MITIGATION STRATEGY: FUEL EFFICIENT CARS

The fuel efficiency of an average car is 30 miles per gallon (mpg), but the popular hybrid car below is estimated to achieve up to 58 mpg. A typical passenger car emits 4.6 metric tons of carbon dioxide per year (EPA, 2018). It is estimated that there are currently over 1 billion vehicles in the world, and there will be 2 billion by 2035. Owners of hybrid cars usually spend less on gas because the car is more efficient, but hybrid cars usually cost more than average cars, making it hard for some to afford them. Scientists have calculated that carbon emissions would be reduced by 1 Pg/year if we replaced 2 billion average cars with fuel efficient cars.[1] One person can reduce their carbon emissions by 0.52 metric tons of carbon per year by switching from a traditional to hybrid car.[2]

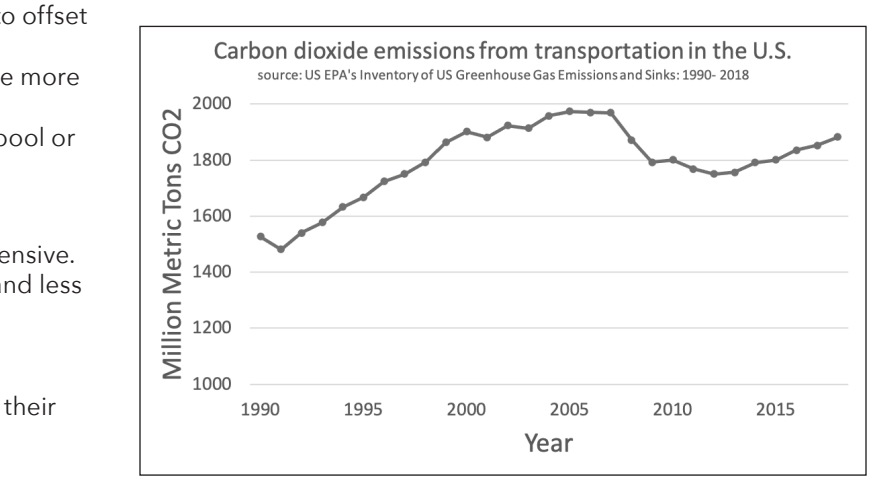
WHAT COULD HELP MAKE THIS HAPPEN:

- Governments could offer a tax credit to offset the cost of the car.
- A new law could require new cars to be more fuel efficient.
- Allow fuel efficient cars to use the carpool or HOV lanes to avoid traffic.

CHALLENGES:

- Hybrid and electric cars are more expensive.
- Fuel efficient cars are usually smaller and less powerful than standard cars.
- Car manufacturing plants are set up to make standard cars; making new types of cars requires them to change their factory set up and equipment.

Photo credit: Toyota (toyota.com/search/search.html?keyword=prius)



