Congressional Budget Office
Nonpartisan Analysis for the U.S. Congress

Emissions of Carbon Dioxide in the Transportation Sector

DECEMBER | 2022

At a Glance

The largest source of emissions of carbon dioxide (CO_2, the most common greenhouse gas) in the United States is the transportation sector. Emissions from transportation surpassed emissions from the electric power sector five years ago and now constitute two-fifths of domestic emissions from burning fossil fuels.

In this report, the Congressional Budget Office provides an overview of CO_2 emissions in the transportation sector, describing the sources of and trends in such emissions and projecting their future path.

- **In 2021, CO_2 emissions in the transportation sector were 6 percent less than they were in 2005.** The decline in emissions from transportation has contributed to a drop of about 20 percent in total CO_2 emissions in the United States since 2005; most of that overall reduction has come from the electric power sector.
- **Reducing emissions from transportation has been difficult because of the value that people place on transportation and the dominance of a single fuel source—petroleum.** Demand for transportation is much less sensitive to price changes than is demand for electric power, and people have had few cost-effective alternatives to motor fuels.
- **Most emissions in the transportation sector come from cars and trucks.** Motor vehicles accounted for 83 percent of CO_2 emissions from transportation in 2019. Personal vehicles and commercial trucks (the predominant forms of passenger and freight transportation) averaged more CO_2 emissions per passenger-mile or ton-mile than most other modes of transportation.
- **CO_2 emissions have declined since 2005—despite an increase in travel by car and truck—because vehicles have become more efficient.** The use of motor vehicles has expanded with economic growth, but the average fuel economy of new light-duty vehicles (cars and light-duty trucks, including sport utility vehicles, crossover utility vehicles, minivans, and pickup trucks) rose from 20 miles per gallon in 2005 to 25 miles per gallon in 2021.
- **Tighter standards for fuel economy and emissions, along with greater use of electric vehicles, are projected to reduce emissions moderately over the next decade.** CBO projects CO_2 emissions in the transportation sector to decrease by 9 percent from 2021 to 2032 as the vehicle fleet becomes increasingly efficient to comply with more stringent fuel economy standards. Sales of electric vehicles, which accounted for 4 percent of the market in 2021, are expected to grow substantially. The use of electric vehicles is expected to contribute to greater emissions reductions in future decades than it does today because the electric power sector is projected to continue to become progressively less carbon intensive.

Contents

Notes

To produce this report, the Congressional Budget Office adapted data from many sources. For a description of CBO's analytic method, see Appendix A. Citations for the figures are listed in Appendix B.

Numbers in the text and figures may not add up to totals because of rounding.

Unless this report indicates otherwise, all years referred to are calendar years.

Emissions of Carbon Dioxide in the Transportation Sector

The accumulation of greenhouse gases in the atmosphere contributes to climate change. The most prevalent of those gases, carbon dioxide (CO_2), is released when fossil fuels (such as coal, oil, and natural gas) and the derivatives of oil that are frequently used to power transportation (namely, gasoline, diesel fuel, and jet fuel) are burned. Climate change imposes costs on people and countries around the world, including the United States.

Transportation is the largest source of greenhouse gas emissions in the United States, and CO_2 emissions represent roughly 97 percent of the global warming potential of all greenhouse gas emissions from transportation.[1] Before the coronavirus pandemic, CO_2 emissions from transportation had risen (in amount and as a share of emissions) for several years.

In this report, the Congressional Budget Office provides an overview of CO_2 emissions and identifies the sources of those emissions in the transportation sector. The report also discusses factors that determine transportation-related emissions and presents the agency's projections of their path over the next 10 years.

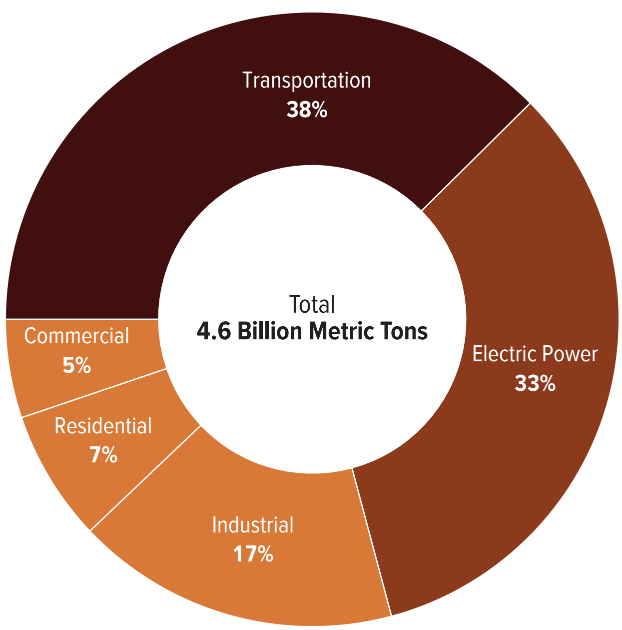
Carbon Dioxide Emissions From Transportation and Other Sectors

In 2021, worldwide emissions of greenhouse gases from all sources amounted to 40.8 billion metric tons (BMT).[2] Greenhouse gas emissions in the United States are estimated to account for almost one-sixth of that amount—6.4 BMT.[3] Of those U.S. emissions, 5.0 BMT (or 80 percent) were CO_2; methane, nitrous oxide, and other (mainly fluorinated) gases from agriculture, industry, energy production, and waste management accounted for the remaining amount.[4]

About 92 percent (or 4.6 BMT) of U.S. CO_2 emissions stemmed from burning fossil fuels to produce energy. The remaining 8 percent of those emissions were unrelated to energy production; they resulted from industrial, agricultural, and waste management processes. Historically, about 15 percent of total CO_2 emissions in the United States were offset by the net absorption of CO_2 by the nation's forests and soil.

In 2021, CO_2 emissions from transportation in the United States totaled 1.7 BMT—the most from any sector of the economy. With CO_2 emissions of 1.5 BMT, the electric power sector was the second largest source that year. (For more information about emissions in that sector, see Congressional Budget Office, *Emissions of Carbon Dioxide in the Electric Power Sector* [December 2022], www.cbo.gov/publication/58419.) Together, the remaining energy-related sources—the industrial, residential, and commercial sectors—contributed an additional 1.4 BMT.

Shares of Energy-Related Emissions of Carbon Dioxide, by Economic Sector, 2021



Emissions of carbon dioxide in the transportation sector accounted for 38 percent of energy-related emissions in the United States in 2021—the largest share of such emissions of any sector of the economy.

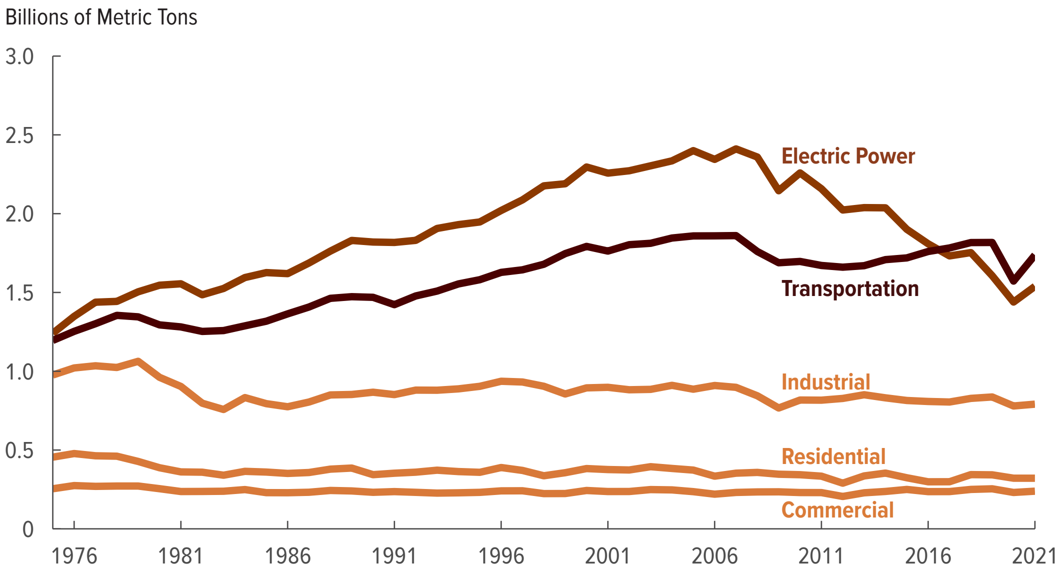
Trends in Carbon Dioxide Emissions

In 2017, CO_2 emissions from transportation, which had peaked in the mid-2000s, surpassed emissions from electric power. After the 2007–2009 recession, transportation-related emissions declined, but they had rebounded and were heading toward their prerecession peak when the pandemic hit in early 2020.

Total energy-related emissions of CO_2 in the United States peaked in 2005 and declined by about 20 percent by 2021—an average reduction of roughly 0.07 BMT per year. Three-quarters of that reduction came from the electric power sector. Emissions from the transportation sector declined by 6 percent over the same period—an average of 0.01 BMT per year. That change accounted for only one-tenth of the overall reduction in energy-related emissions. The industrial, residential, and commercial sectors were responsible for the rest of the decline.

Whereas reductions of emissions in the industrial sector may be offset by corresponding increases in emissions in other countries, reductions in the transportation sector are not likely to be. Policies that lower emissions of greenhouse gases in the United States but lead to offsetting increases in emissions elsewhere—say, by causing activity in carbon-intensive industries to shift to other countries—would leave global emissions (and thus climate change) largely unaffected.

