

Data Highlights

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020



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 2020 and includes a preliminary outlook on 2021 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. For this latest release, EPA has made several important improvements. For example, EPA has added estimates for two important sources of methane: emissions from post-meter uses of natural gas, which includes leak emissions from residential and commercial appliances, industrial facilities and power plants, and natural gas fueled vehicles; and emissions from flooded lands such as hydroelectric and agricultural reservoirs. Additionally, EPA worked with researchers to include estimates of methane emissions from large anomalous leak events, such as well blow-outs.

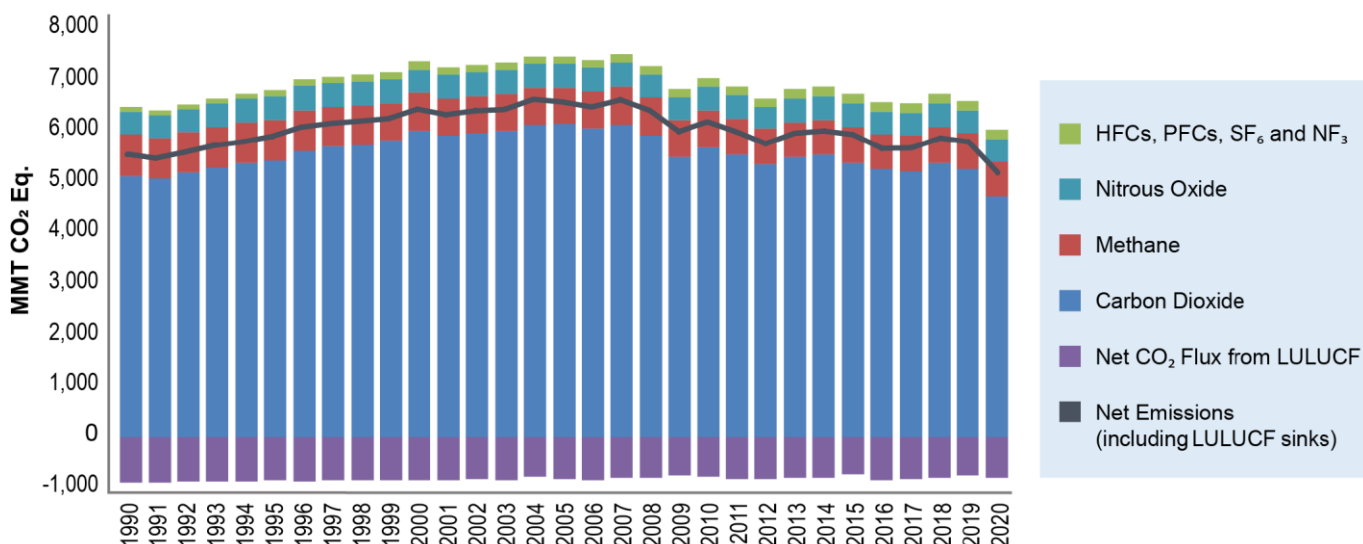
In preparing the annual Inventory, EPA collaborates with hundreds of experts representing more than a dozen U.S. government agencies, academic institutions, industry associations, consultants, and environmental organizations. EPA also collects greenhouse gas emission data from individual facilities and 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 decline since 2005

In 2020, total gross U.S. greenhouse gas emissions were 5,981 million metric tons of carbon dioxide equivalent (MMT CO₂ Eq.). Net emissions (including sinks) were 5,222 MMT CO₂ Eq. From 2005 to 2020, net emissions declined 21 percent, reflecting the combined impacts of long-term trends in many factors including population and 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. In 2020, net greenhouse gas emissions decreased by 11 percent largely due to the impacts of the coronavirus (COVID-19) pandemic on travel and economic activity. Net emissions in 2020 were 7 percent lower than in 1990.