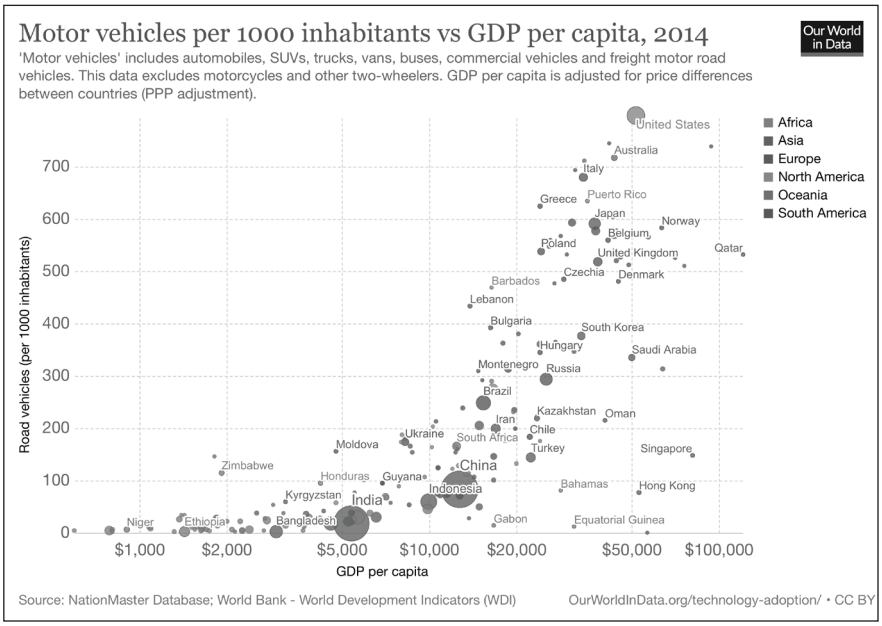


Image credit (right): Our World in Data (https://ourworldindata.org/grapher/road-vehicles-per-1000-inhabitants-vs-gdp-per-capita?time=latest&country=USA~BRB)

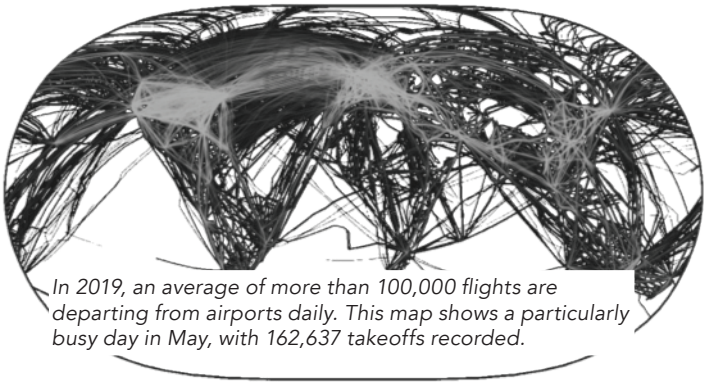
1. Pacala, S. and R. Socolow. 2004. Stabilization wedges: solving the climate problem for the next 50 years with current technologies. Science 305: 968-972.

2. Wynes, S. and Nicholas, K.A. 2017. The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters: 12.

3. Environmental Protection Agency. 2020. Inventory of US Greenhouse Gas Emissions and Sinks 1990-2018

MITIGATION STRATEGY: DECREASE AIR TRAVEL

Traveling by airplane emits large amounts of carbon into the atmosphere due to burning fuel. The United Nations (2019) predicts CO_2 emissions from air travel could triple by 2050. A round trip from New York to San Francisco generates approximately 1 metric ton of CO_2 per passenger. Eliminating or minimizing air travel is often claimed to be one of the most effective ways an individual can decrease their carbon emissions. Compared to traveling by car, the greenhouse gas emissions per passenger traveling by plane are much higher, especially for shorter distances. A family of four driving from Los Angeles to San Francisco generates about a third of the CO_2 that flying would generate. According to a NASA (2010) study, most of the emissions generated by planes are from take off and landing. Scientists have calculated that avoiding one transatlantic flight per year will save 1.6 metric tons of CO_2 ,[1] or decrease the average American's carbon emissions by 10%.



In 2019, an average of more than 100,000 flights are departing from airports daily. This map shows a particularly busy day in May, with 162,637 takeoffs recorded.

Image Credit: The Guardian (https://www.theguardian.com/environment/ng-interactive/2019/jul/19/carbon-calculator-how-taking-one-flight-emits-as-much-as-many-people-do-in-a-year)

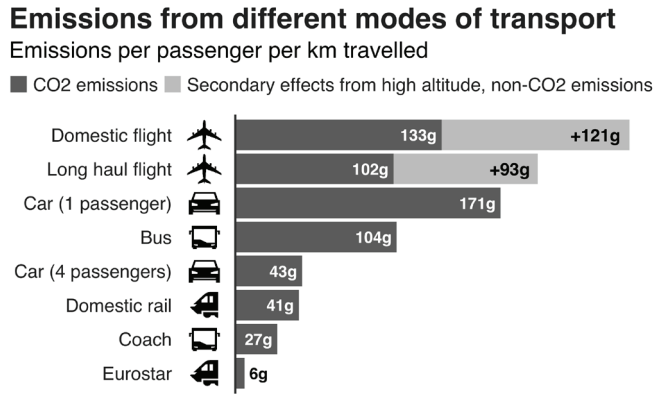


Image Credit: BBC (https://www.bbc.com/news/science-environment-49349566)

