

# Carbon Footprint

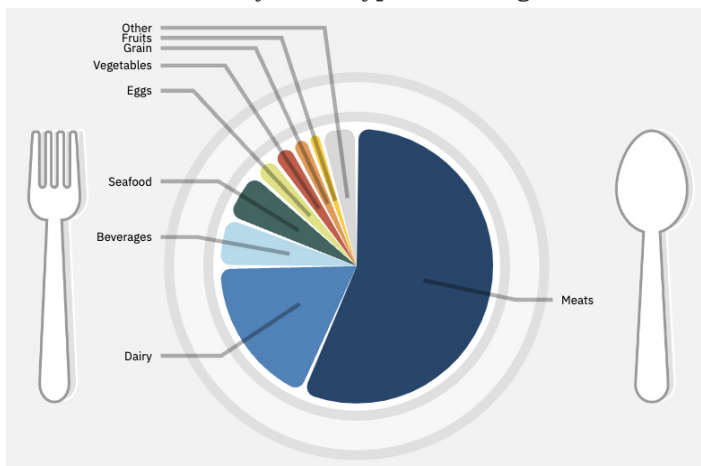
A carbon footprint is the total greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event, or product.<sup>1</sup> It is calculated by summing the emissions resulting from every stage of a product or service's lifetime (material production, manufacturing, use, and end-of-life). Throughout a product's lifetime, or lifecycle, GHGs such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O), may be emitted. Differences in heat trapping 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 (CO<sub>2</sub>e) (See the [Greenhouse Gases Factsheet](#)). A typical U.S. household has a carbon footprint of 4 t CO<sub>2</sub>e/yr,<sup>2</sup> with 16-20% occurring in other countries such as China and Canada<sup>3</sup>. On a per capita basis, GHG emissions of an individual in the U.S. (14.4 t CO<sub>2</sub>e) is triple that of the global average (4.9 t CO<sub>2</sub>e).<sup>4</sup>

## Sources of Emissions

### Food (See [U.S. Food System Factsheet](#))

- Food accounts for 10-30% of a household's carbon footprint, often a higher percentage in lower-income households.<sup>6</sup>
- Production accounts for 68% of household food emissions, restaurant, retail, and wholesale trade combined accounts for 27%, and transportation accounts for 5%.<sup>7</sup>
- Food production emissions consist mainly of CO<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub>, which result primarily from agricultural practices.<sup>8</sup>
- 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 CH<sub>4</sub> released from manure management and enteric fermentation in ruminants.<sup>8</sup>
- Livestock emitted 192.6 Mt CO<sub>2</sub>e of methane in 2022 from enteric fermentation, 137 Mt (71%) of this from beef cattle.<sup>9</sup>

### GHG Contribution by Food Type in Average Diet<sup>5</sup>



See "[Carbon Footprint Factsheet](#)" online for an interactive chart.

- In an average U.S. household, eliminating the transport of food for one year could save the GHG equivalent of driving 1,000 mi, while shifting to a vegetarian meal one day a week could save the equivalent of driving 1,160 mi.<sup>8</sup>
- 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 kg (30.4 kg CO<sub>2</sub>e) are 7.2 times greater than those of chicken (4.2 kg CO<sub>2</sub>e).<sup>10</sup>
- Diets from the top 20% of income earners accounted for 7.9 times the GHG emissions as those from the bottom 20% of diets in the U.S.<sup>5</sup>

## Household Energy

### (See [Residential Buildings Factsheet](#))

- For each kWh generated in the U.S., an average of 0.83 lbs of CO<sub>2</sub>e is released at the power plant.<sup>11</sup> Coal releases 2.25 lbs/kWh, petroleum releases 1.43 lbs/kWh, and NG releases 0.86 lbs/kWh. Nuclear, solar, wind, and hydroelectric release no CO<sub>2</sub> when they produce electricity, but emissions are released from upstream production activities (e.g., solar cells, nuclear fuels, cement production).<sup>9</sup>
- Residential electricity use in 2022 resulted in 582.2 Mt CO<sub>2</sub>e, 9.2% of the U.S. total.<sup>9</sup>
- Space heating and cooling were estimated to account for 44% of energy used in U.S. residential buildings in 2023.<sup>12</sup>
- Refrigerators are one of the largest users of household appliance energy. In 2020, an average of 686 lbs CO<sub>2</sub>e per household was due to refrigeration.<sup>13, 14</sup>
- 26 Mt CO<sub>2</sub>e are released in the U.S. each year from washing clothes.<sup>13, 14</sup> Switching to a cold water wash once per week can reduce household GHG emissions by over 70 lbs annually.<sup>15</sup>

## Personal Transportation

### (See [Personal Transportation Factsheet](#))

- U.S. fuel economy (mpg) declined by 12% from 1988-2004, then improved by 35% from 2004-2022, reaching an average of 26 mpg in 2022.<sup>16</sup>
- Annual per capita miles driven were 9,937 in 2019, an increase of 9% since 1995.<sup>17</sup> The average daily trip length for a U.S. commuter was 13.43 mi in 2022, a 17.2% increase since 2017.<sup>18</sup>
- Cars and light trucks emitted 1.03Gt CO<sub>2</sub>e or 16% of total U.S. GHG emissions in 2022.<sup>9</sup>
- Of the roughly 66,000 lbs CO<sub>2</sub>e emitted over the lifetime of an internal combustion engine car (assuming 93,000 miles driven), 84% come from the use phase.<sup>19</sup> See the [Electric Vehicle Factsheet](#) for GHG emissions from ICEVs and EVs.
- Gasoline releases 19.4 lbs CO<sub>2</sub>/gal when burned, compared to 22.5 lbs/gal for diesel.<sup>20</sup> However, diesel has 11% more BTU per gallon, which improves its fuel economy.<sup>21</sup>

