

# Data Highlights

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019



## 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 2019 and includes a preliminary outlook on 2020 emissions. 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) and where appropriate, its supplements and refinements.

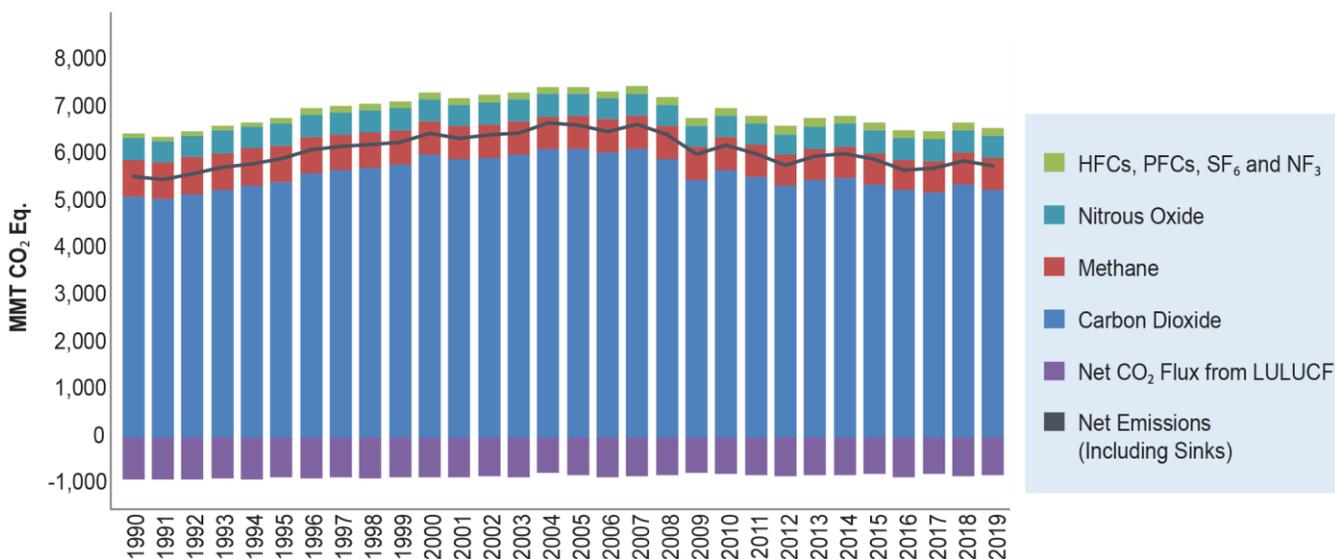
In preparing the annual Inventory, EPA collaborates with hundreds of experts representing more than a dozen U.S. government agencies, academic institutions, industry associations, consultants, and environmental organizations. EPA also collects greenhouse gas emission data from individual facilities and 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

In 2019, total gross U.S. greenhouse gas emissions were 6,558 million metric tons of carbon dioxide equivalent (MMT CO<sub>2</sub> Eq.). Net emissions (including sinks) were 5,769 MMT CO<sub>2</sub> Eq. From 2005 to 2019, net emissions declined 13 percent, reflecting the combined impacts of 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 CO<sub>2</sub>-intensive natural gas for generating electricity and a rapid increase in the use of renewable energy in the electric power sector. Between 2018 and 2019, greenhouse gas emissions decreased by almost 2 percent due to multiple factors, including a 1 percent decrease in total energy use. Net emissions in 2019 were 4 percent higher than in 1990.