Energy-Related Emissions of Carbon Dioxide, by Economic Sector, 1975 to 2021



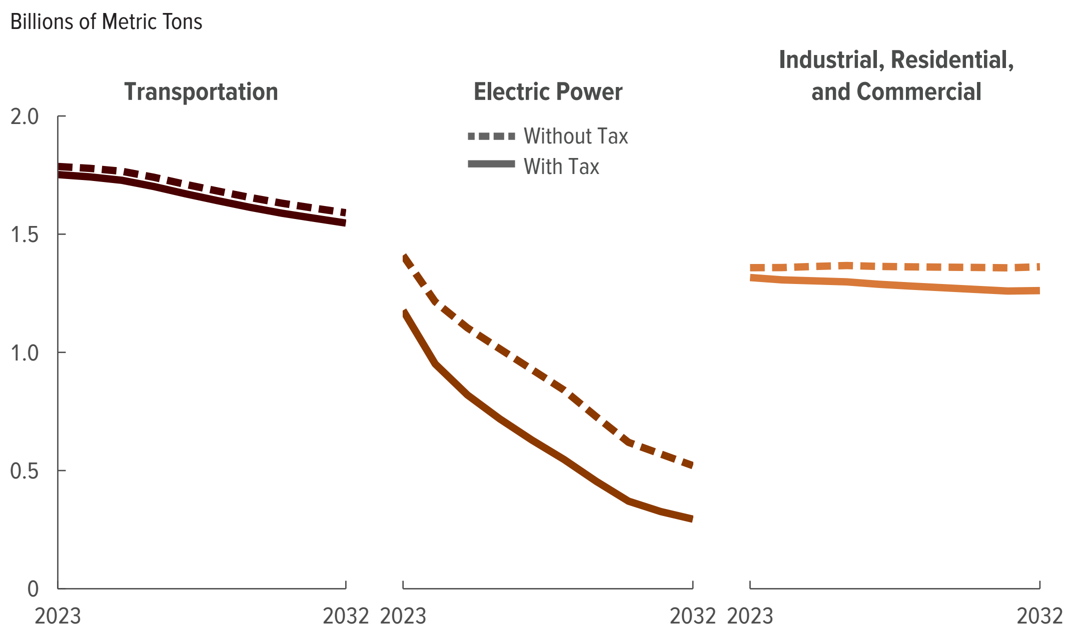
Transportation became the leading source of CO_2 emissions in the United States in 2017 after emissions in the electric power sector declined substantially.

Challenges in Reducing Emissions From Transportation

Reductions in emissions from transportation have been harder to achieve than those in the electric power sector for three main reasons. First, the demand for transportation services is not very sensitive to the price of such services. Demand for transportation is built into the places that people live, work, and socialize and the places that businesses produce and sell their goods. Those locations can change, but such change typically happens slowly. Second, the transportation sector is overwhelmingly dependent on a single fossil fuel, petroleum. Although the price of petroleum is higher than that of other fossil fuels per unit of energy (in part because of the cost of refining it into usable fuels), few cost-effective alternatives are currently available. In fact, the price of embedded CO_2 (what final users pay for energy per metric ton of CO_2 released) in the transportation sector is more than twice the price in the other sectors. Third, people tend to own vehicles for a long time, delaying the effects of improvements in the fuel efficiency of new vehicles.

The difficulty in reducing transportation emissions can be illustrated by considering the effects on different sectors of an emissions tax—for example, one that would start at $25 per metric ton and grow at an inflation-adjusted rate of 5 percent per year.[5] The transportation sector would experience a smaller reduction in CO_2 emissions than other sectors would as a result of such a tax—a 3 percent reduction compared with a reduction of 34 percent in the electric power sector and of 6 percent in the industrial, residential, and commercial sectors combined, CBO estimates.

Estimated Effects of a $25-per-Ton Tax on Energy-Related Emissions of Carbon Dioxide That Grows at an Inflation-Adjusted Annual Rate of 5 Percent, by Economic Sector



This illustrative case involving a tax on each metric ton of CO_2 emitted demonstrates one key challenge to reducing transportation emissions: Demand for transportation is much less sensitive to changes in prices than is demand for electric power, the second leading source of emissions.

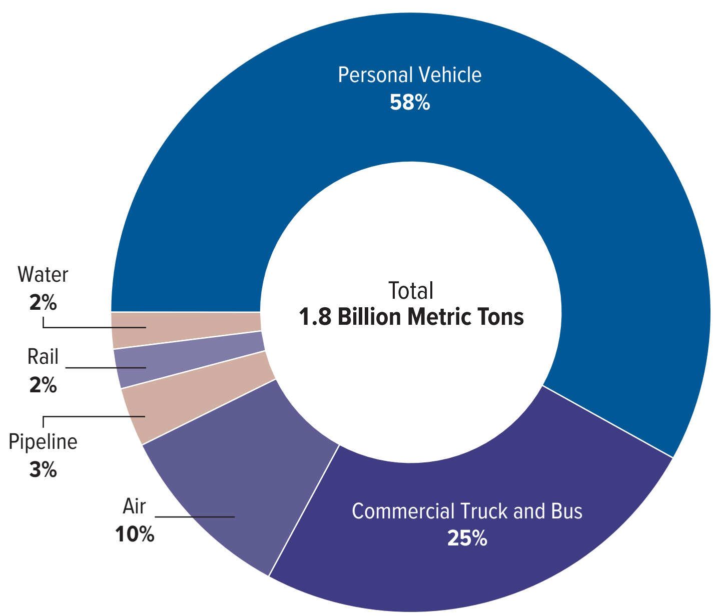
Sources of Transportation-Related Emissions

Personal vehicles—cars, light-duty trucks (including sport utility vehicles, crossover utility vehicles, minivans, and pickup trucks), and motorcycles—were responsible for 58 percent of emissions in the transportation sector in 2019. (Although data for 2020 were available, CBO used 2019 as its reference year because emissions in 2020 were affected by the coronavirus pandemic.) Emissions from commercial trucks and all buses accounted for 25 percent. Together, the following modes of transportation accounted for the remaining 17 percent: air (including commercial passenger aviation, general aviation, air cargo, and military aviation), pipelines (for which fuel is burned to power compressors that keep oil and natural gas flowing at a steady rate), rail (passenger railroads, rail transit, and freight railroads), and water (including ships and boats).

This report focuses on motor vehicles (personal vehicles as well as commercial trucks and buses) because they account for the bulk of emissions. But emissions reductions could be achieved in the other modes of transportation. For instance, improvements in aircraft design have led to emissions reductions in aviation, and alternative fuels could someday reduce emissions from other forms of transportation.

The figure below reflects all transportation regardless of whether people or goods are being transported; in the rest of this section, passenger and freight transportation are discussed separately.

Shares of Transportation-Related Carbon Dioxide Emissions, by Mode of Transportation, 2019



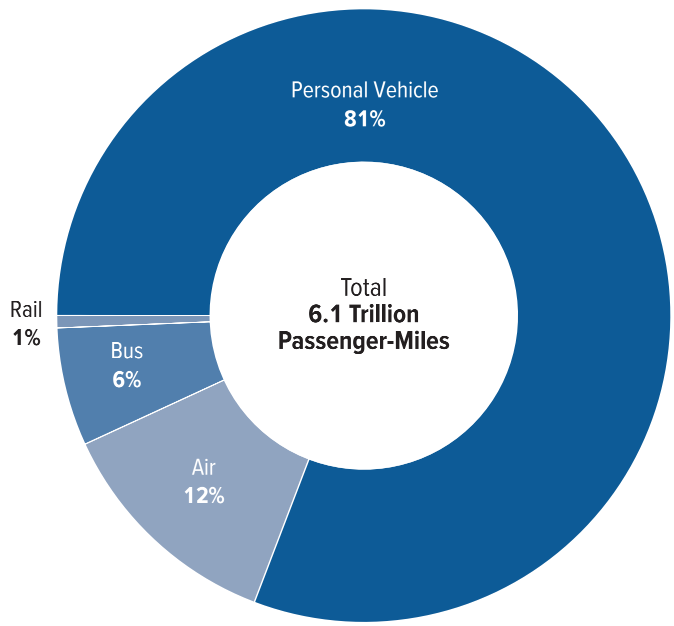
Motor vehicles—personal vehicles and commercial trucks and buses—accounted for 83 percent of emissions in the transportation sector in 2019.

Passenger Transportation

In 2019, most passenger travel—81 percent of all passenger-miles—took place in personal vehicles. (A passenger-mile represents one person traveling one mile. The Bureau of Transportation Statistics cautions that the mileage may reflect some double-counting and may exclude small amounts of self-propelled travel from walking and biking.) For long-distance travel, air travel was the primary alternative to motor vehicles; for local travel, bus and rail transit were the main alternatives.

Rail transit systems fall into two categories: heavy rail and light rail. Usually in urban centers and often underground, heavy-rail transit (commonly called a subway or metro) serves a large volume of passengers. Light-rail transit (such as streetcars and trolleys) serves fewer passengers than heavy rail and is typically at street level. Passenger railroads include Amtrak and commuter railroads, which operate on railroad tracks and typically provide service between the center of a metropolitan area and its outlying areas.

Shares of Passenger-Miles Traveled, by Mode of Transportation, 2019



Most passenger travel occurs in personal vehicles. Air, bus, and rail (including heavy- and light-rail transit and passenger railroads) account for much smaller shares of passenger travel.

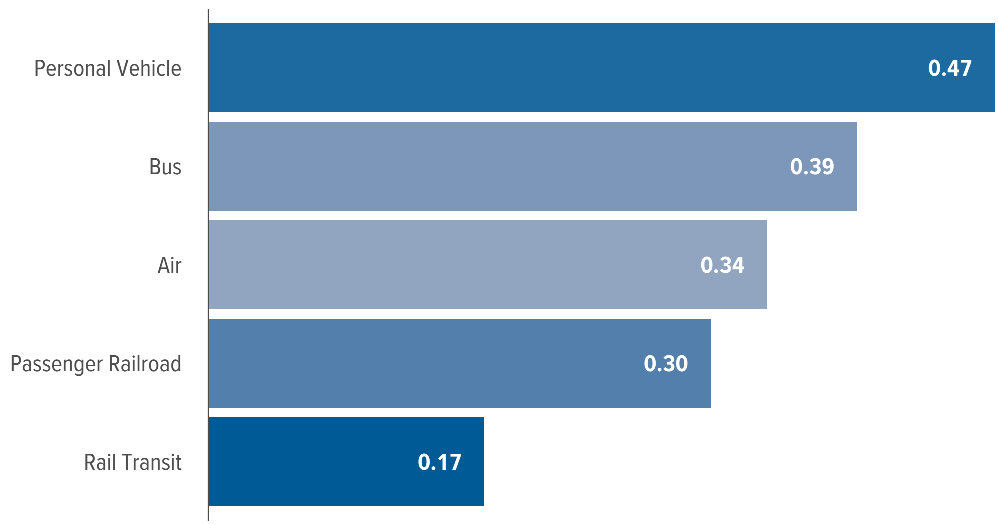
Emissions From the Different Modes of Passenger Transportation

In 2019, CO_2 emissions from personal vehicles averaged 0.47 pounds per passenger-mile.[6] Average emissions from other modes of passenger transportation—heavy- and light-rail transit, passenger railroads, commercial air travel, and bus—were all lower per passenger-mile. Emissions from bus transportation averaged 0.39 pounds of CO_2 per passenger-mile in 2019; that average encompasses several kinds of bus operations with varying emissions. Transit buses, for example, averaged 0.95 pounds per passenger-mile, largely because they often operated at only a fraction of their capacity. (Emissions per passenger-mile decline as the number of occupants increases.) Emissions of CO_2 from intercity buses (including charter buses and tour buses, which are sometimes referred to as motorcoaches) were much lower, averaging 0.15 pounds per passenger-mile, slightly less than the average for rail transit.