- The average passenger car emitted 0.74 lbs of CO<sub>2</sub> per mile driven in 2022.<sup>16</sup>
- 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 \$0.27-\$0.54 per gallon.<sup>22</sup>
- Commercial aircraft GHG emissions, which vary by aircraft type, trip length, occupancy, and passenger and cargo weight, were 138 Mt CO<sub>2</sub>e in 2022.<sup>9</sup> The average domestic commercial flight emitted 0.43 lbs of CO<sub>2</sub>e per passenger mile.<sup>9, 23</sup>
- Domestic air travel fuel efficiency (passenger miles/gallon) increased 112% from 1990-2022 largely due to increased occupancy.<sup>23</sup> Emissions per domestic passenger-mile decreased 42.6% from 1990-2022, but the period of 2019-2021 saw a increase of 16% due to Covid restrictions.<sup>9, 23</sup>
- In 2022, rail transportation emitted 35.6 Mt CO<sub>2</sub>e, accounting for 2% of transportation emissions in the U.S.<sup>9</sup>

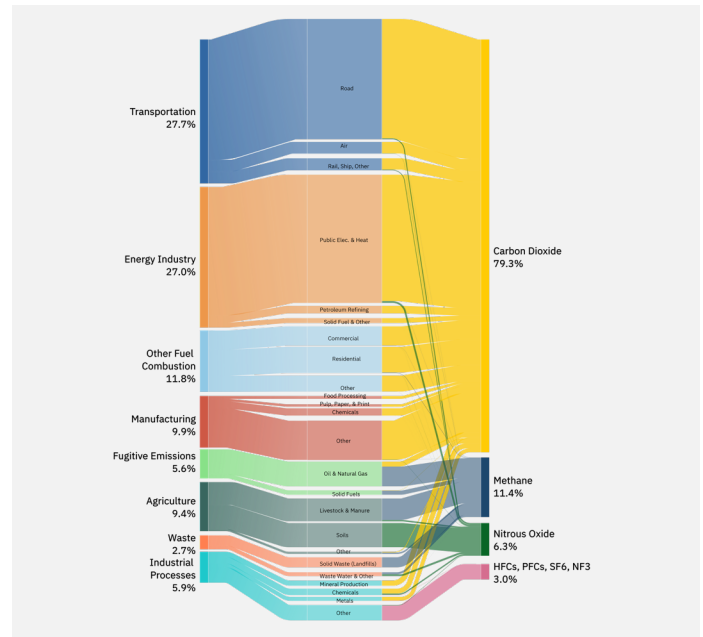
- Reduce and reuse to minimize personal waste. See the [Municipal Solid Waste Factsheet](#).
- Think green before buying. Ask yourself: Do I really need it? Can I get it used? How long will it last?<sup>30</sup>
- Reduce food waste by only buying what you need, composting food scraps, and donating unused food to food banks or shelters.<sup>31</sup> See the [U.S. Food System Factsheet](#).
- 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 Mt CO<sub>2</sub> over the structures' lifetime<sup>32</sup>, equivalent to turning off 34 coal power plants for one year<sup>33</sup>.
- Replacing the roof and wall panels on the global fleet of shipping containers with aluminum would save \$28 billion in fuel.<sup>34</sup>

## Solutions and Sustainable Actions

### Ways to Reduce Your Carbon Footprint

- Reduce meat in your diet and avoid wasting food.
- Walk, bike, carpool, use 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.<sup>24</sup>
- Smaller houses use less energy. Average energy use is highest in single-family houses (80.9M Btu), followed by mobile homes (61.3M Btu), apartments with 2-4 units (53.5M Btu), and apartments with 5+ units in the building (33.7M Btu).<sup>13</sup> Whether you hand wash dishes or use a dishwasher, follow recommended practices to decrease water and energy use and reduce emissions.<sup>25</sup>
- Energy used by electronic devices in standby mode accounts for 5-10% of residential energy use, adding up to \$100 per year for the average American household. Unplug devices or plug them into a power strip and turn the power strip off when not in use.<sup>26</sup>
- Choose energy-efficient lighting. Switching from incandescent to LED light bulbs saves an average household more than \$200/year.<sup>27, 28</sup>
- Revamp the way you heat, cool, and power your home by making it energy efficient. Through 2032, homeowners can use federal tax credits to cut energy-efficiency upgrade costs by up to 30% or \$3,200 annually, as well as receiving a 30% tax credit for clean energy equipment, such as rooftop solar, geothermal heat pumps, and energy storage.<sup>29</sup>

U.S. GHG Emissions, 2021<sup>35</sup>



See [Carbon Footprint Factsheet](#) online for full-size image.

### Carbon Footprint Calculators

- 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/](http://www3.epa.gov/carbon-footprint-calculator/)
- The Nature Conservancy: [www.nature.org/greenliving/carboncalculator/](http://www.nature.org/greenliving/carboncalculator/)
- Global Footprint Network: <https://www.footprintcalculator.org/>