### Total U.S. Greenhouse Gas Emissions by Gas

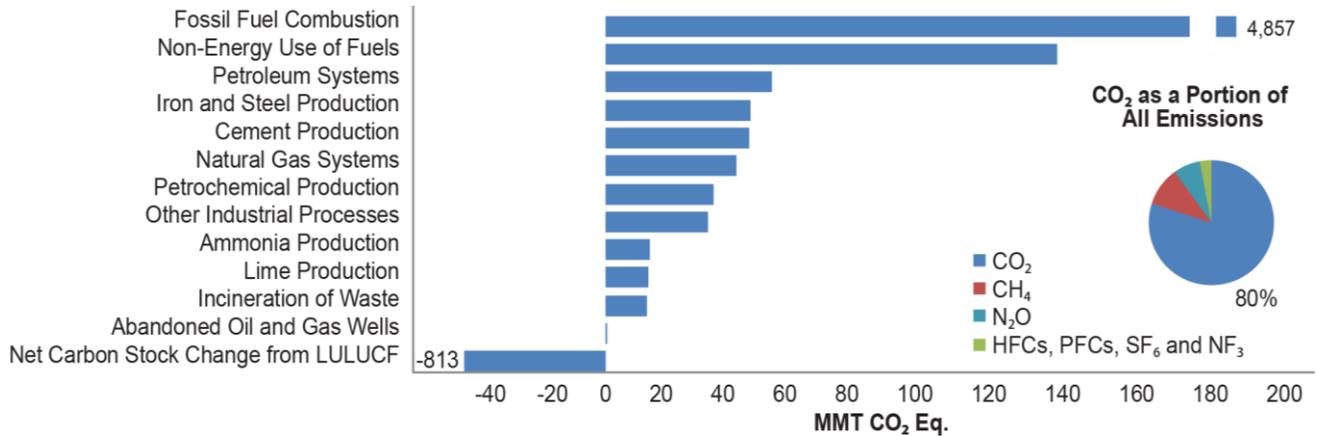


## More about Carbon Dioxide

CO<sub>2</sub> is the primary greenhouse gas contributing to total U.S. emissions, accounting for 80 percent of the total in 2019. Total CO<sub>2</sub> emissions decreased 2 percent between 2018 and 2019. In 2019, fossil fuel combustion (e.g., for electric power generation) accounted for over 92 percent of CO<sub>2</sub> emissions. Changes in CO<sub>2</sub> emissions from fossil fuel combustion are influenced by many of the same long-term and short-term factors already noted above. Fossil fuel combustion CO<sub>2</sub> emissions also depend on the type of fuel consumed (e.g., natural gas) and its carbon intensity.

Other sources of U.S. CO<sub>2</sub> emissions include non-combustion emissions from industrial processes (e.g., cement production) and changes in land use, and are shown in the figure below. 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 CO<sub>2</sub> 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 2019 and is a steady sink across the 1990 to 2019 time series. Major U.S. sinks include long-term forests and recent conversions of other land uses to forests.

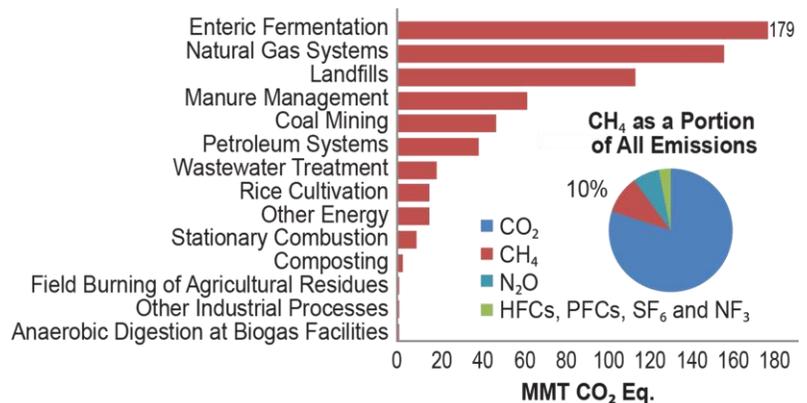
## 2019 Sources of Carbon Dioxide (CO<sub>2</sub>) Emissions



## More about Methane

CH<sub>4</sub> accounted for 10 percent of emissions and has decreased by nearly 4 percent since 2005 and 15 percent since 1990. Emissions increased by less than 1 percent from 2018 to 2019. 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.

