2011–2013: Transportation sector total renewable energy consumption is the sum of the transportation sector consumption values for fuel ethanol (minus denaturant), biodiesel, and renewable diesel fuel.

2014 forward: Transportation sector total renewable energy consumption is the sum of the transportation sector consumption values for fuel ethanol (minus denaturant), biodiesel, renewable diesel fuel, and other biofuels.
Electric Power Sector, Hydroelectric Power
1949 forward: Electric power sector conventional hydroelectricity net generation data from Table 7.2b are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Electric Power Sector, Geothermal
1960 forward: Electric power sector geothermal electricity net generation data from Table 7.2b are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Electric Power Sector, Solar
1984 forward: Electric power sector solar electricity net generation data from Table 7.2b are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Electric Power Sector, Wind
1983 forward: Electric power sector wind electricity net generation data from Table 7.2b are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Electric Power Sector, Wood
1949 forward: Table 7.4b.

Electric Power Sector, Biomass Waste
1970 forward: Table 7.4b.

Electric Power Sector, Total Biomass
1949–1969: Electric power sector total biomass consumption is equal to electric power sector wood consumption.

1970 forward: Electric power sector total biomass consumption is the sum of the electric power sector consumption values for wood and biomass waste.

Electric Power Sector, Total Renewable Energy
1949–1959: Electric power sector total renewable energy consumption is the sum of the electric power sector consumption values for hydroelectric power and total biomass.

1960–1982: Electric power sector total renewable energy consumption is the sum of the electric power sector consumption values for hydroelectric power, geothermal, and total biomass.

1983: Electric power sector total renewable energy consumption is the sum of the electric power sector consumption values for hydroelectric power, geothermal, wind, and total biomass.

1984 forward: Electric power sector total renewable energy consumption is the sum of the electric power sector consumption values for hydroelectric power, geothermal, solar, wind, and total biomass.

Table 10.3 Sources

Feedstock
1981 forward: Calculated as fuel ethanol production (in thousand barrels) minus denaturant, and then multiplied by the fuel ethanol feedstock factor—see Table A3.

Losses and Co-products
1981 forward: Calculated as fuel ethanol feedstock plus denaturant minus fuel ethanol production.

Denaturant
1981–2008: Data in thousand barrels for petroleum denaturant in fuel ethanol produced are estimated as 2% of fuel ethanol production; these data are converted to Btu by multiplying by 4.661 million Btu per barrel (the estimated quantity-weighted factor of natural gasoline and conventional motor gasolines used as denaturant).

2009–2020: U.S. Energy Information Administration (EIA), Petroleum Supply Annual (PSA), annual reports, Table 1. Data in thousand barrels for net production of natural gasoline at “renewable fuels and oxygenate plants” are multiplied by
-; these data are converted to Btu by multiplying by 4.638 million Btu per barrel (the approximate heat content of natural gasoline). Data in thousand barrels for net production of conventional motor gasoline and motor gasoline blending components at “renewable fuels and oxygenate plants” are multiplied by -1; these data are converted to Btu by multiplying by 5.222 million Btu per barrel (the approximate heat content of motor gasoline blending components). Total denaturant is the sum of the values for natural gasoline, conventional motor gasoline, and motor gasoline blending components.

2021: EIA, PSA, annual report, Table 1. Data in thousand barrels for net production of natural gasoline at biofuels plants are multiplied by -1; these data are converted to Btu by multiplying by 4.638 million Btu per barrel (the approximate heat content of natural gasoline). Data in thousand barrels for net production of conventional motor gasoline and motor gasoline blending components at biofuels plants are multiplied by -1; these data are converted to Btu by multiplying by 5.222 million Btu per barrel (the approximate heat content of motor gasoline blending components). Total denaturant is the sum of the values for natural gasoline, conventional motor gasoline, and motor gasoline blending components.

2022: EIA, Petroleum Supply Monthly (PSM), monthly reports, Table 1. Data in thousand barrels for net production of natural gasoline at biofuels plants are multiplied by -1; these data are converted to Btu by multiplying by 4.638 million Btu per barrel (the approximate heat content of natural gasoline). Data in thousand barrels for net production of conventional motor gasoline and motor gasoline blending components at biofuels plants are multiplied by -1; these data are converted to Btu by multiplying by 5.222 million Btu per barrel (the approximate heat content of motor gasoline blending components). Total denaturant is the sum of the values for natural gasoline, conventional motor gasoline, and motor gasoline blending components.