Traffic congestion and travel speeds, which are influenced by travel growth, can affect the efficiency with which motor vehicles burn fuel and produce emissions. An extra 0.04 BMT of greenhouse gases—about 2 percent of all transportation-related emissions—were emitted in 2019 as a result of congestion.[7]

Average Carbon Dioxide Emissions per Passenger-Mile, by Mode of Transportation, 2019

Pounds of Carbon Dioxide per Passenger-Mile



Carbon dioxide emissions per passenger-mile from travel by personal vehicles are higher on a per-mile basis than emissions from other forms of passenger travel. Heavy- and light-rail transit produce relatively few emissions per passenger-mile.

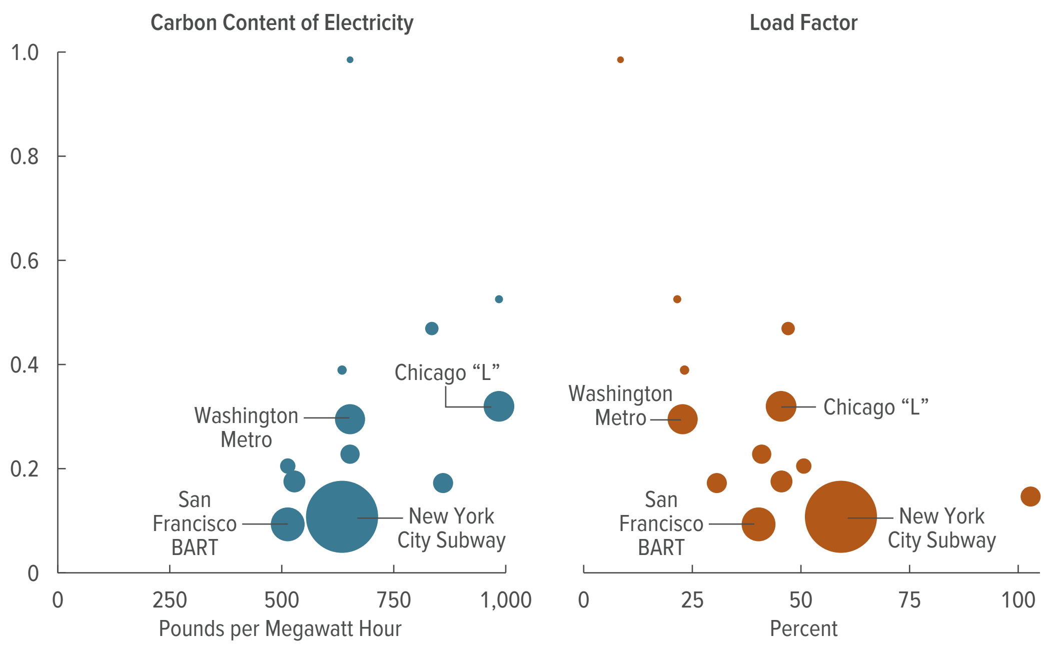
Differences in Emissions Within Modes of Passenger Transportation

Average emissions obscure substantial differences within each mode of transportation. Several factors—including vehicle size, average occupancy, the type of fuel used, and fuel efficiency—affect emissions per passenger-mile. Conventional cars typically have greater fuel economy than light duty trucks. Newer vehicles are usually more fuel efficient than older ones. And smaller vehicles get better mileage, on average, than larger ones. The most popular size car in 2020 emitted 0.60 pounds of CO_2 per vehicle mile, whereas one category of large pickup trucks built in that year had average emissions that were nearly twice that amount—1.18 pounds of CO_2 per vehicle mile.[8]

A transit system's emissions depend on the average carbon content of the electricity used to power it (that is, the amount of CO_2 released in the process of generating that electricity) as well as the system's load factor (the percentage of the system's seats that are filled, on average). Emissions from heavy-rail transit systems in 2019 varied greatly, ranging from 0.09 pounds of CO_2 per passenger-mile to 0.99 pounds. Some public transportation systems may offer frequent service and a large network of routes to provide greater mobility for their users; those offerings can reduce a system's load factor and thus increase its emissions per mile traveled.

Emissions of Carbon Dioxide From Heavy-Rail Transit Systems, by Carbon Content of Electricity and Load Factor, 2019

Pounds of Carbon Dioxide per Passenger-Mile



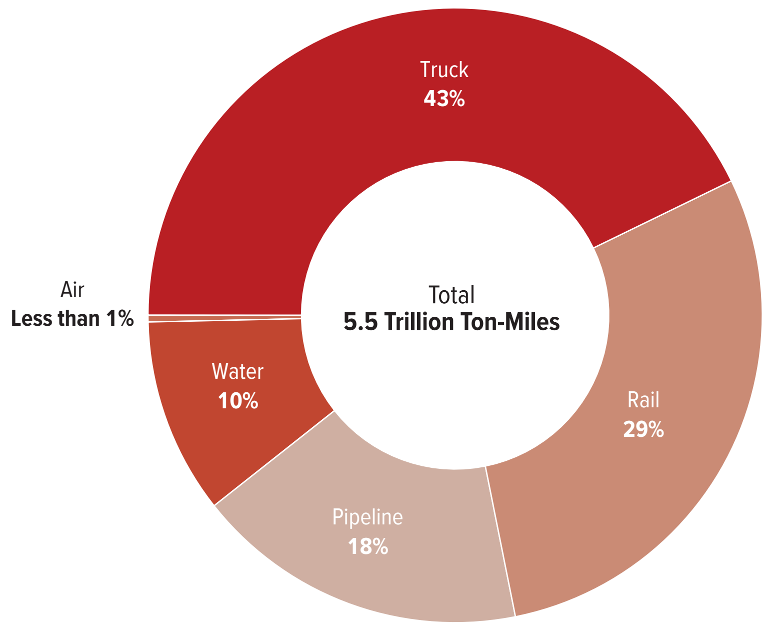
(Symbol size represents volume of passenger-miles.)

Emissions per passenger-mile can vary substantially within a particular mode. For instance, subways that use electricity with less carbon content and systems that are more heavily utilized tend to have lower emissions per passenger-mile.

Freight Transportation

Emissions from freight transportation depend on the weight of the cargo. In 2019, trucks carried 43 percent of all ton-miles; railroads, 29 percent; and pipelines and water transportation, most of the rest. (A ton-mile represents one ton of freight transported one mile.) Measured in terms of weight, air cargo accounted for less than 1 percent of freight transportation. (When the value of cargo is used instead of its weight to measure freight transportation, trucking still accounted for the largest share of such transportation. But whereas the *weight* of goods shipped by railroad exceeded that of goods shipped by air, the *value* of goods shipped by air was greater.)

Shares of Ton-Miles of Freight, by Mode of Transportation, 2019



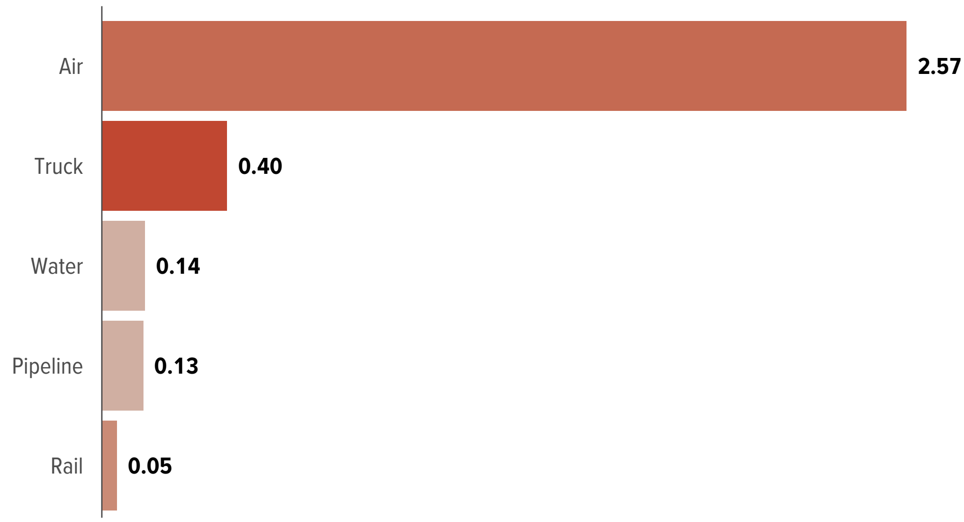
Trucking is the primary form of freight transportation, although it does not dominate freight transportation as much as motor vehicles do passenger travel.

Emissions From the Different Modes of Freight Transportation

CO_2 emissions per ton-mile from the different modes of freight transportation vary greatly—far more than those from the different modes of passenger transportation. Per ton-mile, trucking produced more CO_2 emissions, on average, than most other modes of freight transportation but far less than air cargo.

Average Carbon Dioxide Emissions per Ton-Mile of Freight, by Mode of Transportation, 2019

Pounds of Carbon Dioxide per Ton-Mile



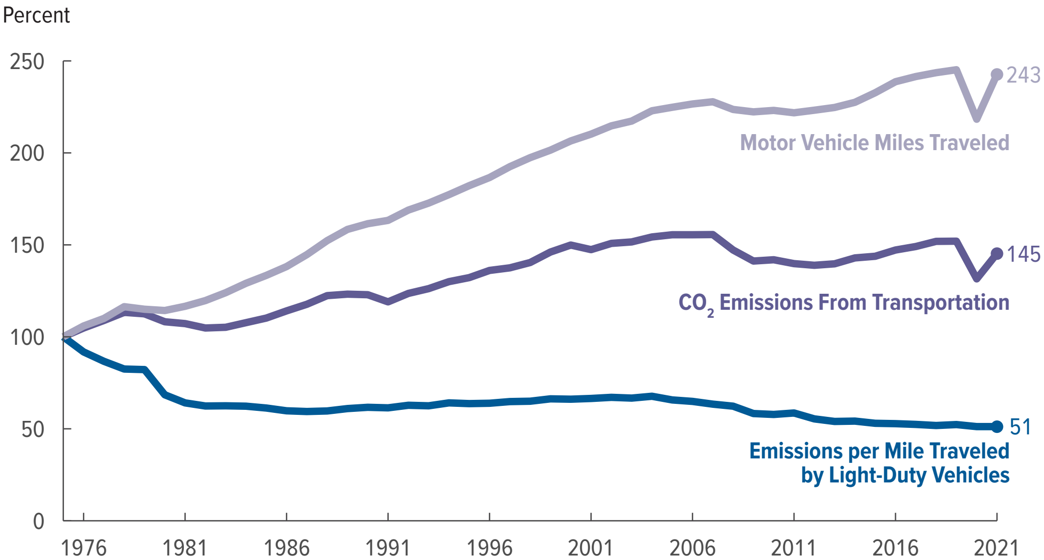
Per ton-mile, emissions from trucking, the predominant mode of freight transportation, were eight times those from rail. And emissions per ton-mile from air cargo were six times those from trucks.