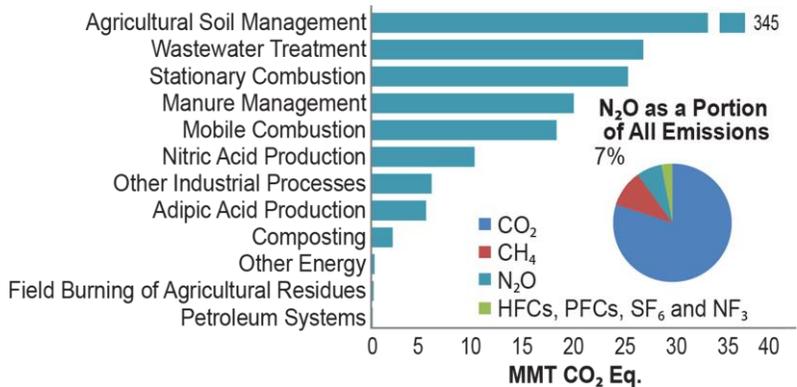
## 2019 Sources of Methane (CH<sub>4</sub>) Emissions



## More about Nitrous Oxide

N<sub>2</sub>O accounted for 7 percent of emissions and has decreased by 1 percent since 1990. Emissions decreased by less than 1 percent from 2018 to 2019. Key trends in N<sub>2</sub>O emissions are influenced by changes in emissions from agricultural soils due to interannual weather patterns, fertilizer use, and crop production; a small decrease of N<sub>2</sub>O emissions from stationary combustion; and a decrease of N<sub>2</sub>O emissions from mobile combustion due to national emission control standards and technologies for on-road vehicles.

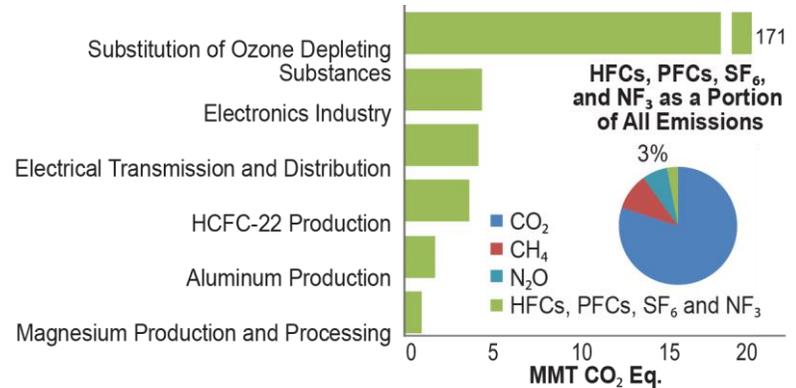
## 2019 Sources of Nitrous Oxide (N<sub>2</sub>O) Emissions



### More about Fluorinated Gases

Emissions of fluorinated gases accounted for nearly 3 percent of emissions and have increased by 26 percent since 2005 and 85 percent since 1990. Emissions increased by less than 3 percent since 2018. Key trends include a significant increase in HFCs and PFCs resulting from the substitution of ozone depleting substances (ODS) as a result of efforts to phase out CFCs and other ODS in the U.S. and increases in emissions from the electronics industry reflecting the competing influences of industrial growth and the adoption of emission reduction technologies.