WHAT COULD HELP MAKE THIS HAPPEN:

- Normalizing telework and work-from-home so traveling for business becomes less necessary.
- Using alternate methods of travel – more long distance and fast buses and trains.
- Choosing nonstop flights to decrease the number of take offs and landings during a trip.
- Educate people about the carbon costs of travel (e.g. an app that tells you how much carbon a trip releases).
- Purchase carbon offsets if flights are required.
- Discourage private jet flights.

CHALLENGES:

- 30% of American air travel is business-related travel, not personal choices.[3]
- When there is only one person in the car, carbon emissions from a long road trip are actually higher than from flying.[2]
- Flying is convenient and fast.
- There are not easy alternatives to flying (e.g., high speed trains) in the U.S.

Flying from Los Angeles (LAX) to New York John F. Kennedy (JFK)

Flying from Los Angeles to New York John F. Kennedy and back generates about 697 kg CO_2. There are 50 countries where the average person produces less CO_2 in a year.

Image Credit: The Guardian (https://www.theguardian.com/environment/ng-interactive/2019/jul/19/carbon-calculator-how-taking-one-flight-emits-as-much-as-many-people-do-in-a-year)

1. Wynes, S. and Nicholas, K.A. 2017. The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters: 12.

2. Borken-Kleefeld, J., Fuglestvedt, J. and T. Berntsen. 2013. Mode, load, and specific climate impact from passenger trips. Environ. Sci. Technol. 47: 7608–7614.

3. Airlines for America. 2016. Air travel is affordable, accessible, and vast majority of travelers satisfied with overall experience according to new national survey

MITIGATION STRATEGY: PLANT-BASED MEAT

People have relied on livestock, like cattle, as a food source for thousands of years. Many domestic animals are able to eat the plants that grow in dry environments, allowing people to live in places where they cannot grow many crops. However, raising cattle requires a lot of land, water and food. According to the United Nations (2013), livestock produce 14.5% of global greenhouse gas emissions. Many people suggest reducing the amount of meat you eat as a way to decrease greenhouse gas emissions. There are multiple companies that sell plant-based meat, a food designed to taste and look like meat but actually made from plants. These products, such as the Impossible Burger and Beyond Meat, require less land and water to produce, and making them releases less carbon dioxide and other greenhouse gasses into the atmosphere than raising livestock. Scientists have calculated that one person choosing a plant-based diet can save 0.82 metric tons of carbon per year.[1]

WHAT COULD HELP MAKE THIS HAPPEN:

- People choosing to eat plant-based meat over real meat.
- Companies continuing to develop better tasting and healthier plant-based meats.
- Scientists researching how to make healthy, environmentally friendly plant-based meats.
- Large restaurant chains could switch to plant-based meats. McDonalds, Burger King, KFC and Carl's Jr. have all added plant-based meats to their menus.

CHALLENGES:

- Thousands of people make a living through the meat industry: raising, feeding, slaughtering and selling livestock.
- Many people like to eat meat.
- Scientists are researching whether new plant-based meats are healthier than meat products.[2,3]
- Plant-based meat, especially burgers and chicken, is generally more expensive than real meat.[4]
- Many people rely on fast food, like hamburgers and chicken nuggets, that is inexpensive and easy to get.

