About the Greenhouse Gas Inventory

EPA’s annual report, the *Inventory of U.S. Greenhouse Gas Emissions and Sinks* (the Inventory), provides a comprehensive accounting of U.S. greenhouse gas emissions and sinks by source, economic sector, and greenhouse gas going back to 1990. This technical overview summarizes the latest information on U.S. anthropogenic greenhouse gas emission trends from 1990 through 2018. The estimates presented are calculated using methodologies consistent with those recommended in the *2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (IPCC 2006).

In preparing the annual Inventory, EPA collaborates with hundreds of experts representing more than a dozen U.S. government agencies, academic institutions, industry associations, consultants, and environmental organizations. EPA also collects greenhouse gas emission data from individual facilities and suppliers of certain fossil fuels and industrial gases through its *Greenhouse Gas Reporting Program (GHGRP)*. The GHGRP does not provide full coverage of total annual U.S. greenhouse emissions and sinks (e.g., the GHGRP excludes emissions from the agricultural, land use, and forestry sectors), but it is an important input to the calculations of national-level emissions in the Inventory.

Highlights of Recent Trends in Emissions and Sinks

**GHG emissions show long-term decline since 2005, with annual variation**

In 2018, total gross U.S. greenhouse gas emissions were 6,677 million metric tons of carbon dioxide equivalent (MMT CO₂ Eq.). Net emissions (including sinks) were 5,903 MMT CO₂ Eq. From 2005 to 2018, net emissions declined 10 percent, reflecting long-term trends in many factors including population, economic growth, energy markets, technological changes including energy efficiency, and energy fuel choices. The decline in recent years is due to an increasing shift to use of less CO₂-intensive natural gas for generating electricity and a rapid increase in the use of renewable energy in the electric power sector. Between 2017 and 2018, greenhouse gas emissions increased 3 percent due to multiple factors, including increased energy use from greater heating and cooling needs due to a colder winter and hotter summer in 2018 compared to 2017. Since 1990, net emissions have increased 6 percent.

**More about Carbon Dioxide**

CO₂ is the primary greenhouse gas contributing to total U.S. emissions, accounting for 81 percent of the total in 2018. Total CO₂ emissions increased 3 percent between 2017 and 2018. In 2018, fossil fuel combustion (e.g., for electric power generation) accounted for nearly 93 percent of CO₂ emissions. Changes in CO₂ emissions from fossil fuel combustion are influenced by many of the same long-term and short-term factors already noted above. Fossil fuel combustion CO₂ emissions also depend on the type of fuel consumed (e.g., natural gas) and its carbon intensity.

Other sources of U.S. CO₂ emissions include non-combustion emissions from industrial processes (e.g., cement production) and changes in land use. Land use, land-use change and forestry (LULUCF) activities include fluxes of carbon resulting from land use conversions (e.g., emissions from conversion of forest land to agricultural or urban use) or land use management practices that remove CO₂ from the atmosphere and store it in long-term carbon sinks (e.g., through net forest growth). The LULUCF sector offset about 12 percent of total gross U.S. emissions in 2018 and is a steady sink across the 1990 to 2018 time series. Major U.S. sinks include long-term forests and recent conversions of other land uses to forests.

**2018 Sources of Carbon Dioxide (CO₂) Emissions**

**More about Methane**

CH₄ accounted for nearly 10 percent of emissions and has decreased 7 percent since 2005 and 18 percent since 1990. Emissions increased by less than 1 percent from 2017 to 2018. Key trends include reduced emissions from natural gas systems due to decreases in emissions from distribution, transmission, and storage; decreases in emissions from landfills due to increased landfill gas collection and less decomposable materials discarded in landfills; and increased emissions from livestock in line with increasing cattle populations.

**2018 Sources of Methane (CH₄) Emissions**

**More about Nitrous Oxide**

N₂O accounted for 7 percent of emissions and has decreased by less than 1 percent since 1990. Emissions increased by 3 percent from 2017 to 2018. Key trends in N₂O emissions are influenced by changes in emissions from agricultural soils due to interannual weather patterns, fertilizer use, and crop production; an increase of N₂O emissions from stationary combustion; and a decrease in N₂O emissions from mobile combustion due to national emission control standards and technologies for on-road vehicles.

**2018 Sources of Nitrous Oxide (N₂O) Emissions**
### Emissions by Economic Sector

Greenhouse gases are emitted across five economic sectors: transportation, electric power (electricity generation), residential/commercial (homes and businesses), industry, and agriculture. For more information on trends in the land use, land use change and forestry sector, see textbox above titled More about Carbon Dioxide.

#### U.S. Greenhouse Gas Emissions Allocated to Economic Sectors*

[Graph showing emissions by economic sector]

*Land use sinks and U.S. territories are excluded from this figure.