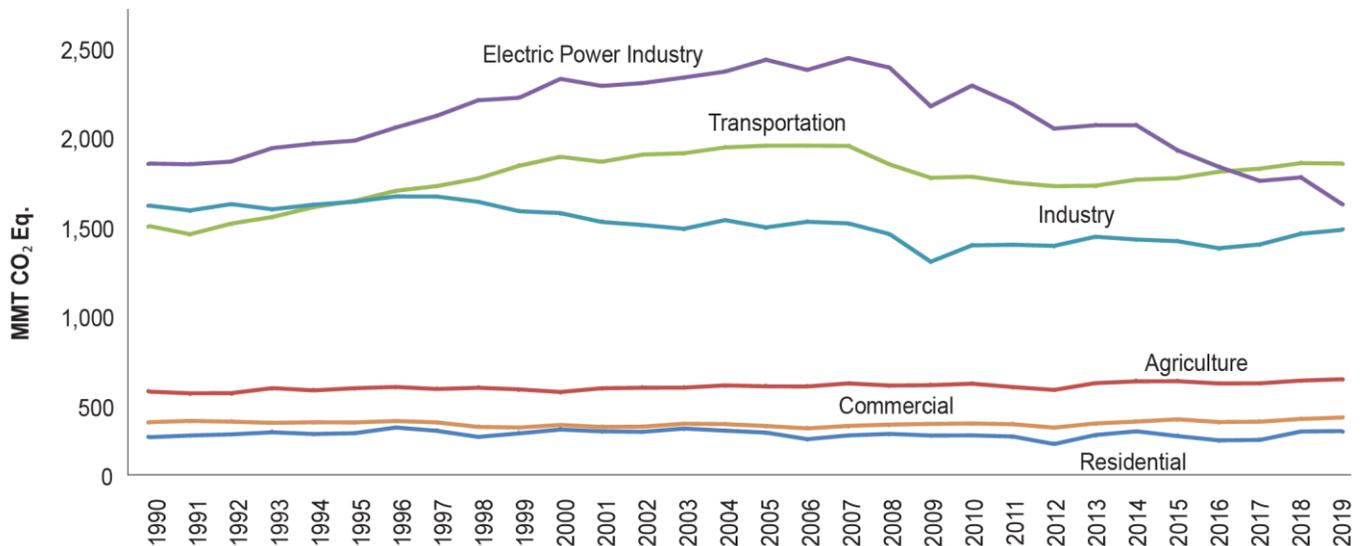
### 2019 Sources of Fluorinated (HFCs, PFCs, SF<sub>6</sub>, and NF<sub>3</sub>) Emissions



### 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\*

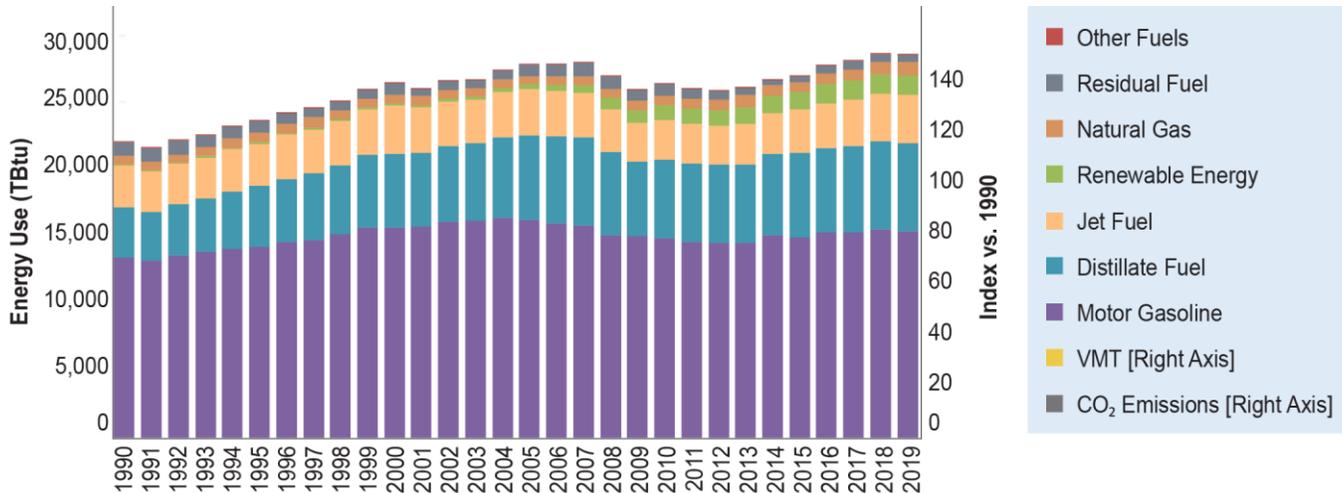


\*Land use sinks and U.S. Territories are excluded from this figure.

### Transportation Sector

Transportation activities are the largest source of emissions, accounting for 29 percent of total U.S. greenhouse gas emissions in 2019. From 1990 to 2019, transportation CO<sub>2</sub> emissions from fossil fuel combustion rose by 24 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 48 percent from 1990 to 2019; VMT by medium- and heavy-duty trucks increased 109 percent over the same period. While an increased demand for travel has led to increasing CO<sub>2</sub> emissions since 1990, improvements in average new vehicle fuel economy since 2005 has slowed the rate of increase of CO<sub>2</sub> emissions. In 2019, light-duty vehicles represented 58 percent of CO<sub>2</sub> 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 60 percent from gasoline consumption in automobiles and other highway vehicles. Diesel fuel for freight trucks and jet fuel for aircraft accounted for 25 and 10 percent of fuel consumption, respectively. The remaining 5 percent of petroleum-based energy used for transportation was supplied by natural gas, residual fuel, aviation gasoline, and liquefied petroleum gases.