Total U.S. Greenhouse Gas Emissions by Gas

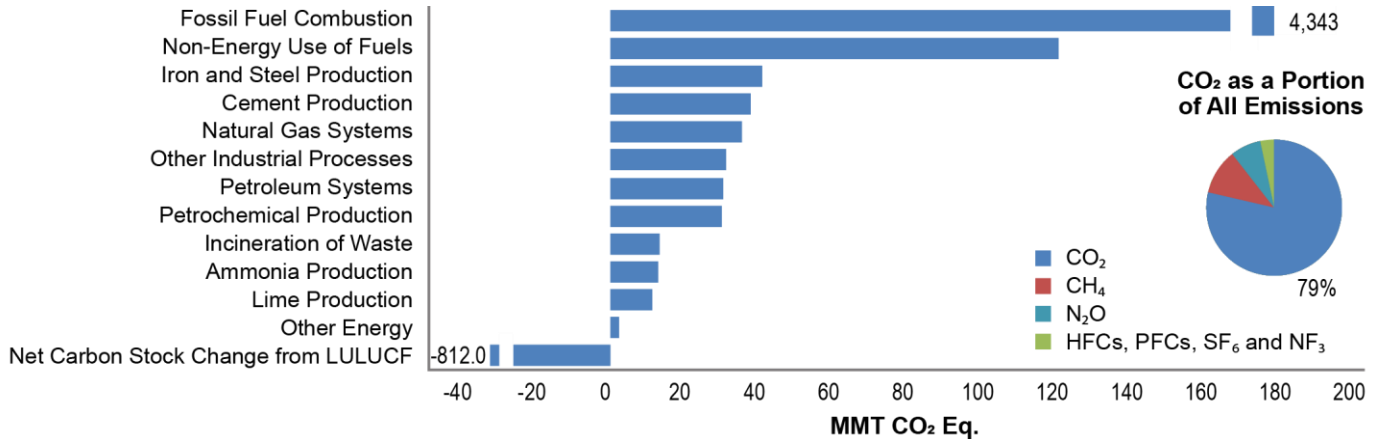


More about Carbon Dioxide

CO₂ is the primary greenhouse gas contributing to total U.S. emissions, accounting for 79 percent of the total in 2020. Total CO₂ emissions decreased 10 percent between 2019 and 2020. In 2020, fossil fuel combustion (e.g., for electric power generation) accounted for over 94 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, 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 CO₂ from the atmosphere and store it in long-term carbon sinks (e.g., through net forest growth). The LULUCF sector offset about 14 percent of total gross U.S. emissions in 2020 and is a steady sink across the 1990 to 2020 time series. Major U.S. sinks include long-term forests and recent conversions of other land uses to forests.

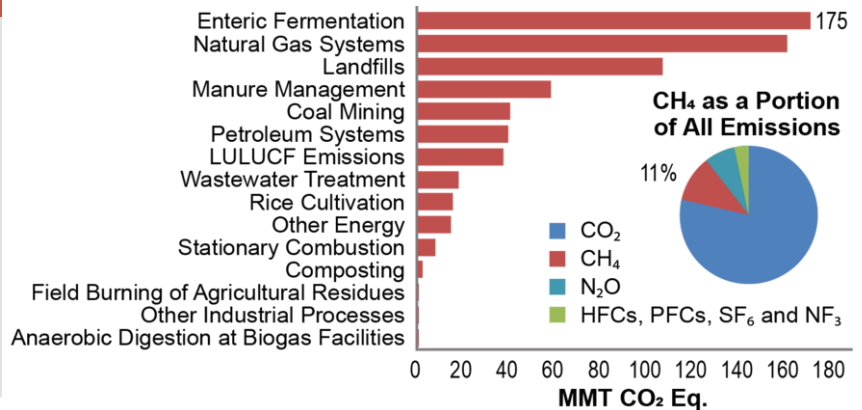
2020 Sources of Carbon Dioxide (CO₂) Emissions



More about Methane

CH₄ accounted for 11 percent of emissions and has decreased by nearly 7 percent since 2005 and 17 percent since 1990. Emissions increased by nearly 3 percent from 2019 to 2020. 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.