### Transportation Sector

Transportation activities are the largest source of emissions, accounting for 28 percent of total U.S. greenhouse gas emissions in 2018, and have increased by 2 percent since 2017. From 1990 to 2018, transportation emissions from fossil fuel combustion rose by 21 percent due in large part to increased demand for travel. The number of vehicle miles traveled (VMT) by light-duty vehicles (i.e., passenger cars and light-duty trucks) increased by 46 percent from 1990 to 2018; VMT by medium- and heavy-duty trucks increased 113 percent over the same period. While an increased demand for travel has led to increasing CO₂ emissions since 1990, improvements in average new vehicle fuel economy since 2005 has slowed the rate of increase of CO₂ emissions. In 2018, light-duty vehicles represented 58 percent of CO₂ emissions from transportation fossil fuel combustion and medium- and heavy-duty trucks and buses represented 25 percent. Petroleum-based products supplied 95 percent of the energy used for transportation, with 57 percent from gasoline consumption in automobiles and other highway vehicles. Diesel fuel for freight trucks and jet fuel for aircraft accounted for 24 and 13 percent of fuel consumption, respectively. The remaining 6 percent of petroleum-based energy used for transportation was supplied by natural gas, residual fuel, aviation gasoline, and liquefied petroleum gases.
Fuels Used in Transportation Sector, Onroad VMT, and Total Sector CO₂ Emissions

Electric Power Sector

The electric power sector accounted for 27 percent of total U.S. greenhouse gas emissions in 2018. While emissions from the electric power sector have decreased by approximately 4 percent since 1990, the carbon intensity of the electric power sector, in terms of emissions (CO₂ Eq.) per Qبت input, has significantly decreased—by 13 percent—during that same timeframe. This decoupling of electric power generation and the resulting CO₂ emissions is shown below.

Electric Power Generation and Emissions

Trends in CO₂ emissions from fossil fuel combustion have been strongly influenced by the electric power sector, which historically has accounted for the largest share of these emissions. The types of fuel consumed to produce electricity have changed in recent years. Total electric power generation increased by 3 percent from 2017 to 2018. However, CO₂ emissions only increased 1 percent from 2017 to 2018 due to increasing electric power generation from natural gas and renewables and decreasing generation from coal. Carbon dioxide emissions from coal consumption for electric power generation decreased by 42 percent since 2005. The decrease in coal-powered electricity generation and increase in natural gas and renewable electricity generation have contributed to a 27 percent decrease in overall CO₂ emissions from electric power generation from 2005 to 2018.

Commercial and Residential Sectors

The commercial and residential sectors accounted for 7 and 6 percent total U.S. greenhouse gas emissions in 2018, respectively. Emissions from the commercial and residential sectors have increased since 1990 and short-term trends are often correlated with seasonal fluctuations in energy use caused by weather conditions. Emissions from natural gas consumption in the residential and commercial sectors increased by 13 percent and 11 percent from 2017 to 2018, respectively. This trend can largely be attributed to a 12 percent increase in heating degree days, which led to an increased demand for heating fuel in these sectors.
Industry

The industrial sector accounted for 22 percent of U.S. greenhouse gas emissions in 2018. Since 1990, industrial sector emissions have declined by 10 percent. Structural changes within the U.S. economy that led to shifts in industrial output away from energy-intensive manufacturing products to less energy-intensive products (e.g., from steel to computer equipment) have had a significant effect on industrial emissions. EPA’s GHGRP data provide insights into underlying trends in the industrial sector. Between 2017 and 2018, industrial sector coal consumption decreased, and natural gas consumption increased in specific industries, including chemical manufacturing; pulp, paper and print; food processing, beverages and tobacco; and minerals manufacturing.

Agriculture

Agriculture accounted for 10 percent of U.S. greenhouse gas emissions in 2018 and includes a variety of processes, including enteric fermentation in domestic livestock, livestock manure management, and agricultural soil management. In 2018, agricultural soil management was the largest source of N₂O emissions, and enteric fermentation was the largest source of CH₄ emissions in the United States.

Preliminary Outlook for 2019

Carbon dioxide emissions from fossil fuel combustion represent about 75 percent of total U.S. CO₂ emissions. While the current inventory does not include 2019 estimates, preliminary energy data are available for 2019 and can be used to project energy-related CO₂ emissions. Preliminary 2019 data are not available for other sectors to provide projections. The preliminary estimates indicate fossil fuel combustion CO₂ emissions will decrease by about 3 percent in 2019 compared to 2018 (U.S. EIA 2020b). Carbon dioxide emissions from the electric power sector are projected to represent the largest decline in 2019 compared to 2018. This reflects the continuing trend of increasing electricity generation from natural gas and renewables and decreasing generation from coal (EPA 2019), as well as an anticipated decrease in electricity demand due in part to milder weather in 2019 compared to 2018 and associated lower space heating and cooling demand (U.S. EIA 2020a). Transportation sector CO₂ emissions are anticipated to remain relatively unchanged compared to 2018 and continue to be the largest source of fossil fuel combustion CO₂ emissions in 2019 (U.S. EIA 2020a).
References


For More Information

Additional resources and tools with more information and data related to the U.S. Greenhouse Gas Inventory are available at: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks.

Fast Facts on the National-Level U.S. Greenhouse Gas Inventory and U.S. Transportation sector provide a quick look at trends and an overview of findings

The Greenhouse Gas Inventory Data Explorer allows users to visualize the data underlying U.S. Inventory estimates

The full Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018 report here provides access to in-depth information on data sources and methodologies

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