Trends in Transportation Sector Emissions

Changes in the volume of motor vehicle transportation and changes in vehicles' fuel efficiency are the two factors that have most influenced emissions. In the late 1970s and early 1980s, improvements in the fuel economy of light-duty vehicles (that is, passenger cars and light-duty trucks) partially offset the substantial increase in vehicle miles traveled by road.[9] In the mid-1980s, fuel economy plateaued and then decreased slightly as consumers shifted from traditional automobiles to less efficient trucks and sport utility vehicles; as a result, emissions generally rose as highway use increased.

A two-decade stretch of travel growth from the mid-1980s to the mid-2000s stopped with the 2007–2009 recession. Because of that break in the trend and further improvements in fuel economy, transportation emissions in 2019 were slightly lower than their prerecession high. Emissions fell sharply in 2020 as a result of the pandemic but rebounded in 2021.

Emissions of Carbon Dioxide in the Transportation Sector, Motor Vehicle Miles Traveled, and Emissions per Mile Traveled by Light-Duty Vehicles Measured as a Percentage of Their Value in 1975



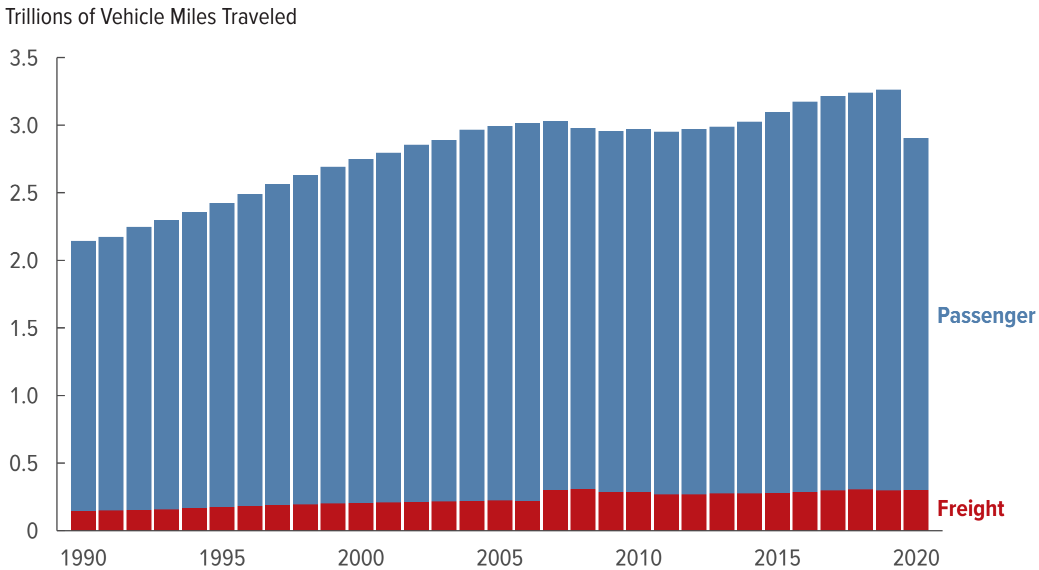
Transportation sector emissions have not risen nearly as much as vehicle miles traveled because gains in fuel economy have reduced emissions per mile of travel.

Growth in Motor Vehicle Travel

The demand for passenger and freight transportation by motor vehicle has historically not been very sensitive to the cost of such transportation and has typically declined only during economic recessions. From 1990 to the mid-2000s, vehicle miles traveled by passenger and freight motor vehicles grew steadily. The 2007–2009 recession disrupted that long-term growth: Freight transportation by truck, in particular, fell—dropping by 14 percent from 2008 to 2011—before slowly climbing back toward its 2008 level.

In 2020, the growth of motor vehicle travel was temporarily reversed by the pandemic. As economic activity slowed and people traveled less during the first year of the pandemic, the number of vehicle miles traveled by passenger motor vehicles dropped by 12 percent.

Miles Traveled by Passenger and Freight Motor Vehicles, 1990 to 2020



Measured in terms of motor vehicle miles traveled, passenger and freight transport by motor vehicle grew at similar rates in the 1990s and early 2000s. Freight transport by motor vehicle fell as a result of the 2007–2009 recession, and passenger travel dropped in 2020 during the coronavirus pandemic.

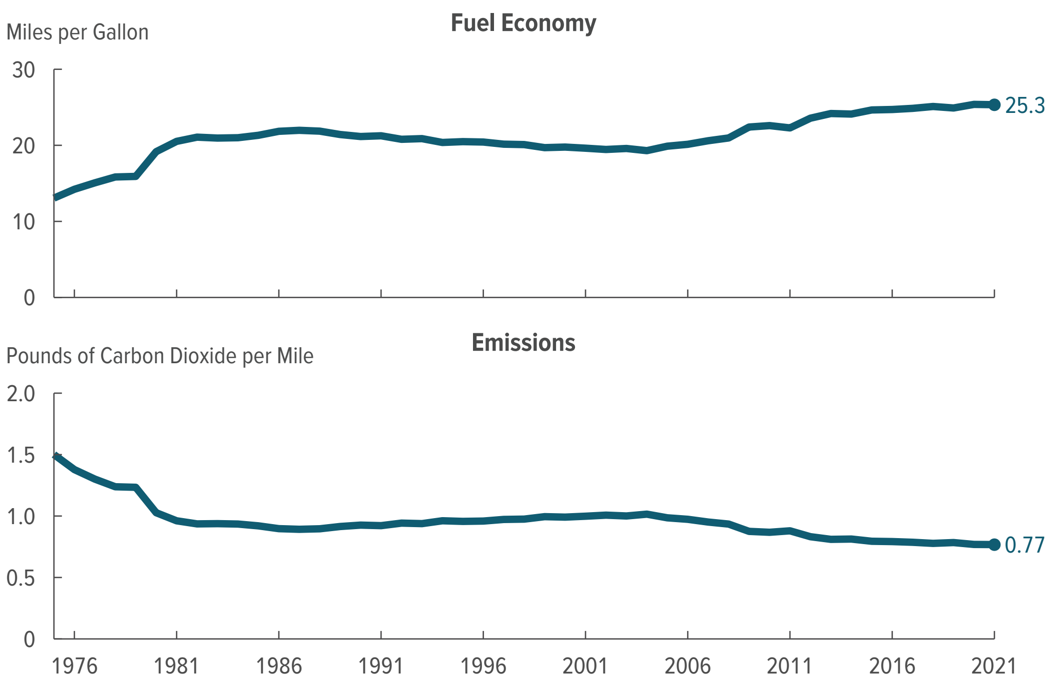
Changes in Fuel Economy

Corporate average fuel economy (CAFE) standards set by the National Highway Traffic Safety Administration (NHTSA) govern fuel consumption for light-duty vehicles. The standards require each auto manufacturer to meet annual targets for the fuel economy of its entire U.S. fleet, weighted to reflect the sales of different models. Those fleet-wide targets account for different standards for vehicles of different sizes. The fuel economy ratings that are used to determine compliance with CAFE standards are calculated using a series of laboratory tests of fuel consumption under specific conditions.

Estimated "real-world" data about fuel economy and emissions are measured using tests that incorporate a wider range of conditions than those used to determine compliance with CAFE standards. That wider range of conditions—including hot and cold weather, higher speeds, and faster accelerations—better reflects the conditions the average driver is likely to encounter. The fuel economy values found on the window stickers of new cars, which are roughly 20 to 30 percent lower than the values used to determine compliance with CAFE standards, are based on the same tests as those used for the real-world data, though the calculations of the two measures differ slightly: Highway driving is weighted more heavily in the mix of driving between city and highway conditions used to calculate the real-world measure than it is in the calculation of the sticker value.

Average real-world fuel economy for new light-duty vehicles increased from an average of 20 miles per gallon in 2005 to an average of 25 miles per gallon in 2021. (By comparison, the average fuel economy of the largest trucks in service was 6 miles per gallon in 2019.)[10] Emissions of carbon dioxide per vehicle mile for new light-duty vehicles dropped accordingly—from an average of 0.99 pounds per vehicle mile in 2005 to an average of 0.77 pounds per vehicle mile in 2021.

Real-World Fuel Economy of and Carbon Dioxide Emissions From New Light-Duty Vehicles, 1975 to 2021



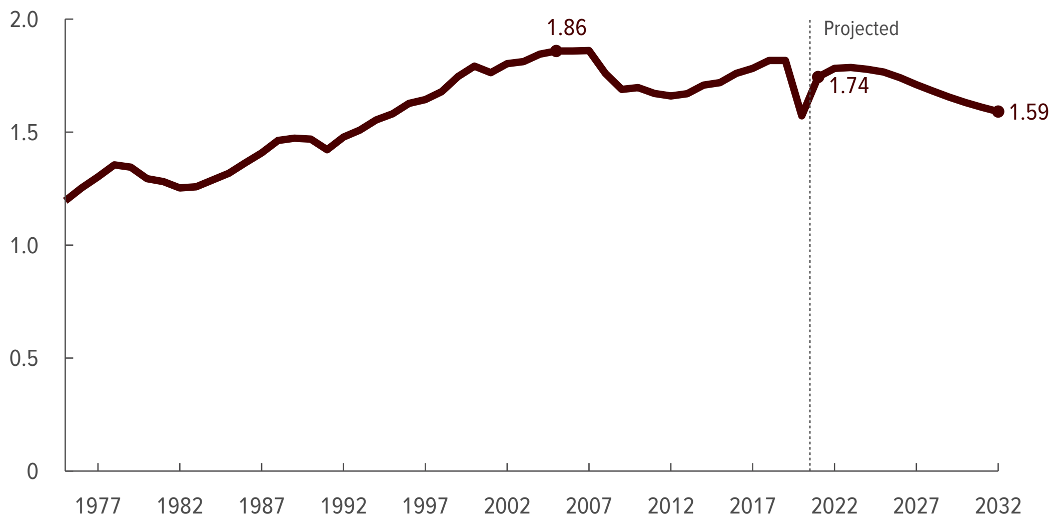
The fuel economy of new light-duty vehicles in the United States has improved by about one quarter over the past 15 years. As fuel economy improved, CO_2 emission rates fell.