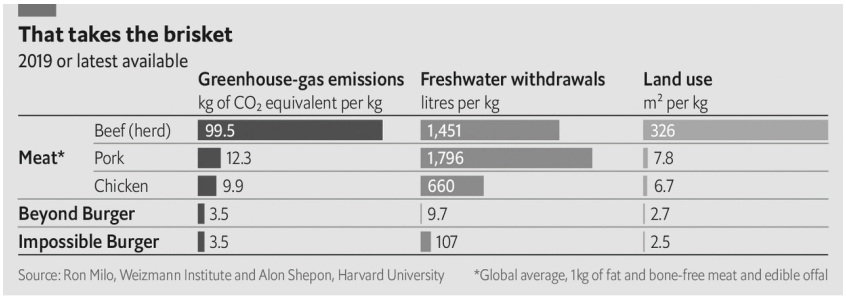
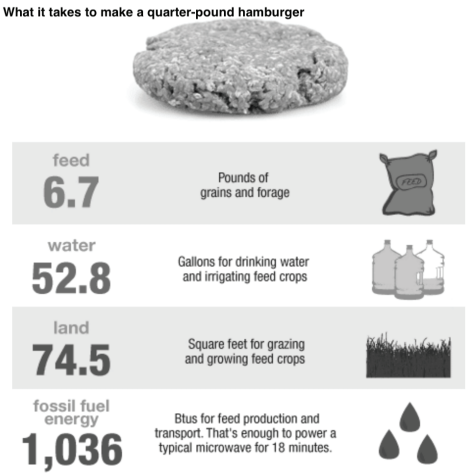


Image Credit: The Economist
(https://www.economist.com/international/2019/10/12/plant-based-meat-could-create-a-radically-different-food-chain)

Image Credit: Vox
(https://www.vox.com/2019/5/28/18626859/meatless-meat-explained-vegan-impossible-burger)



Source: J.L. Capper, Journal of Animal Science, December, 2011.
Credit: Producers: Eliza Barclay, Jessica Stoller-Conrad; Designer: Kevin Uhrmacher/NPR

1. Wynes, S. and Nicholas, K.A. 2017. The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters: 12

2. Plant-based meat lowers some cardiovascular risk factors compared with red meat, study finds/Journal of Clinical Nutrition

3. Harvard Health Publishing. 2019. Impossible and Beyond: How healthy are these meatless burgers?

4. Vox. 2020. The next challenge for plant-based meat: Winning the price war against animal meat

MITIGATION STRATEGY: LIVE CAR FREE

A typical passenger car emits 4.6 metric tons of carbon dioxide per year (EPA, 2018). It is estimated that there are currently over 1 billion vehicles in the world. Living without a car challenges people to find alternative transportation options like walking, biking, or taking trains and buses. People without a car tend to travel shorter distances in their daily lives. Fewer cars on the road means that the remaining drivers will waste less gas sitting in traffic, and infrastructure like roads and bridges will last longer and need less maintenance due to lighter use. Scientists have estimated that one person switching from an average car to a car-free life-style will save 2.4 metric tons of CO_2 per year.[1]

WHAT COULD HELP MAKE THIS HAPPEN:

- Investing in more public transportation, like buses and trains.
- Car, bike, and scooter sharing apps.
- Making cities more pedestrian and bike friendly.
- Building stores in residential areas so people can walk to them.
- More people working from home.
- Higher gasoline prices to make driving less affordable.

CHALLENGES:

- Easiest to do in cities where homes, stores, and work places are close together; hard to do in rural or suburban areas.
- Much of the country lacks efficient public transportation.
- It's hard to travel outside of your city or hometown without a car.
- There are many jobs that rely on car owners (sales, mechanics, car detailers, etc.).
- Not having a car limits how far you can go to find work, health care, and other necessities.