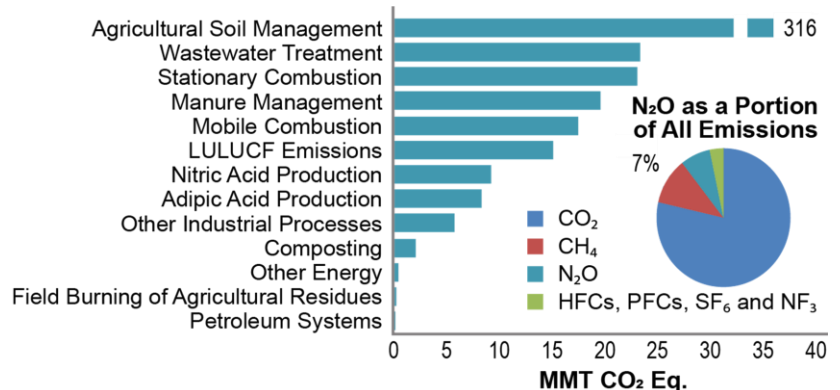
2020 Sources of Methane (CH₄) Emissions



More about Nitrous Oxide

N₂O accounted for 7 percent of emissions and has decreased by 5 percent since 1990. Emissions decreased by nearly 7 percent from 2019 to 2020. Key trends in N₂O emissions are influenced by changes in emissions from agricultural soils due to interannual weather patterns, fertilizer use, and crop production; a small decrease of N₂O emissions from stationary combustion; and a decrease of N₂O emissions from mobile combustion due to national emission control standards and technologies for on-road vehicles.

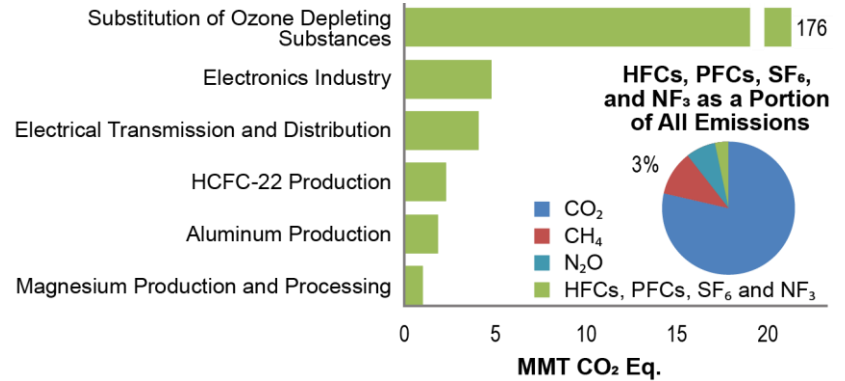
2020 Sources of Nitrous Oxide (N₂O) Emissions



More about Fluorinated Gases

Emissions of fluorinated gases accounted for nearly 3 percent of emissions and have increased by 29 percent since 2005 and 90 percent since 1990. Emissions increased by 1 percent since 2019. 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.