Projections of Carbon Dioxide Emissions From Transportation

Drawing on estimates from the Energy Information Administration (EIA) and adjusting them for subsequent changes in relevant laws and regulations, CBO projects that transportation emissions of carbon dioxide will decline over the next decade as electric and other more fuel-efficient vehicles (including those produced in accordance with the 2022 increases to the CAFE standards for model years 2024, 2025, and 2026) constitute a larger share of the vehicle stock. The reductions in emission rates are projected to outweigh increases in vehicle miles traveled, reducing total CO_2 emissions from transportation, on net. In CBO's projections, transportation-related emissions of CO_2 fall by 9 percent from 2021 to 2032—from 1.74 BMT to 1.59 BMT, which is 15 percent less than the 1.86 BMT of such emissions produced in 2005. (For a discussion of the method that CBO used to make its projections, see Appendix A.)

Carbon Dioxide Emissions From Transportation, 1975 to 2032

Billions of Metric Tons



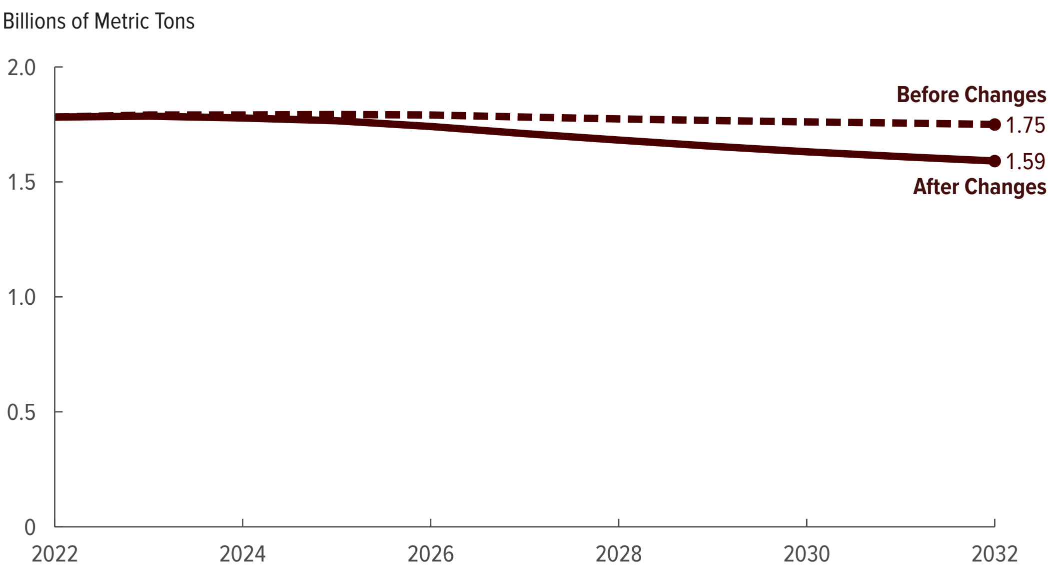
CO_2 emissions from motor vehicles are projected to decline as recent and scheduled increases in fuel economy standards for new vehicles, combined with greater use of electric vehicles, lower the average rate of emissions of vehicles over time.

Changes in Standards, Electric Vehicle Incentives, and Emissions

Increases in CAFE and greenhouse gas emissions standards and changes in incentives for purchasing electric vehicles take time to improve the average fuel economy of vehicles on the road because the stock of vehicles is replaced slowly. The average age of passenger vehicles driven in the United States is 12 years, so even several years after a new standard is adopted or electric vehicle sales are boosted, most vehicles on the road will still be older models that produce more emissions. In CBO's projections, regulatory and legislative changes adopted in 2021 and 2022 result in transportation-related CO_2 emissions in 2032 that are 0.16 BMT (or about 10 percent) lower than the agency estimates they would have been without those changes.

Federal agencies are considering additional changes to CAFE and greenhouse gas emissions standards, but those plans have not been incorporated into CBO's emissions projections because the proposals remain preliminary. In August 2022, NHTSA announced its intent to analyze the potential environmental impacts of new CAFE standards for passenger cars and light-duty trucks starting with model year 2027 and of new fuel efficiency standards for heavy-duty pickup trucks and vans starting with model year 2029. Similarly, EPA has begun work to establish new emissions standards for heavy-duty vehicles for model years 2027 through 2030 or later.

Projected Carbon Dioxide Emissions From Transportation Before and After the Changes in Fuel Economy Standards, Emissions Standards, and Incentives for Electric Vehicles That Were Adopted in 2021 and 2022



Higher fuel economy and emissions standards, combined with increases in incentives for purchasing electric vehicles, are projected to reduce transportation-related CO_2 emissions in 2032 by about 10 percent.

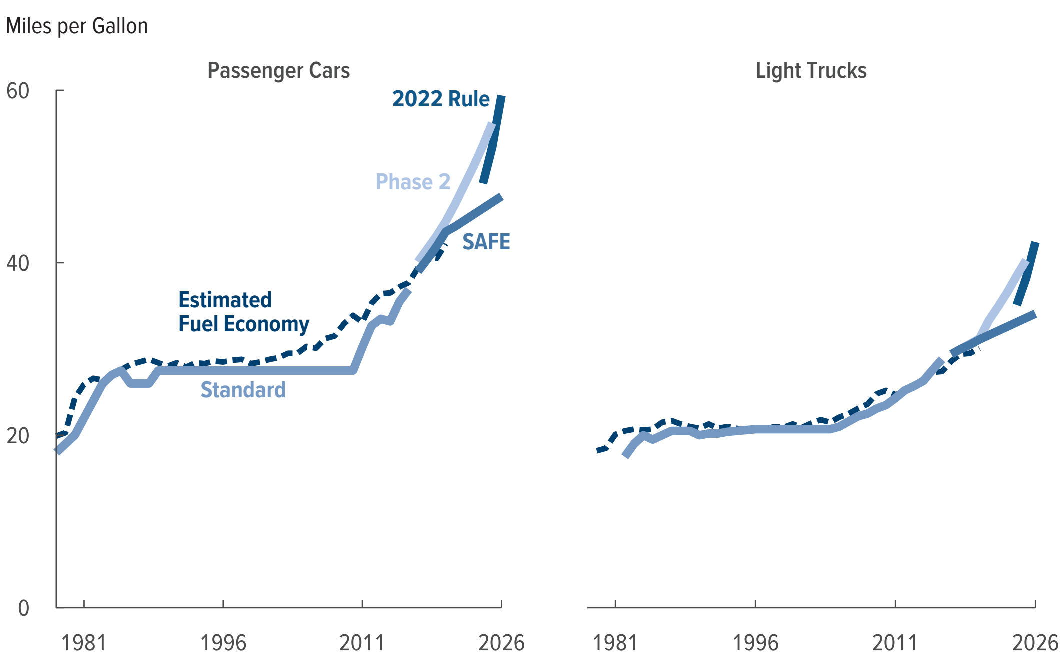
CAFE Standards

CAFE standards were first applied to model year 1978 vehicles and increased through the early 1980s. The standards remained unchanged for many years thereafter. In accordance with energy legislation enacted in 2007, the National Highway Traffic Safety Administration set higher standards, which were implemented in two phases, one for model years 2012 to 2016 and the second for model years 2017 to 2025.

Issued in 2020, the Safer, Affordable, Fuel-Efficient (SAFE) Vehicles Rule replaced those standards with lower standards: Whereas the earlier Phase 2 standards required an increase in fuel economy of about 5 percent each year, the revised standards mandated a 1.5 percent increase each year starting in 2021 and were projected to result in an industry-wide average fleet fuel economy of about 40 miles per gallon in 2026. In 2022, NHTSA raised standards once again, bringing them closer to the original Phase 2 standards by requiring increases of 8 percent annually for model years 2024 and 2025 and an increase of 10 percent for model year 2026; NHTSA projected that those new standards would result in an industry-wide fleet average (among cars and light trucks) of approximately 49 miles per gallon in 2026.

A fleet's average fuel economy depends not only on the fuel economy of each model of car and truck but also on the mix of vehicles sold. Light-duty trucks, which include popular compact sport utility vehicles, represented only half of sales of new light-duty vehicles as recently as 2013 but outsold cars 3 to 1 by 2021. (Although only standards for light-duty vehicles are shown below, NHTSA has set additional Phase 2 standards that currently apply to commercial trucks, large pickup trucks, vans, and all buses and work trucks of model years 2021 to 2027.)

CAFE Standards for and Estimated Fuel Economy of New Light-Duty Vehicles, 1978 to 2026



The 2022 increase in CAFE standards represents a substantial increase in fuel economy over the previous SAFE Rule and returns the standards closer to the earlier Phase 2 standards.

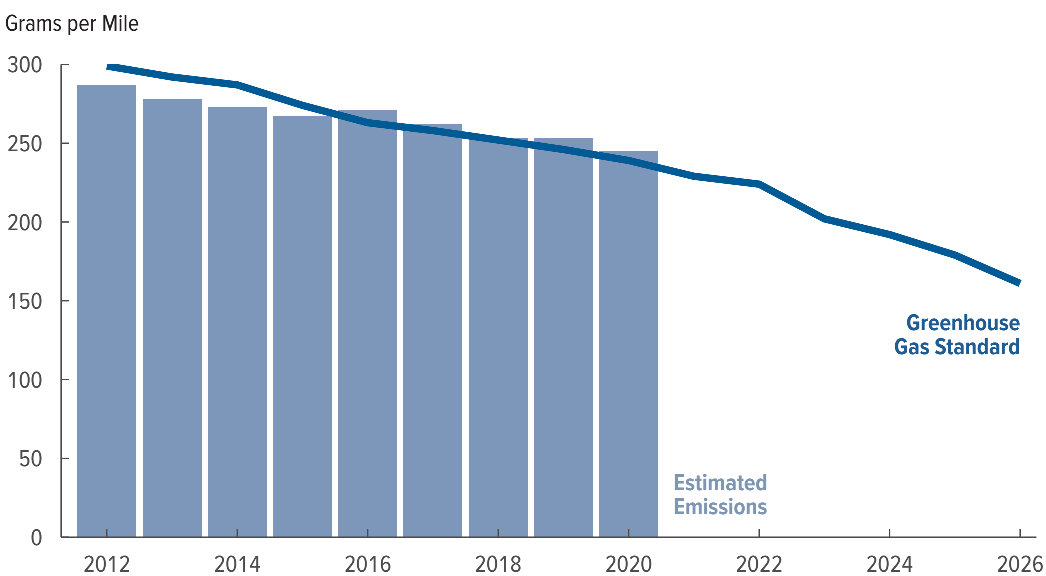
Greenhouse Gas Emissions Standards

New motor vehicles are also subject to greenhouse gas emissions standards established by the Environmental Protection Agency (EPA) under the Clean Air Act. For many years, EPA aligned its standards with NHTSA's CAFE program, but the two sets of standards diverged with the latest regulatory changes announced by the agencies for the 2023–2026 period. EPA states that the model year 2026 emissions standard of 161 grams per mile is equivalent to a 55 mile per gallon fuel economy standard if the emissions standard was met solely by reducing tailpipe emissions.[11] But manufacturers can reduce their emissions to meet the standard in a number of ways, including by producing alternative-fuel vehicles, improving the integrity and efficiency of air-conditioning systems, and implementing other technologies that improve the operating efficiency of their vehicles. (Such technologies can also be used to meet CAFE standards.) The different pathways to compliance make it difficult to determine whether the fuel economy standards or emissions standards have the greater effect on emissions; CBO expects that the changes in CAFE standards and emissions standards will have similar effects on CO_2 emissions.