**Production**

1981–1992: Fuel ethanol production is assumed to equal fuel ethanol consumption—see sources for "Consumption."

1993–2004: Calculated as fuel ethanol consumption plus fuel ethanol stock change minus fuel ethanol net imports. These data differ slightly from the original production data from EIA, Form EIA-819, "Monthly Oxygenate Report," and predecessor form, which were not reconciled and updated to be consistent with the final balance.


2009–2020: EIA, PSA, annual reports, Table 1, data for net production of fuel ethanol at “renewable fuels and oxygenate plants.”

2021: EIA, PSA, annual report, Table 1, data for net production of fuel ethanol at biofuels plants.

2022: EIA, PSM, monthly reports, Table 1, data for net production of fuel ethanol at biofuels plants.

**Trade, Stocks, and Stock Change**

1992–2021: EIA, PSA, annual reports, Table 1.

2022: EIA, PSM, monthly reports, Table 1.

**Consumption**


1993–2004: EIA, PSA, annual reports, Tables 2 and 16. Calculated as 10% of oxygenated finished motor gasoline field production (Table 2), plus fuel ethanol refinery input (Table 16).

2005–2008: EIA, PSA, annual reports, Tables 1 and 15. Calculated as motor gasoline blending components adjustments (Table 1), plus finished motor gasoline adjustments (Table 1), plus fuel ethanol refinery and blender net inputs (Table 15).
2009–2021: EIA, PSA, annual reports, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments.

2022: EIA, PSM, monthly reports, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments.

Consumption Minus Denaturant
1981 forward: Calculated as fuel ethanol consumption minus the amount of denaturant in fuel ethanol consumed. Denaturant in fuel ethanol consumed is estimated by multiplying denaturant in fuel ethanol produced by the fuel ethanol consumption-to-production ratio.

Table 10.4a Sources

Biodiesel Feedstock
2001 forward: Calculated as biodiesel production in thousand barrels multiplied by 5.433 million Btu per barrel (the biodiesel feedstock factor—see "Biodiesel Feedstock" entry in the "Thermal Conversion Factor Source Documentation" at the end of Appendix A).

Biodiesel Losses and Co-products
2001 forward: Calculated as biodiesel feedstock minus biodiesel production.

Biodiesel Production
2001–2005: U.S. Department of Agriculture, Commodity Credit Corporation, Bioenergy Program records. Annual data are derived from quarterly data. Monthly data are estimated by dividing the annual data by the number of days in the year and then multiplying by the number of days in the month.


2009 and 2010: EIA, Monthly Biodiesel Production Report, monthly reports, Table 1.

2011–2020: EIA, Petroleum Supply Annual (PSA), annual reports, Table 1, data for “renewable fuels except fuel ethanol.”

2021: EIA, PSA, annual report, Table 1, data for biodiesel.

2022: EIA, Petroleum Supply Monthly (PSM), monthly reports, Table 1, data for biodiesel.

Biodiesel Trade
2001–2011: For imports, U.S. Department of Agriculture, data for the following Harmonized Tariff Schedule codes: 3824.90.40.20, "Fatty Esters Animal/Vegetable Mixture" (data through June 2010); and 3824.90.40.30, "Biodiesel/Mixes" (data for July 2010–2011). For exports, U.S. Department of Agriculture, data for the following Schedule B codes: 3824.90.40.00, "Fatty Substances Animal/Vegetable/Mixture" (data through 2010); and 3824.90.40.30, “Biodiesel <70%” (data for 2011). (The data above are converted from pounds to gallons by dividing by 7.4.) Although these categories include products other than biodiesel (such as biodiesel coprocessed with petroleum feedstocks; and products destined for soaps, cosmetics, and other items), biodiesel is the largest component. In the absence of other reliable data for biodiesel trade, EIA sees these data as good substitutes.


2021: EIA, PSA, annual report, Table 1, data for biodiesel.

2022: EIA, PSM, monthly reports, Table 1, data for biodiesel.

