



Carbon Footprint

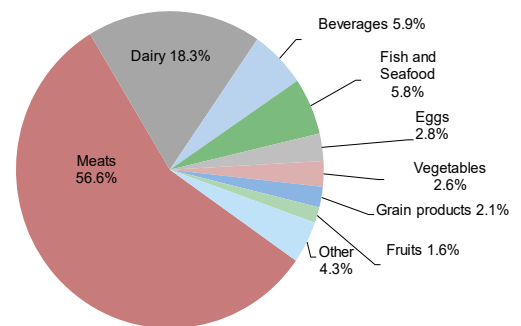
“A carbon footprint is the total greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event or product.”¹ It is calculated by summing the emissions resulting from every stage of a product or service’s lifetime (material production, manufacturing, use, and end-of-life). Throughout a product’s lifetime, or lifecycle, different GHGs may be emitted, such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), each with a greater or lesser ability to trap heat in the atmosphere. These differences are accounted for by the global warming potential (GWP) of each gas, resulting in a carbon footprint in units of mass of carbon dioxide equivalents (CO₂e). See the Center for Sustainable Systems “Greenhouse Gases Factsheet” for more information on GWP. A typical U.S. household has a carbon footprint of 48 metric tons CO₂e/yr.²

Sources of Emissions

Food

- Food accounts for 10-30% of a household's carbon footprint, typically a higher portion in lower-income households.² Production accounts for 68% of food emissions, while transportation accounts for 5%.⁴
- Food production emissions consist mainly of CO₂, N₂O, and CH₄, which result primarily from agricultural practices.⁵
- Meat products have larger carbon footprints per calorie than grain or vegetable products because of the inefficient conversion of plant to animal energy and due to CH₄ released from manure management and enteric fermentation in ruminants.⁵
- Ruminants such as cattle, sheep, and goats produced 179 million metric tons (mmt) CO₂e of enteric methane in the U.S. in 2019.⁶
- In an average U.S. household, eliminating the transport of food for one year could save the GHG equivalent of driving 1,000 miles, while shifting to a vegetarian meal one day a week could save the equivalent of driving 1,160 miles.⁵
- A vegetarian diet greatly reduces an individual’s carbon footprint, but switching to less carbon intensive meats can have a major impact as well. For example, beef’s GHG emissions per kilogram are 7.2 times greater than those of chicken.⁷

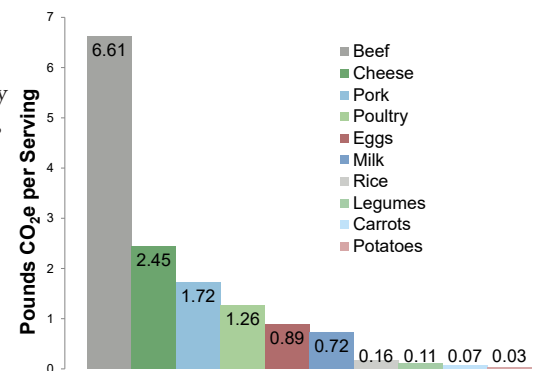
Greenhouse Gases Contribution by Food Type in Average Diet³



Household Emissions

- For each kWh generated in the U.S., an average of 0.889 pounds of CO₂e is released at the power plant.⁸ Coal releases 2.2 pounds, petroleum releases 1.9 pounds, and natural gas releases 0.9 pounds. Nuclear, solar, wind, and hydroelectric release no CO₂ when they produce electricity, but emissions are released during upstream production activities (e.g., solar cells, nuclear fuels, cement production).^{6,9}
- Residential electricity use in 2019 emitted 598.8 mmt CO₂e, 9.1% of the U.S. total.⁶
- Space heating and cooling are estimated to account for 42% of energy in U.S. homes in 2021.¹⁰
- Refrigerators are one of the largest users of household appliance energy; in 2019, an average of 672 lbs CO₂e per household was due to refrigeration.^{8,11}
- 26 mmt CO₂e are released in the U.S. each year from washing clothes. Switching to a cold water wash once per week can reduce household GHG emissions by over 70 lbs annually.¹²

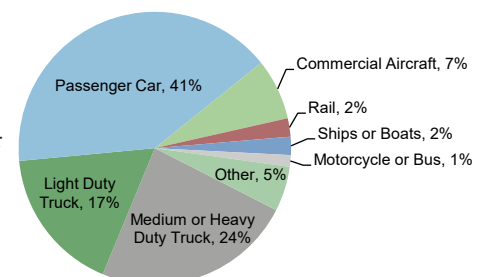
Pounds of CO₂e per Serving¹³
(4 oz. meat, 1/2 c. asparagus & carrots, 8 oz. liquids)



Personal Transportation

- U.S. fuel economy (mpg) declined by 12% from 1988-2004, then improved by 29% from 2004-2019, reaching an average of 24.9 mpg in 2019.¹⁴ Annual per capita miles driven increased 9% since 1995 to 9,919 miles in 2018.¹⁵
- Cars and light trucks emitted 1.1 billion metric tons CO₂e or 17% of the total U.S. GHG emissions in 2019.⁶
- Of the roughly 66,000 lbs CO₂e emitted over the lifetime of an internal combustion engine car (assuming 93,000 miles driven), 84% come from the use phase.¹⁶
- Gasoline releases 19.6 pounds of CO₂ per gallon when burned, compared to 22.4 pounds per gallon for diesel.¹⁷ However, diesel has 11% more BTU per gallon, which improves its fuel economy.¹⁸
- The average passenger car emits 0.78 pounds of CO₂ per mile driven.¹⁴
- Automobile fuel economy can improve 7-14% by simply observing the speed limit. Every 5 mph increase in vehicle speed over 50 mph is equivalent to paying an extra \$0.20-\$0.40 per gallon.¹⁹