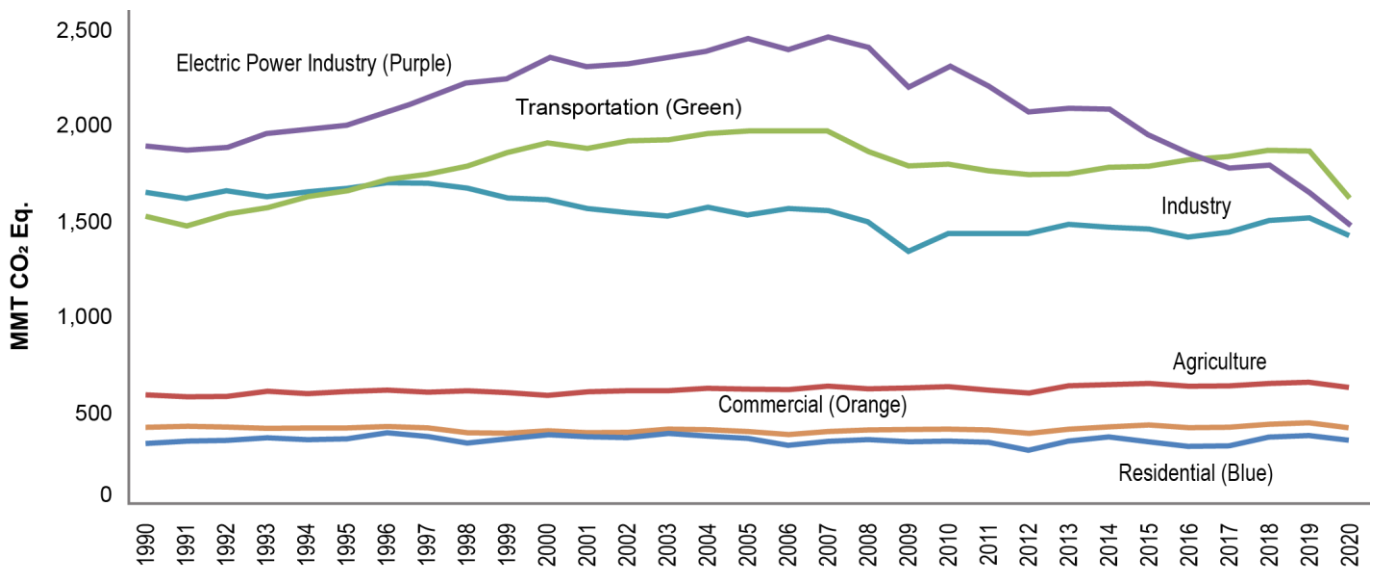
2020 Sources of Fluorinated (HFCs, PFCs, SF₆, and NF₃) Emissions



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*

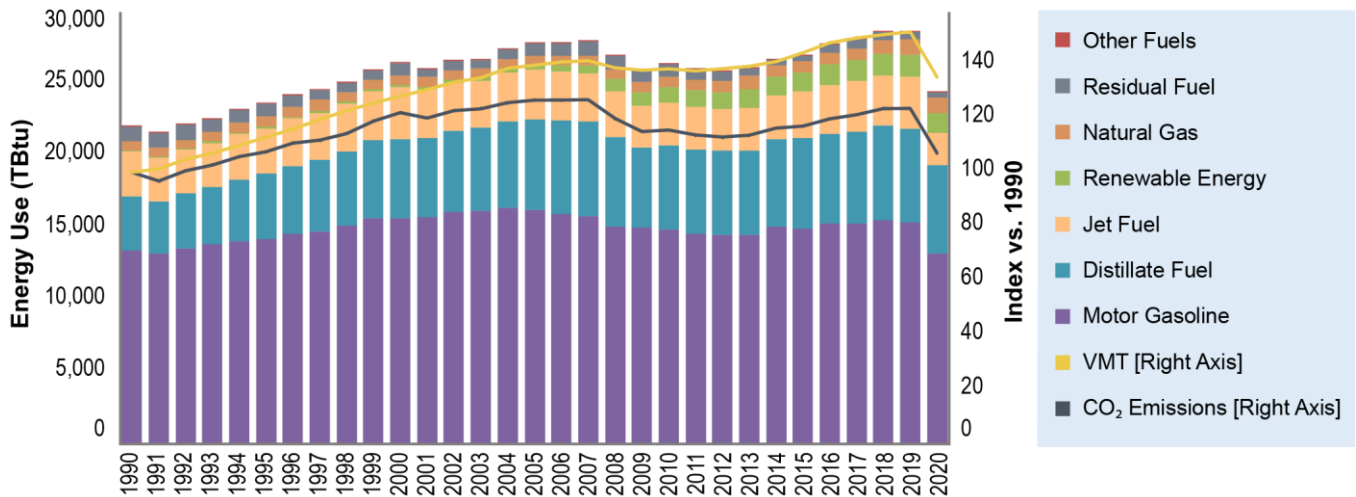


*Land use sinks and U.S. Territories are excluded from this figure.