**Biodiesel Stocks and Stock Change**


2021: EIA, PSA, annual report, Table 1, data for biodiesel.

2022: EIA, PSM, monthly reports, Table 1, data for biodiesel.

**Biodiesel Consumption**

2001–2008: Calculated as biodiesel production plus biodiesel net imports.

January and February 2009: EIA, PSA, Table 1, data for refinery and blender net inputs of “renewable fuels except fuel ethanol.”

March 2009 forward: Calculated as biodiesel production plus biodiesel net imports minus biodiesel stock change.

**Table 10.4b Sources**

**Renewable Diesel Fuel Production**


2021: EIA, PSA, annual report, Table 1, data for renewable diesel fuel.

2022: EIA, PSM, monthly reports, Table 1, data for renewable diesel fuel.

**Renewable Diesel Fuel Trade (Imports)**

2012–2020: EIA, PSA, annual reports, Table 25, data for “other renewable diesel fuel.”

2021: EIA, PSA, annual report, Table 1, data for renewable diesel fuel.

2022: EIA, PSM, monthly reports, Table 1, data for renewable diesel fuel.

**Renewable Diesel Fuel Stocks and Stock Change**


2021: EIA, PSA, annual report, Table 1, data for renewable diesel fuel.

2022: EIA, PSM, monthly reports, Table 1, data for renewable diesel fuel.

**Renewable Diesel Fuel Consumption**

2011 forward: Calculated as renewable diesel fuel production plus renewable diesel fuel imports minus renewable diesel fuel stock change.
Table 10.4c Sources

Other Biofuels Production

2021: EIA, PSA, annual report, Table 1, data for other biofuels.
2022: EIA, PSM, monthly reports, Table 1, data for other biofuels.

Other Biofuels Trade (Imports)
2012–2020: EIA, PSA, annual reports, Table 25, data for “other renewable fuels.”

2021: EIA, PSA, annual report, Table 1, data for other biofuels.
2022: EIA, PSM, monthly reports, Table 1, data for other biofuels.

Other Biofuels Stocks and Stock Change

2021: EIA, PSA, annual report, Table 1, data for other biofuels.
2022: EIA, PSM, monthly reports, Table 1, data for other biofuels.

Other Biofuels Consumption
2014 forward: Calculated as other biofuels production plus other biofuels imports minus other biofuels stock change.

Table 10.5 Sources

Small-Scale Solar Energy Consumption: Heat

Annual Data
1989–2009: Annual estimates by the U.S. Energy Information Administration (EIA) based on EIA, Form EIA-63A, "Annual Solar Thermal Collector/Reflector Shipments Report." Solar energy consumption by solar thermal non-electric applications (mainly in the residential sector, but with some in the commercial and industrial sectors) is based on assumptions about the stock of equipment in place and other factors.

2010 forward: Annual estimates based on commercial sector solar thermal growth rates from EIA’s Annual Energy Outlook (AEO) data system. (Annual estimates are subject to revision when a new AEO is released.)

Monthly Data
1989–2013: Monthly estimates for each year are obtained by allocating a given year’s annual value to the months in that year. Each month’s allocator is the average of that month’s "Small-Scale Solar Energy Consumption: Electricity, Total" values in 2014 and 2015. The allocators, when rounded, are as follows: January—5%; February—6%; March—8%; April—9%; May—10%; June—10%; July—10%; August—10%; September—9%; October—9%; November—7%; and December—7%.

2014 forward: Once all 12 months of "Small-Scale Solar Energy Consumption: Electricity, Total" data are available for a given year, they are used as allocators and applied to the annual estimate in order to derive monthly estimates for that year. Initial monthly estimates for the current year use the previous year’s allocators.
**Small-Scale Solar Energy Consumption: Electricity, Residential Sector**

Beginning in 2014, monthly and annual data for residential sector small-scale solar photovoltaic generation are from EIA, *Electric Power Monthly*, Table 1.2.E. Those data are converted to consumption data in Btu by multiplying by the total fossil fuels heat rate factors in MER Table A6.

Backcasts for earlier periods are developed as follows:

**Annual Data**

1989–2003: Annual growth rates are calculated based on small-scale solar electricity consumption in all sectors. Consumption is estimated using information on shipments of solar panels from EIA, Form EIA-63B, "Annual Photovoltaic Cell/Module Shipments Report," and assumptions about the stock of equipment in place and other factors. The growth rates are applied to more recent data to create historical annual estimates.