Transportation Greenhouse Gases, 2019⁶

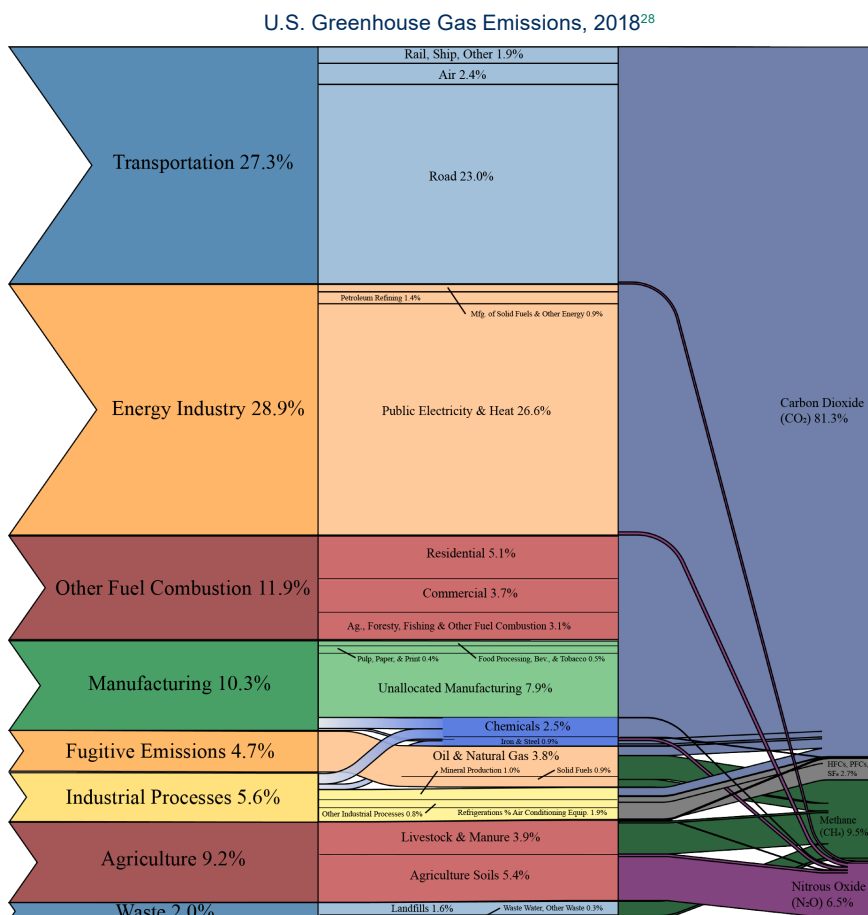


- Commercial aircraft GHG emissions vary according to aircraft type, trip length, occupancy rates, and passenger and cargo weight, and totaled 135.4 mmt CO₂e in 2019.⁶ In 2019, the average domestic commercial flight emitted 0.39 pounds of CO₂e per passenger mile.^{6,20}
- Domestic air travel fuel efficiency (passenger miles/gallon) rose by 115% from 1990 to 2019, largely due to increased occupancy.²⁰ Emissions per domestic passenger-mile decreased 45% from 1990-2019, due to increased occupancy and fuel efficiency.^{6,20}
- In 2019, rail transportation emitted 40.8 mmt CO₂e, accounting for 2% of transportation emissions in the U.S.⁶

Solutions and Sustainable Actions

Ways to Reduce Carbon Footprint

- Reduce meat in your diet and avoid wasting food.
- Walk, bike, carpool, use mass transit, or drive a best-in-class vehicle.
- Ensure car tires are properly inflated. Fuel efficiency decreases by 0.2% for each 1 PSI decrease.²¹
- Smaller homes use less energy. Average household energy use is highest in houses (82.3 million BTU), followed by mobile homes (59.8 million BTU), apartments with 2-4 units (53.5 million BTU), and apartments with 5+ units in the building (34.2 million BTU).¹¹
- Whether you hand wash dishes or use a dishwasher, follow recommended practices to decrease water and energy use and reduce emissions.²²
- Energy consumed by devices in standby mode accounts for 5-10% of residential energy use, adding up to \$100 per year for the average American household. Unplug electronic devices when not in use or plug them into a power strip and turn the power strip off.²³
- Choose energy-efficient lighting and transition away from incandescent light bulbs.²⁴
- Reduce what you send to a landfill by recycling, composting, and buying products with minimal packaging.
- Purchase items with a comparatively low carbon footprint. Some manufacturers have begun assessing and publishing their products' carbon footprints.
- Covering 80% of roof area on commercial buildings in the U.S. with solar reflective material would conserve energy and offset 125 mmt CO₂ over the structures' lifetime, equivalent to turning off 32 coal power plants for one year.^{25,26}
- Replacing the global fleet of shipping containers' roof and wall panels with aluminum would save \$28 billion in fuel.²⁷



Carbon Footprint Calculator

Estimate your personal or household greenhouse gas emissions and explore the impact of different techniques to lower those emissions:

- U.S. Environmental Protection Agency: www3.epa.gov/carbon-footprint-calculator/
- The Nature Conservancy: www.nature.org/greenliving/carboncalculator/
- Global Footprint Network: <https://www.footprintcalculator.org/>

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