Transportation Sector

Transportation activities are the largest source of emissions, accounting for 27 percent of total U.S. greenhouse gas emissions in 2020. From 1990 to 2020, transportation CO₂ emissions from fossil fuel combustion rose by 7 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 30 percent from 1990 to 2020; VMT by medium- and heavy-duty trucks increased 107 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 2020, light-duty vehicles represented 57 percent of CO₂ emissions from transportation fossil fuel combustion and medium- and heavy-duty trucks and buses represented 26 percent. Petroleum-based products supplied 94 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 27 and 10 percent of fuel consumption, respectively. The remaining 1 percent of petroleum-based energy used for transportation was supplied by natural gas, residual fuel, aviation gasoline, and liquefied petroleum gases. Renewable fuels account for the remaining 6 percent of energy used for transportation.

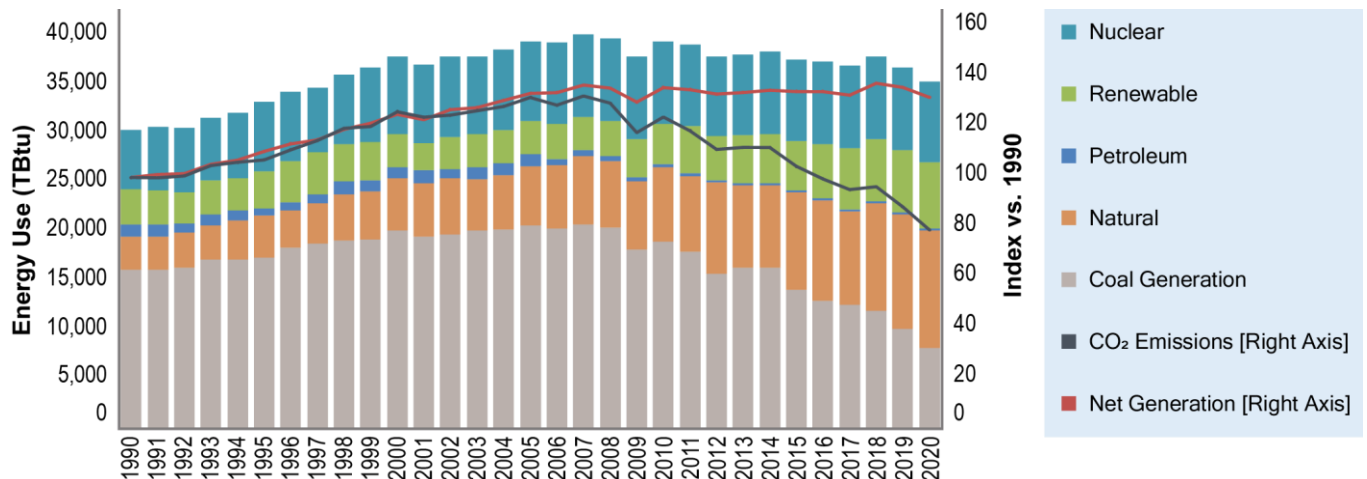
Fuels Used in Transportation Sector, Onroad VMT, and Total Sector CO₂ Emissions



Electric Power Sector

The electric power sector accounted for 25 percent of total U.S. greenhouse gas emissions in 2020. Emissions from the electric power sector have decreased by approximately 21 percent since 1990, while the carbon intensity of the electric power sector, in terms of emissions (CO₂ Eq.) per QBtu input, has decreased by 32 percent during that same timeframe. This decoupling of electric power generation and the resulting CO₂ emissions is shown below.