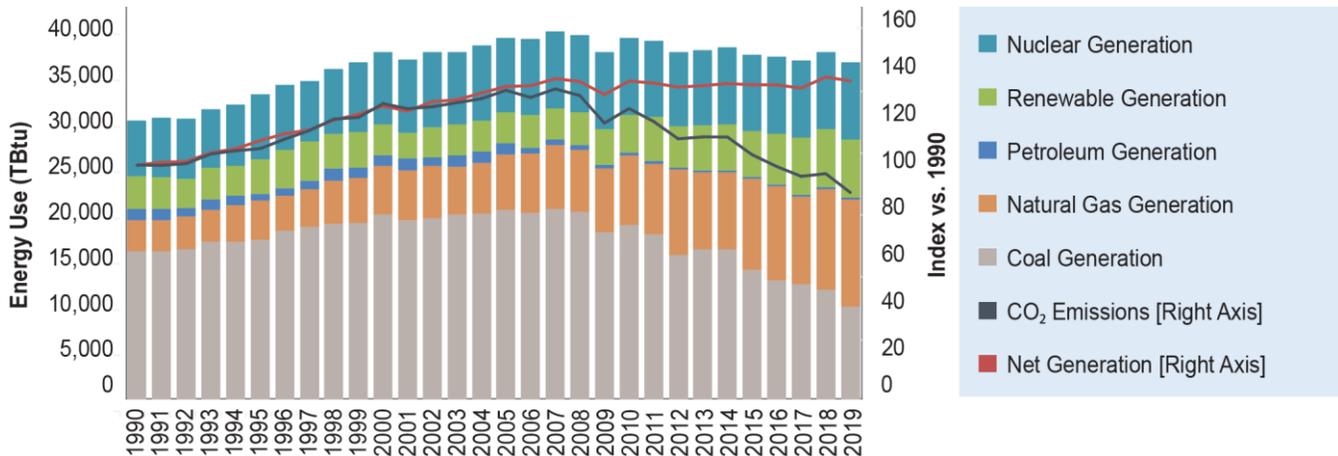
## Fuels Used in Transportation Sector, Onroad VMT, and Total Sector CO<sub>2</sub> Emissions



## Electric Power Sector

The electric power sector accounted for 25 percent of total U.S. greenhouse gas emissions in 2019. Emissions from the electric power sector have decreased by approximately 12 percent since 1990, while the carbon intensity of the electric power sector, in terms of emissions (CO<sub>2</sub> Eq.) per QBTu input, has decreased by 27 percent during that same timeframe. This decoupling of electric power generation and the resulting CO<sub>2</sub> emissions is shown below.