2004–2008: Annual growth rates based on commercial sector solar photovoltaic growth rates from EIA's *Annual Energy Outlook* (AEO) data system are applied to more recent data to create historical annual estimates. (Annual estimates are subject to revision when a new AEO is released.)

2009–2013: Annual growth rates based on residential sector solar photovoltaic growth rates from EIA's *Annual Energy Outlook* (AEO) data system are applied to more recent data to create historical annual estimates. (Annual estimates are subject to revision when a new AEO is released.)

**Monthly Data**


**Small-Scale Solar Energy Consumption: Electricity, Commercial Sector**

Beginning in 2014, monthly and annual data for commercial sector small-scale solar photovoltaic generation are from EIA, *Electric Power Monthly*, Table 1.2.C. Those data are converted to consumption data in Btu by multiplying by the total fossil fuels heat rate factors in MER Table A6.

Backcasts for earlier periods are developed as follows:

**Annual Data**

1989–2003: Annual growth rates based on EIA, Form EIA-63B, "Annual Photovoltaic Cell/Module Shipments Report," are applied to more recent data to create historical annual estimates. (See "Small-Scale Solar Energy Consumption: Electricity, Residential Sector" sources above for details.)

2004–2013: Annual growth rates based on commercial sector solar photovoltaic growth rates from EIA's *Annual Energy Outlook* (AEO) data system are applied to more recent data to create historical annual estimates. (Annual estimates are subject to revision when a new AEO is released.)

**Monthly Data**


**Small-Scale Solar Energy Consumption: Electricity, Industrial Sector**

Beginning in 2014, monthly and annual data for industrial sector small-scale solar photovoltaic generation are from EIA, *Electric Power Monthly*, Table 1.2.D. Those data are converted to consumption data in Btu by multiplying by the total fossil fuels heat rate factors in MER Table A6.

Backcasts for earlier periods are developed as follows:

**Annual Data**

1989–2003: Annual growth rates based on EIA, Form EIA-63B, "Annual Photovoltaic Cell/Module Shipments Report," are applied to more recent data to create historical annual estimates. (See "Small-Scale Solar Energy Consumption: Electricity, Residential Sector" sources above for details.)
2004–2013: Annual growth rates based on commercial sector solar photovoltaic growth rates from EIA’s Annual Energy Outlook (AEO) data system are applied to more recent data to create historical annual estimates. (Annual estimates are subject to revision when a new AEO is released.)

Monthly Data

Small-Scale Solar Energy Consumption: Electricity, Total
1989 forward: Small-scale solar energy consumption for total electricity is the sum of the small-scale solar energy consumption for electricity (for electricity) values for the residential, commercial, and industrial sectors.

Small-Scale Solar Energy Consumption: Total
1989 forward: Small-scale solar energy consumption total is the sum of small-scale solar energy consumption values for heat and total electricity.

Utility-Scale Solar Energy Consumption: Electricity, Commercial Sector
2008 forward: Commercial sector solar photovoltaic and solar thermal electricity net generation data from EIA, Form EIA-923, "Power Plant Operations Report," are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Utility-Scale Solar Energy Consumption: Electricity, Industrial Sector
2010 forward: Industrial sector solar photovoltaic and solar thermal electricity net generation data from EIA, Form EIA-923, "Power Plant Operations Report," are converted to Btu by multiplying by the total fossil fuels heat rate factors in Table A6.

Utility-Scale Solar Energy Consumption: Electricity, Electric Power Sector
1984 forward: Electric power sector solar photovoltaic and solar thermal electricity net generation data from Table 7.2b are converted to Btu by multiplying the total fossil fuels heat rate factors in Table A6.

Utility-Scale Solar Energy Consumption: Electricity, Total
1984 forward: Utility-scale solar energy consumption for total electricity is the sum of the utility-scale solar energy consumption (for electricity) values for the commercial, industrial, and electric power sectors.

Solar Energy Consumption: Total
1984 forward: Total solar energy consumption is the sum of the values for total small-scale solar energy consumption and total utility-scale solar energy consumption.