Electric Power Generation and Emissions

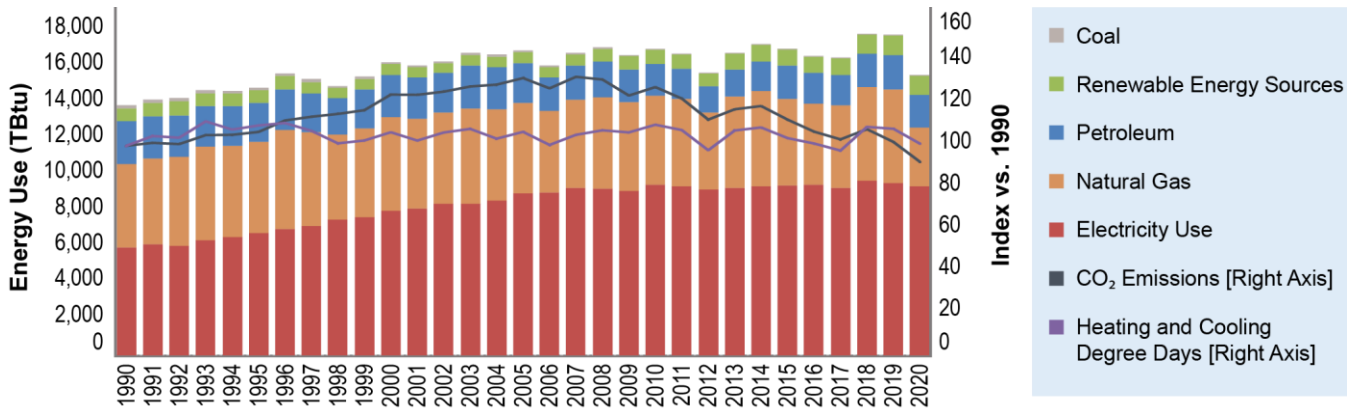


Trends in CO₂ emissions from fossil fuel combustion have been strongly influenced by the electric power sector, which until recently has accounted for the largest share of these emissions. The types of fuel consumed to produce electricity have changed in recent years. Total electric power generation decreased by 3 percent from 2019 to 2020. However, CO₂ emissions decreased 10.3 percent from 2019 to 2020 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 60.2 percent since 2005. The decrease in coal-powered electricity generation and increase in natural gas and renewable electricity generation have contributed to a 40 percent decrease in overall CO₂ emissions from electric power generation from 2005 to 2020.

Commercial and Residential Sectors

The commercial and residential sectors accounted for 7 and 6 percent total U.S. greenhouse gas emissions in 2020, 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 decreased 7 percent and 11 percent from 2019 to 2020, respectively. This trend can be attributed to a decrease in heating degree days (9 percent), which led to a decreased demand for heating fuel in these sectors.

Fuels Used in Residential and Commercial Sectors, Heating and Cooling Degree Days, and Total Sector CO₂ Emissions



Industry

The industrial sector accounted for 24 percent of U.S. greenhouse gas emissions in 2020. Since 1990, industrial sector emissions have declined by 14 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 2019 and 2020, industrial sector coal consumption and natural gas consumption decreased slightly across all industries.