### Electric Power Generation and Emissions

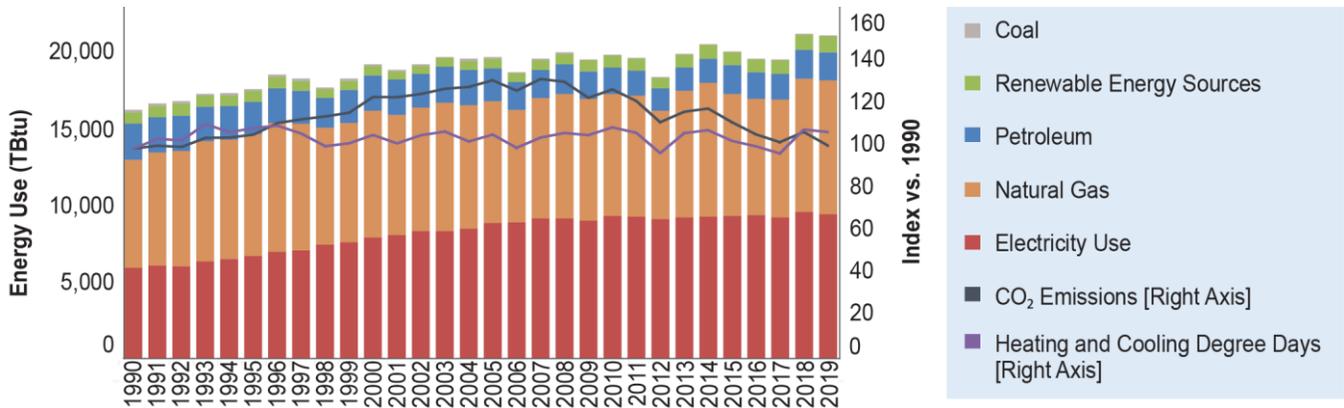


Trends in CO<sub>2</sub> emissions from fossil fuel combustion have been strongly influenced by the electric power sector, which until recently has accounted for the largest share of these emissions. The types of fuel consumed to produce electricity have changed in recent years. Total electric power generation decreased by 1.3 percent from 2018 to 2019. However, CO<sub>2</sub> emissions decreased 8.4 percent from 2018 to 2019 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 52 percent since 2005. The decrease in coal-powered electricity generation and increase in natural gas and renewable electricity generation have contributed to a 33 percent decrease in overall CO<sub>2</sub> emissions from electric power generation from 2005 to 2019.

## Commercial and Residential Sectors

The commercial and residential sectors accounted for 7 and 6 percent total U.S. greenhouse gas emissions in 2019, 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. Carbon dioxide emissions from natural gas consumption in the residential and commercial sectors increased by 0.5 percent and 0.1 percent from 2018 to 2019, respectively. This trend can be attributed to a slight increase in heating degree days (0.6 percent), which led to an increased demand for heating fuel in these sectors.

## Fuels Used in Residential and Commercial Sectors, Heating and Cooling Degree Days, and Total Sector CO<sub>2</sub> Emissions



### Industry

The industrial sector accounted for 23 percent of U.S. greenhouse gas emissions in 2019. Since 1990, industrial sector emissions have declined by 8 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 2018 and 2019, industrial sector coal consumption decreased, and natural gas consumption remained relatively flat across all industries.

### Agriculture

Agriculture accounted for about 11 percent of U.S. greenhouse gas emissions in 2019 and includes sources such as enteric fermentation in domestic livestock, livestock manure management, N<sub>2</sub>O from agricultural soil management, and combustion from agricultural equipment. In 2019, agricultural soil management was the largest source of N<sub>2</sub>O emissions, and enteric fermentation was the largest source of CH<sub>4</sub> emissions in the United States. Changes in agricultural soil carbon stocks are included in the land use sector,

## Preliminary Outlook for 2020

Carbon dioxide emissions from fossil fuel combustion represent about 74 percent of total U.S. CO<sub>2</sub> emissions. Prior to the COVID-19 pandemic, 2020 fossil fuel combustion emissions were projected to decrease by about 2 percent compared to 2019 (EIA 2020). However, the pandemic reduced economic activity and caused changes in energy demand and supply across all energy end-use sectors (EIA 2021). While the current Inventory does not include 2020 estimates, preliminary energy data are available and can be used to project energy-related CO<sub>2</sub> emissions. Preliminary 2020 data are not available for other sectors to provide projections. From 2019 to 2020, total energy use decreased by nearly 8 percent and fossil fuel combustion CO<sub>2</sub> emissions decreased by roughly 11 percent (EIA 2021). The transportation sector saw some of the biggest reductions where gasoline use decreased by 13 percent and jet fuel use decreased by 38 percent. Overall U.S. electricity use decreased by 4 percent and the trend of decreased coal use and increased use of natural gas and renewables continued (EPA 2021). Reduced economic and manufacturing activity resulted in lower energy use in the commercial and industrial sectors and there was a mixed impact on energy use in the residential sector due to stay at home orders increasing energy use combined with warmer temperatures leading to lower energy demand.

### Comparison of Fossil Fuel CO<sub>2</sub> Combustion Emission Projections