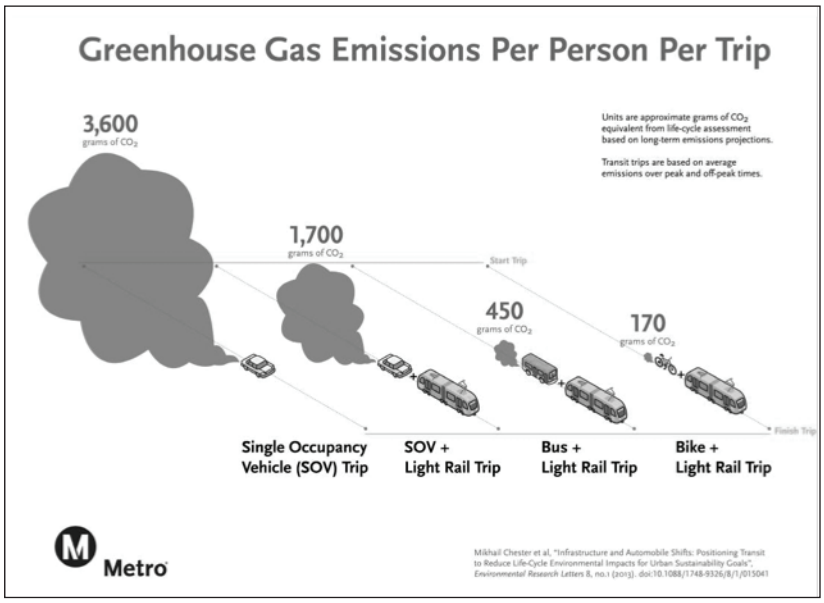


Image Credit: Metro
(https://thesource.metro.net/2017/03/20/seven-ways-riding-a-bike-can-improve-your-life/)

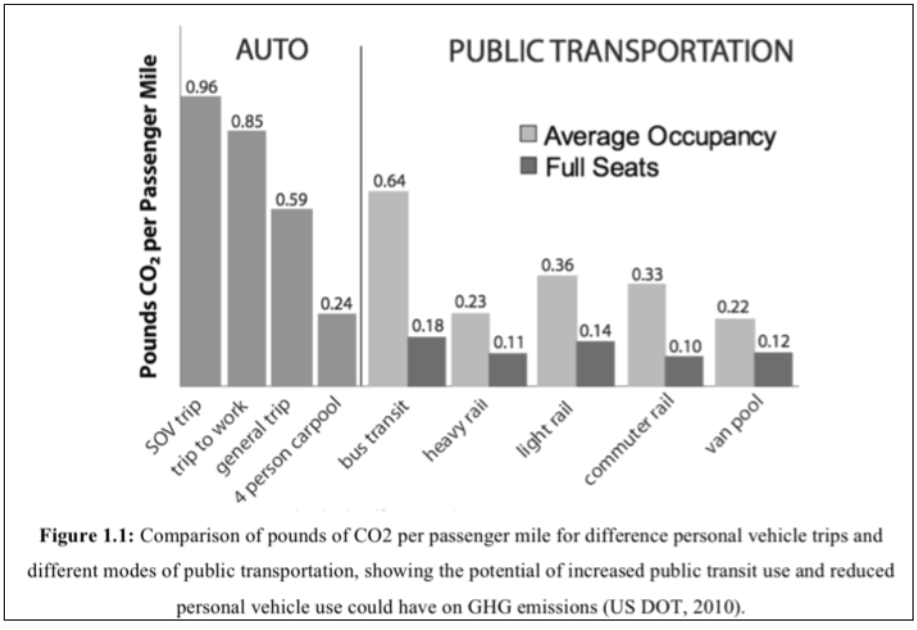


Figure 1.1: Comparison of pounds of CO2 per passenger mile for difference personal vehicle trips and different modes of public transportation, showing the potential of increased public transit use and reduced personal vehicle use could have on GHG emissions (US DOT, 2010).

Image Credit: Metro
(https://thesource.metro.net/2017/03/20/seven-ways-riding-a-bike-can-improve-your-life/)