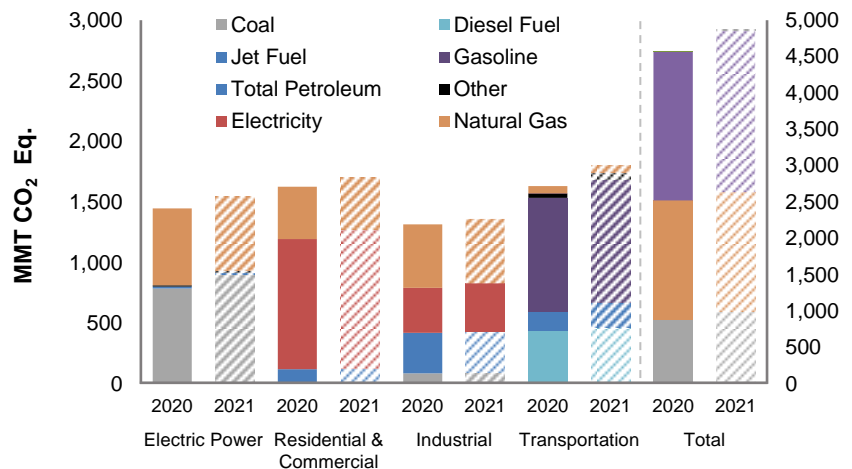
Agriculture

Agriculture accounted for about 11 percent of U.S. greenhouse gas emissions in 2020 and includes sources such as enteric fermentation in domestic livestock, livestock manure management, N₂O from agricultural soil management, and combustion from agricultural equipment. In 2020, agricultural soil management was the largest source of N₂O emissions, and enteric fermentation was the largest source of CH₄ emissions in the United States. Changes in agricultural soil carbon stocks are included in the land use sector,

Preliminary Outlook for 2021

Carbon dioxide emissions from fossil fuel combustion represent about 73 percent of total U.S. CO₂ emissions. While the current Inventory does not include 2021 estimates, preliminary energy data are available and can be used to project energy-related CO₂ emissions. Preliminary 2021 data are not available for other sectors to provide projections. The preliminary energy estimates indicate that in 2021 economic activity recovered from the 2020 COVID-19 pandemic impacts and contributed to a total energy use increase of nearly 5 percent and emissions from energy use increased by 6 percent (EIA 2021). Transportation sector emissions increased 11 percent in 2021 compared to 2020. Overall U.S. electricity use increased by 3 percent and emissions from the electric power sector increased 7 percent in part due to a reversion back to increased coal use and decreased use of natural gas. In 2021, coal use increased 16 percent, and natural gas use declined 3 percent in the electric power sector (EPA 2022). The growth in renewable sources continued with renewable energy use increasing 6 percent in 2021 (EPA 2022). Emissions from the residential and commercial and the industrial sectors increased 5 percent and 3 percent respectively.

Comparison of Fossil Fuel CO₂ Combustion Emission Projections



References

IPCC (2006) *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. The National Greenhouse Gas Inventories Programme, The Intergovernmental Panel on Climate Change, H.S. Eggleston, L. Buendia, K. Miwa, T Ngara, and K. Tanabe (eds.). Hayama, Kanagawa, Japan. Available online at: <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>

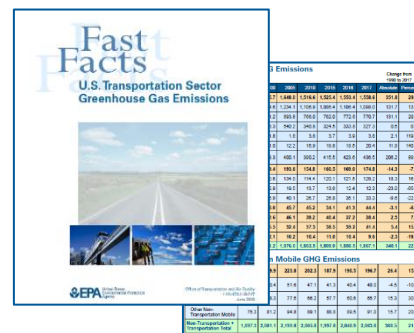
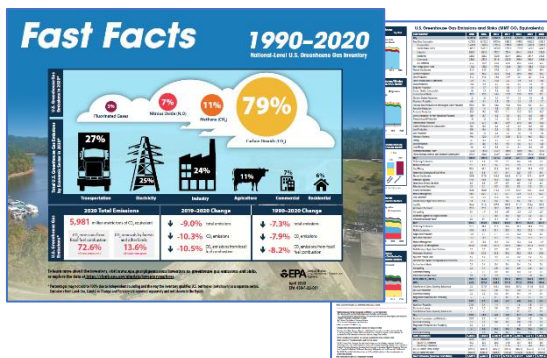
U.S. Energy Information Administration (EIA) (2022) *March 2022 Monthly Energy Review*. Available online at: <https://www.eia.gov/totalenergy/data/monthly/previous.php>