The timing of changes in emissions in relation to changes in the standards is affected by a system of emissions credits. Manufacturers can earn credits by achieving lower average annual emissions than required under the standard and accumulate them for use in future years. They can also sell those credits to other automakers that would otherwise fall short of the standard. Such trading lowers the overall costs for the industry of meeting the standards. Credits can even be applied retroactively: Firms have three years in which to bank or acquire the necessary amounts to achieve compliance. (The CAFE standards program has a similar credit system.)

After accumulating a stockpile of credits in the early years of the program, manufacturers used an average of 0.02 BMT of credits per year from 2016 to 2020. As a result, vehicles of those model years will emit an average of 0.02 BMT of CO_2 more over their lifetime than the standards would suggest. A bank of 0.10 BMT of credits is expected to carry over from 2021 to 2022.

Greenhouse Gas Emissions Standards and Estimated Emissions for New Light-Duty Vehicles, 2012 to 2026



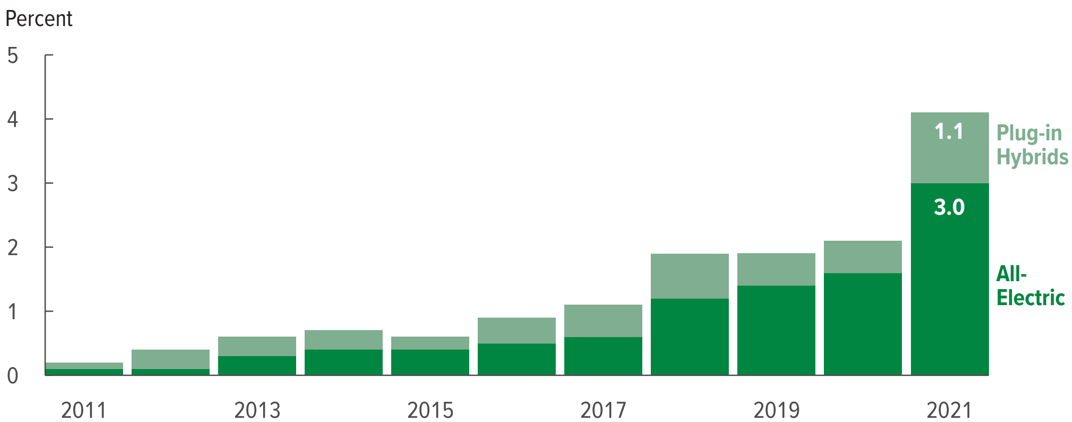
From 2012 to 2015, auto manufacturers achieved better emissions results than the EPA standard. Since then, the estimated industry-wide emission rate has exceeded the standard. In December 2021, EPA adopted more stringent standards for model years 2023 to 2026.

Demand for Electric Vehicles

Electric vehicle sales (including sales of plug-in hybrids and all-electric vehicles) have grown substantially over the past few years as the cost of batteries has declined, their storage capacity has increased, and charging infrastructure has expanded. In 2021, 610,000 light-duty electric vehicles were sold, and three-quarters of them relied entirely on electricity to operate. The number of charging stations, small for many years, roughly doubled from 2019 to 2021. About 6,600 stations offered the fastest charging rates (providing roughly 300 miles of charge in one hour and 15 minutes) in 2021.[12] (By comparison, approximately 130,000 stations sell gasoline.[13])

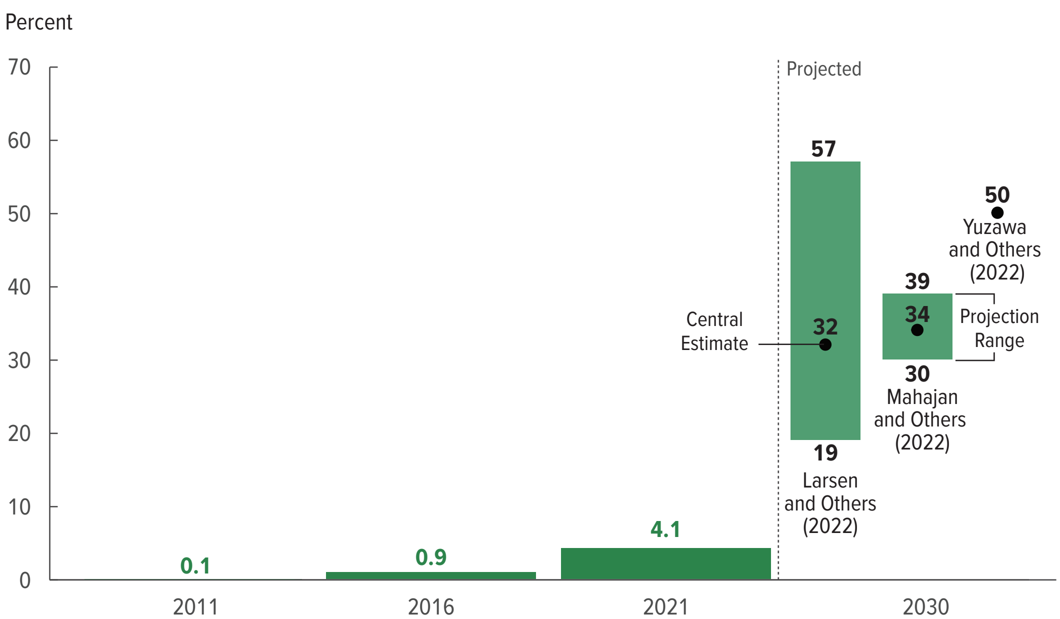
Electric vehicles are expected to make up a growing share of light-duty vehicle sales in coming years. Projections of electric vehicle sales in 2030 vary widely because federal subsidies for charging stations and electric vehicles changed in 2021 and 2022. Among the changes were up to \$7.5 billion in federal funding for new charging infrastructure and a revised income tax credit of up to \$7,500 per vehicle for buyers of qualifying plug-in electric vehicles. Many states also provide financial incentives for purchasing electric vehicles. And in California, by 2035, all new cars sold are required to be free of CO_2 emissions.

Electric Vehicles' Share of New Light-Duty Vehicle Sales, 2011 to 2021



Sales of electric vehicles jumped in 2021 to account for 4 percent of all new light-duty vehicle sales.

Electric Vehicles' Share of New Light-Duty Vehicle Sales in Recent Years and Selected Projections for 2030



Projections of the market share of electric vehicle sales in 2030 vary widely. The seven projections that CBO examined range from 19 percent to 57 percent of all new light-duty vehicle sales.

Emissions Attributable to Electric Vehicles

Even as sales of electric vehicles are expected to rise substantially, the effect of that increase on overall CO_2 emissions depends on interactions with CAFE standards and greenhouse gas emissions standards. Auto manufacturers might delay the adoption of fuel-saving and emission-reducing features or lower the prices of their non-electric offerings in response to greater sales of electric vehicles and still meet stricter fuel economy and emissions standards. Those changes could offset reductions in emissions from sales of electric vehicles.

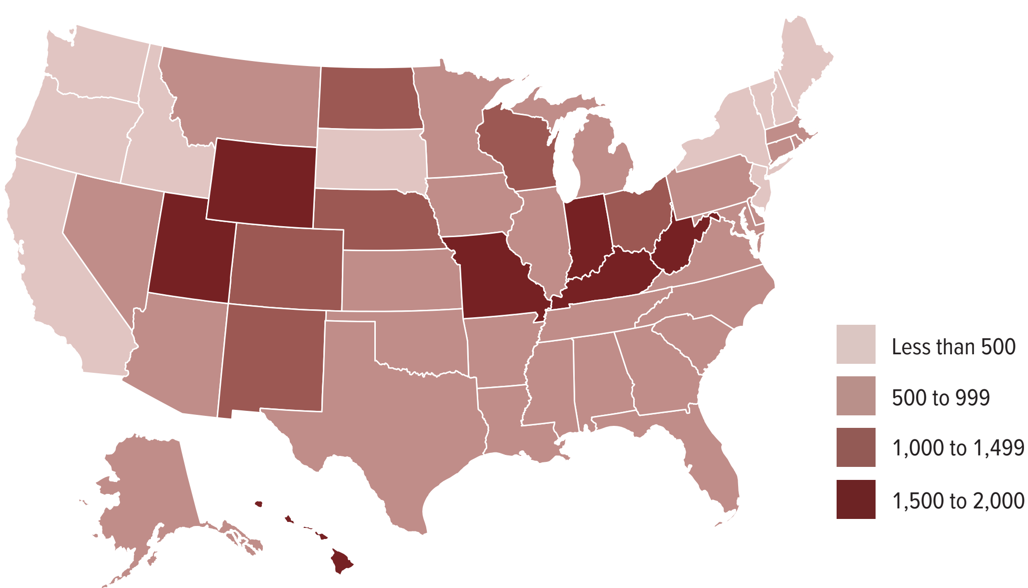
When comparing emissions from operating different types of vehicles, the emissions from producing and distributing the power to operate the vehicles are relevant. A car getting 59.4 miles per gallon (the standard for new cars in 2026) will emit about 0.33 pounds of CO_2 per mile from burning motor fuel. Producing and distributing the fuel also creates greenhouse gases. On average, those emissions add roughly 30 percent to the emissions released from the tailpipe of a light-duty vehicle.[14]

No emissions are produced by the motor of a vehicle powered by electricity. However, generating electricity results in emissions, so the reduction in emissions represented by an electric vehicle also depends on where its battery is charged. Some regions of the country have much lower CO_2 emission rates from electricity production than others. For example, in 2020, generating one megawatt-hour of electricity in the California subregion of the Western Electricity Coordinating Council resulted in an average of 514 pounds of CO_2, whereas generating the same amount of electricity in the Rockies subregion yielded 1,145 pounds of CO_2, on average.[15] Such differences can lead to substantial variation in electric vehicle emissions. For instance, a popular model of all-electric sedan powered in California in 2020 was estimated to result in emissions of 0.15 pounds of CO_2 per mile, but charged in Colorado, that same vehicle was estimated to result in 0.33 pounds of CO_2 per mile.[16]

As the generation of electricity becomes less carbon intensive in the future, emissions attributable to driving electric vehicles will decline accordingly. CBO projects that by 2030, CO_2 emissions in the electric power sector will fall to half their 2021 level.[17]

Carbon Dioxide Emission Rate per Megawatt Hour of Electricity Production, by State, 2020

Pounds of Carbon Dioxide per Megawatt Hour



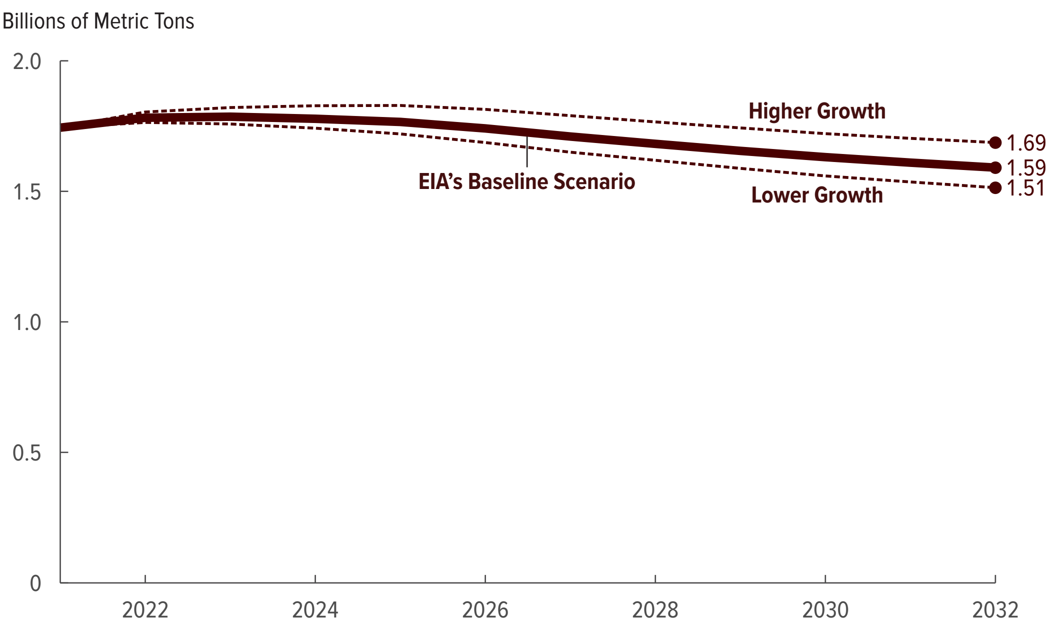
Emissions attributable to electric vehicle use depend on the emissions from generating the electricity used to power them. Some parts of the country—particularly those that use more renewables and natural gas than coal—can generate electricity with much lower CO_2 emission rates than others.

Effects of Economic Growth and Oil Prices on Future Emissions

Economic growth and the price of motor vehicle fuels affect total vehicle miles traveled and, in turn, total CO_2 emissions in the transportation sector. Growth that was faster or slower than anticipated could cause emissions to be higher or lower than projected. In 2032, if real GDP was 8 percent higher than it is in the Energy Information Agency's baseline scenario, transportation emissions would be 6 percent higher than projected, CBO estimates. If, instead, real GDP was 6 percent lower than it is in EIA's baseline scenario over that period, emissions from transportation would be 5 percent lower.

Uncertainty about oil prices is estimated to have less of an impact on transportation emissions. If higher-than-anticipated global demand for liquid fuels and lower-than-expected supply resulted in oil prices in 2032 that were roughly half what they are in EIA's baseline scenario, transportation emissions would be 2 percent higher than projected, CBO estimates. Alternatively, if oil prices in 2032 were double the projected amounts, emissions from transportation would be 1 percent lower.

CBO's Projections of Carbon Dioxide Emissions From Transportation Under Three Scenarios for Economic Growth, 2021 to 2032



Economic growth over the next decade that was higher or lower than projected could increase or decrease transportation emissions by several percent.

1. Environmental Protection Agency, "Greenhouse Gas Emissions From a Typical Passenger Vehicle," EPA-420-F-18-008, (March 2018), https://tinyurl.com/bwmm8a6s.
2. International Energy Agency, *Global Energy Review: CO_2 Emissions in 2021* (March 2022), https://tinyurl.com/mpzxthcp.
3. To estimate energy-related emissions of CO_2 and other greenhouse gases for 2021, CBO used information from Energy Information Administration, *Monthly Energy Review* (September 2022), www.eia.gov/totalenergy/data/monthly/previous.php; and Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9. To estimate non-energy-related emissions, CBO used data from Energy Information Administration, *Annual Energy Outlook 2018* (February 2018), www.eia.gov/outlooks/archive/aeo18/, that agency's most recent long-term projections from which CBO could make projections of non-energy-related emissions.
4. The contribution to warming per physical unit of gas differs for the various greenhouse gases. For simplicity, greenhouse gases are often measured in terms of metric tons of carbon dioxide equivalent, or MT CO_2e—quantities of emissions that, over a period of years (usually a century), contribute to the greenhouse effect by as much as a metric ton of CO_2. See Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.
5. For more details about the estimated effects of this illustrative emissions tax, see Congressional Budget Office, "Impose a Tax on Emissions of Greenhouse Gases," in *Options for Reducing the Deficit, 2023 to 2032—Volume I: Larger Reductions* (December 2022), www.cbo.gov/budget-options/58638.
6. One pound of carbon in a fuel, when burned, combines with oxygen to create 3.7 pounds of CO_2. A gallon of gasoline contains about 5.3 pounds of carbon, so burning that fuel releases 19.6 pounds of CO_2.
7. David Schrank and others, *2021 Urban Mobility Report* (Texas A&M Transportation Institute, 2021), https://mobility.tamu.edu/umr/report/.
8. CBO calculated those values using data from Environmental Protection Agency, *The 2021 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology Since 1975*, EPA-420-R-21-023 (November 2021) www.epa.gov/automotive-trends.
9. Light-duty vehicles include all personal vehicles except motorcycles. Light-duty vehicles are subject to fuel economy standards, but motorcycles are not.
10. Stacy C. Davis and Robert G. Boundy, *Transportation Energy and Data Book: Edition 40* (prepared by Oak Ridge National Laboratory for the Department of Energy, February 2022, updated June 2022), http://tedb.ornl.gov.
11. Environmental Protection Agency, *Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards: Regulatory Update*, EPA-420-F-21-077 (December 2021), https://tinyurl.com/27caws5n (PDF).
12. Department of Energy, "Electric Vehicle Charging Station Locations" (accessed on September 6, 2022), https://tinyurl.com/bd8f7rv.
13. NACS, "U.S. Convenience Store Count" (accessed on September 6, 2022), https://tinyurl.com/mrxvsjyz.
14. John M. DeCicco, *Factor Analysis of Greenhouse Gas Emissions From Automobiles*, Social Science Research Network working paper (December 2012), https://doi.org/10.2139/ssrn.2205144. Making gasoline available to users requires several steps: Oil must be removed from the earth, moved to a refinery, and refined into gasoline, and that gasoline must then be distributed to gas stations.
15. The California subregion's emissions are moderately low, and the Rockies subregion's emissions are moderately high; emissions can be lower or higher than those values. The California subregion of the Western Electricity Coordinating Council does not include all of the state of California, so the state average differs from the subregion average. Environmental Protection Agency, "Emissions & Generation Resource Integrated Database (eGRID) Summary Data" (accessed on September 2, 2022), www.epa.gov/egrid/summary-data.
16. Department of Energy and Environmental Protection Agency, "Beyond Tailpipe Emissions Calculator" (accessed on September 2, 2022), www.fueleconomy.gov/feg/Find.do?action=bt2. Those estimates include losses from the transmission and distribution of electricity. Losses that occur when charging electric vehicle batteries typically add an average of 12 percent to 15 percent to those amounts. See John Voelcker, "EVs Explained: Charging Losses," *Car and Driver* (April 10, 2021), https://tinyurl.com/bdhj83md.
17. Congressional Budget Office, *Emissions of Carbon Dioxide in the Electric Power Sector* (December 2022), www.cbo.gov/publication/58419.

Appendix A: Analytic Method

This appendix provides information about the method that the Congressional Budget Office used to analyze trends in energy-related emissions of carbon dioxide (CO_2).

The Environmental Protection Agency (EPA) provides information about the amount and sources of emissions of greenhouse gases in the United States.[1] In its annual inventory, EPA catalogs emissions of carbon dioxide, methane, nitrous oxide, and other greenhouse gases. Because EPA's 2022 inventory reports emissions through 2020, information about 2021 is not directly available. Although the Energy Information Administration (EIA) reports energy-related emissions of CO_2 on a sectoral basis through 2021, the agency does not publicly report non-energy-related emissions of CO_2 or emissions of other greenhouse gases. Furthermore, EIA's estimates of annual energy-related emissions of CO_2 in 2020 differ from those of EPA by about 5 percent; much of the difference is attributable to the estimates of emissions in the industrial sector.

To describe trends in energy-related emissions of CO_2 through 2021, CBO began with EPA's estimates of emissions through 2020 for each energy-using sector of the economy—transportation, electric power, industrial, residential, and commercial. Using EIA's estimates of emissions, CBO then calculated the percentage increase or decrease in the estimate of emissions in each of those sectors from 2020 to 2021.[2] To project emissions for 2021, CBO applied the percentage changes in EIA's estimates to EPA's estimates for 2020.

For projections of energy-related emissions of CO_2 in the transportation sector from 2022 to 2032, CBO applied the annual percentage change in transportation emissions between 2020 and each of those years in EIA's most recent long-term projections to EPA's 2020 estimate.[3] CBO then adjusted the resulting emissions to make them consistent with CBO's projections of gasoline use, which were revised to reflect the April 2022 change to the corporate average fuel economy (CAFE) standards for 2024 to 2026 and to account for the reconciliation legislation enacted in 2022 (Public Law 117-169), neither of which were reflected in EIA's long-term projections. To estimate the effects of the law's provisions, CBO relied on a set of studies that estimated the effects of the reconciliation act on transportation emissions in 2030.[4]

1. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.