EPA (2022) Clean Air Markets: Power Plant Emission Trends. Available online at: <https://www.epa.gov/airmarkets/power-plant-emission-trends>

For More Information

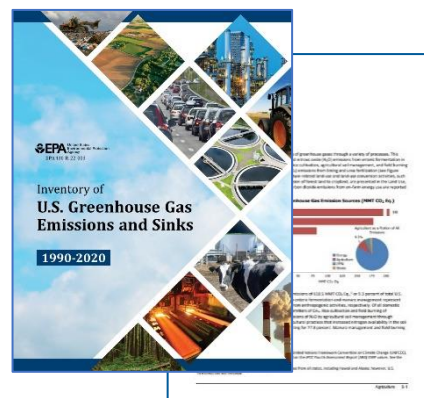
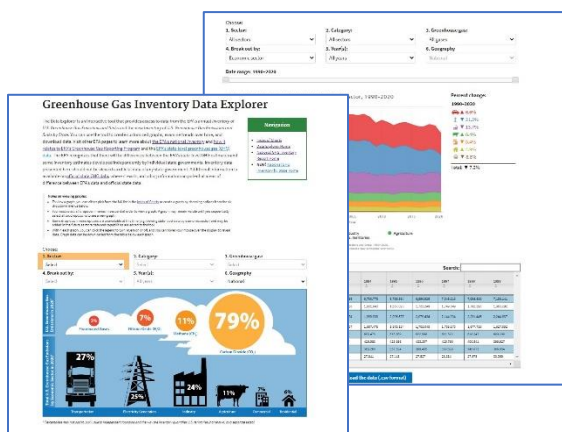
Additional resources and tools with more information and data related to the U.S. Greenhouse Gas Inventory are available at: <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>.

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: 1990-2020* report [here](#) provides access to in-depth information on data sources and methodologies



Download CSVs of the Inventory report tables for your own use

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	1994	1995	1996	1997	1998
Total	97,762	59,901,168	55,211,377	55,588,284	56,188,752	57,071,128	57,444,754	56,577,845	57,449,441	55,611,517	51,909,966	53,588,456	277,2025	267,8699	263,3774	262,5672	253,8948
Transportation	1,0855	250,0359	252,4214	248,5888	247,4442	246,9853	249,2779	252,8397	250,8707	256,0271	243,6571	245,0927	125,4154	128,2632	123,7634	132,346	149,6853
Industry	2,9535	140,1771	132,564	136,3256	129,9274	148,1317	139,6252	140,8802	123,413	125,895	106,6667	114,1591	4985,975	5037,555	5230,333	5293,913	5330,448
Buildings	51,184	77,0158	75,96447	71,14309	71,12843	72,18437	70,718	72,0775	71,11848	81,197	86,2182	88,91402	277,2025	267,8699	263,3774	262,5672	253,8948
Land Use Changes and Forestry	67,118	37,5132	36,644	37,81659	39,33303	40,83791	42,15889	41,37204	42,19085	41,99929	39,55242	42,65702	34,87819	35,10733	36,14493	35,77727	35,45948
Agriculture	42,056	62,23148	59,62693	57,38888	55,09626	51,98884	48,55994	45,93849	41,03515	37,49963	35,16869	33,7209	64,69306	65,76591	66,51952	66,60807	66,60807
Sinks	36,348	11,49317	11,77797	12,21272	12,48586	12,76276	12,85586	12,91301	13,10261	12,24498	11,65686	11,3787	12,30346	12,2622	12,2622	11,2018	11,2018
Other	01,768	6168,634	6090,369	6121,759	6174,167	6280,019	6307,95	6223,856	6291,171	6117,153	5713,886	5894,378	63,22446	64,69306	65,76591	66,51952	66,60807
Incineration of waste								8,009003	8,338733	5,910913	10,10053						
Total								5339,756	5300,775	5399,791	5496,242	5585,243	5631,396	5817,735	5887,812	5931,256	