2. Energy Information Administration, *Monthly Energy Review* (September 2022), www.eia.gov/totalenergy/data/monthly/previous.php.

3. Energy Information Administration, *Annual Energy Outlook 2022* (March 2022), www.eia.gov/outlooks/aeo.

4. John Larsen and others, *A Turning Point for U.S. Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act* (Rhodium Group, August 2022), https://tinyurl.com/2yddcr26; and Megan Mahajan and others, *Updated Inflation Reduction Act Modeling Using the Energy Policy Simulator* (Energy Innovation, August 2022), https://tinyurl.com/yhcrc4n5.

Appendix B: Data Sources for Figures

Shares of Energy-Related Emissions of Carbon Dioxide, by Economic Sector, 2021

Congressional Budget Office, using data from Energy Information Administration, *Monthly Energy Review* (September 2022), www.eia.gov/totalenergy/data/monthly/previous.php; and Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.

Energy-Related Emissions of Carbon Dioxide, by Economic Sector, 1975 to 2021

Congressional Budget Office, using data from Energy Information Administration, *Monthly Energy Review* (September 2022), www.eia.gov/totalenergy/data/monthly/previous.php; and Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.

Estimated Effects of a $25-per-Ton Tax on Energy-Related Emissions of Carbon Dioxide That Grows at an Inflation-Adjusted Annual Rate of 5 Percent, by Economic Sector

Ron Gecan, *How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update*, Working Paper 2021-16 (Congressional Budget Office, December 2021), www.cbo.gov/publication/57580.

Shares of Transportation-Related Carbon Dioxide Emissions, by Mode of Transportation, 2019

Congressional Budget Office, using data from Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.

Shares of Passenger-Miles Traveled, by Mode of Transportation, 2019

Congressional Budget Office, using data from Bureau of Transportation Statistics, *National Transportation Statistics 2021* (November 2021), Table 1-40, www.bts.gov/topics/national-transportation-statistics.

Average Carbon Dioxide Emissions per Passenger-Mile, by Mode of Transportation, 2019

Congressional Budget Office, using data from Bureau of Transportation Statistics, *National Transportation Statistics 2021* (November 2021), Table 1-40, www.bts.gov/topics/national-transportation-statistics; Stacy C. Davis and Robert G. Boundy, *Transportation Energy and Data Book: Edition 40* (prepared by Oak Ridge National Laboratory for the Department of Energy, February 2022, updated June 2022), http://tedb.ornl.gov; and Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.

Emissions of Carbon Dioxide From Heavy-Rail Transit Systems, by Carbon Content of Electricity and Load Factor, 2019

Congressional Budget Office, using data from Federal Transit Administration, "National Transit Database (NTD) Data," (accessed on September 6, 2022), www.transit.dot.gov/ntd/ntd-data, and methods from Federal Transit Administration, *Public Transportation's Role in Responding to Climate Change* (January 2010), https://rosap.ntl.bts.gov/view/dot/17277.

Shares of Ton-Miles of Freight, by Mode of Transportation, 2019

Congressional Budget Office, using data from Bureau of Transportation Statistics, *National Transportation Statistics 2021* (November 2021), Table 1-50, www.bts.gov/topics/national-transportation-statistics.

Average Carbon Dioxide Emissions per Ton-Mile of Freight, by Mode of Transportation, 2019

Congressional Budget Office, using data from Bureau of Transportation Statistics, *National Transportation Statistics 2021* (November 2021), Table 1-50, www.bts.gov/topics/national-transportation-statistics; and Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.

Emissions of Carbon Dioxide in the Transportation Sector, Motor Vehicle Miles Traveled, and Emissions per Mile Traveled by Light-Duty Vehicles Measured as a Percentage of Their Value in 1975

Congressional Budget Office, using data from Bureau of Transportation Statistics, *National Transportation Statistics 2021* (November 2021), Table 1-35, www.bts.gov/topics/national-transportation-statistics; Energy Information Administration, *Monthly Energy Review* (September 2022), www.eia.gov/totalenergy/data/monthly/previous.php; and Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9, and *The 2021 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology Since 1975*, EPA-420-R-21-023 (November 2021), www.epa.gov/automotive-trends.

Miles Traveled by Passenger and Freight Motor Vehicles, 1990 to 2020

Congressional Budget Office, using data from Bureau of Transportation Statistics, *National Transportation Statistics 2021* (November 2021), Table 1-35, www.bts.gov/topics/national-transportation-statistics.

Real-World Fuel Economy of and Carbon Dioxide Emissions From New Light-Duty Vehicles, 1975 to 2021

Congressional Budget Office, using data from Environmental Protection Agency, *The 2021 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology Since 1975*, EPA-420-R-21-023 (November 2021), www.epa.gov/automotive-trends.

Carbon Dioxide Emissions From Transportation, 1975 to 2032

Congressional Budget Office, using data from Energy Information Administration, *Monthly Energy Review* (September 2022), www.eia.gov/totalenergy/data/monthly/previous.php, and *Annual Energy Outlook 2022* (March 2022), www.eia.gov/outlooks/aeo/; and Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.

Projected Carbon Dioxide Emissions From Transportation Before and After the Changes in Fuel Economy Standards, Emissions Standards, and Incentives for Electric Vehicles That Were Adopted in 2021 and 2022

Congressional Budget Office, using data from Energy Information Administration, *Monthly Energy Review* (September 2022), www.eia.gov/totalenergy/data/monthly/previous.php, and *Annual Energy Outlook 2022* (March 2022), www.eia.gov/outlooks/aeo/; Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9; Corporate Average Fuel Economy Standards for Model Years 2024–2026 Passenger Cars and Light Trucks, 87 Fed. Reg. 25710 (May 2, 2022); John Larsen and others, *A Turning Point for US Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act* (Rhodium Group, August 2022), https://tinyurl.com/2yddcr26; and Megan Mahajan and others, *Updated Inflation Reduction Act Modeling Using The Energy Policy Simulator* (Energy Innovation, August 2022), https://tinyurl.com/yhcrc4n5.

CAFE Standards for and Estimated Fuel Economy of New Light-Duty Vehicles, 1978 to 2026

Congressional Budget Office, using data from National Highway Traffic Safety Administration, "MY 2011–2020 Compliance Overview and Credit Flexibility Report" (accessed on July 18, 2022), https://one.nhtsa.gov/cafe_pic/home/ldreports, "Fleet Fuel Economy Performance Report" (October 15, 2019), https://tinyurl.com/yckjt9b9, and "Summary of Fuel Economy Performance (Public Version)" (December 15, 2014), https://tinyurl.com/c4dent4b (PDF); Corporate Average Fuel Economy Standards for Model Years 2024–2026 Passenger Cars and Light Trucks, 87 Fed. Reg. 25710 (May 2, 2022); The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, 85 Fed. Reg. 24174 (April 30, 2020); and 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62624 (October 15, 2012).

Greenhouse Gas Emissions Standards and Estimated Emissions for New Light-Duty Vehicles, 2012 to 2026

Congressional Budget Office, using data from Environmental Protection Agency, *Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards: Regulatory Update*, EPA-420-F-21-077 (December 2021), https://tinyurl.com/27caws5n (PDF), and *The 2021 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology Since 1975*, EPA-420-R-21-023 (November 2021), www.epa.gov/automotive-trends.

Electric Vehicles' Share of New Light-Duty Vehicle Sales, 2011 to 2021

Congressional Budget Office, using data from Bureau of Transportation Statistics, *National Transportation Statistics 2021* (November 2021), Table 1-17, www.bts.gov/topics/national-transportation-statistics; and Department of Energy, "Light-Duty Plug-in Electric Vehicle Sales in the United States Nearly Doubled From 2020 to 2021," Transportation Fact of the Week 1227 (February 28, 2022), https://tinyurl.com/2c3atdbp.

Electric Vehicles' Share of New Light-Duty Vehicle Sales in Recent Years and Selected Projections for 2030

Congressional Budget Office, using data from Bureau of Transportation Statistics, *National Transportation Statistics*, Table 1-17, www.bts.gov/topics/national-transportation-statistics; Department of Energy, "Light-Duty Plug-in Electric Vehicle Sales in the United States Nearly Doubled From 2020 to 2021," Transportation Fact of the Week 1227 (February 28, 2022), https://tinyurl.com/2c3atdbp; John Larsen and others, *A Turning Point for US Climate Progress: Assessing the Climate and Clean Energy Provisions in the Inflation Reduction Act* (Rhodium Group, August 2022), https://tinyurl.com/2yddcr26; Megan Mahajan and others, *Updated Inflation Reduction Act Modeling Using The Energy Policy Simulator* (Energy Innovation, August 2022), https://tinyurl.com/yhcrc4n5; and Kota Yuzawa and others, *Electric Vehicles: What's Next VII: Confronting Greenflation* (Goldman Sachs, March 2022), https://tinyurl.com/f8atnecb.

Carbon Dioxide Emission Rate per Megawatt Hour of Electricity Production, by State, 2020

Congressional Budget Office, using data from Environmental Protection Agency, "Emissions & Generation Resource Integrated Database (eGRID)" (accessed on June 21, 2022), www.epa.gov/egrid.

CBO's Projections of Carbon Dioxide Emissions From Transportation Under Three Scenarios for Economic Growth, 2021 to 2032

Congressional Budget Office, using data from Energy Information Administration, *Monthly Energy Review* (September 2022), www.eia.gov/totalenergy/data/monthly/previous.php, and *Annual Energy Outlook 2022* (March 2022), www.eia.gov/outlooks/aeo/; and Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*, EPA 430-R-22-003 (April 2022), https://tinyurl.com/2p8mhpe9.

About This Document

This report was prepared at the request of the Chairman of the House Committee on the Budget. In keeping with the Congressional Budget Office's mandate to provide objective, impartial analysis, the report makes no recommendations.

Chad Shirley prepared the report with contributions from Ron Gecan and guidance from Joseph Kile. David Adler, David Austin, Nicholas Chase, Ben Hopkins, Aaron Krupkin, Tess Prendergast, Robert Reese, Joseph Rosenberg, Natalie Tawil, and Susan Willie offered comments. Michael Dwyer of the Energy Information Administration and Richard Lattanzio of the Congressional Research Service commented on an earlier draft. The assistance of external reviewers implies no responsibility for the final product; that responsibility rests solely with CBO.

Jeffrey Kling and Robert Sunshine reviewed the report. Bo Peery edited it, and R. L. Rebach created the graphics and prepared the text for publication. The report is available at www.cbo.gov/publication/58566.

CBO seeks feedback to make its work as useful as possible. Please send comments to communications@cbo.gov.

Phillip L. Swagel
Director
December 2022