1. Wynes, S. and Nicholas, K.A. 2017. The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters: 12.

MITIGATION STRATEGY: HAVE ONE FEWER CHILD

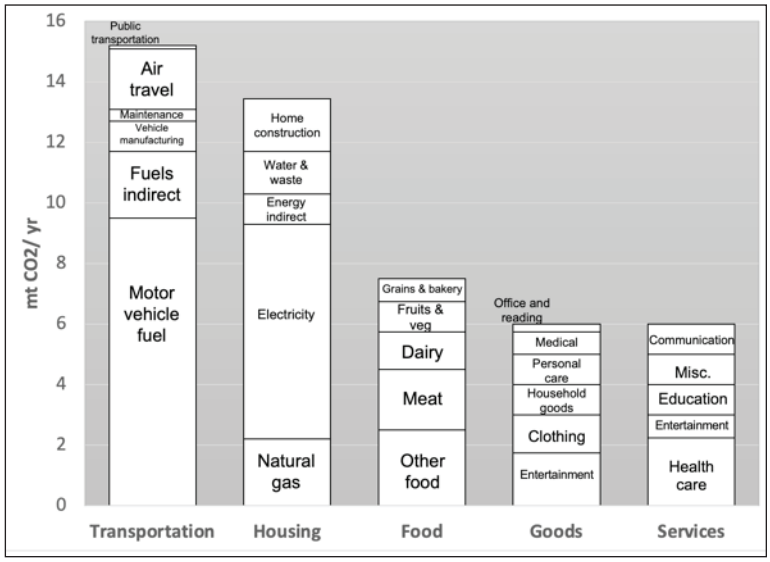
Population growth is often named one of the greatest environmental challenges. As the global population has grown, production of food, energy, and goods has increased to meet the needs of the population. This also leads to an increase in waste and pollution. By making the decision to have one fewer child, parents are decreasing their current carbon emissions and their carbon legacy, the future carbon emissions of their descendants. By slowing population growth, resource consumption and pollution emissions also slow down. Scientists have estimated that having one fewer child will save 58.6 metric tons of carbon over a lifetime.[1]

WHAT COULD HELP MAKE THIS HAPPEN:

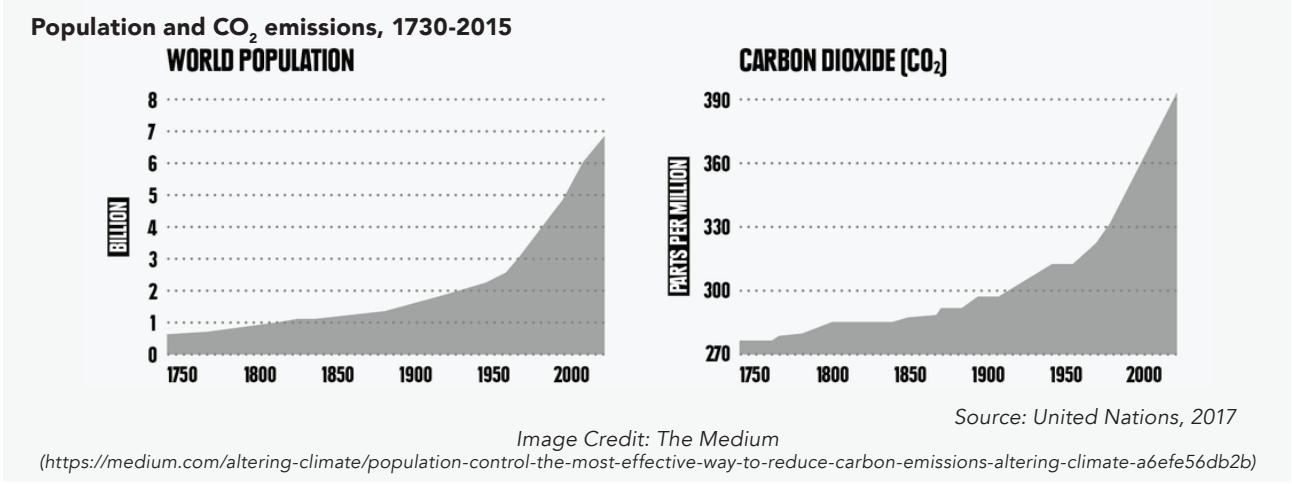
- Educating people about the impacts of individuals on climate change.
- Research shows providing women with easy access to education and health care results in them having fewer children.[2]

CHALLENGES:

- How do you enforce or encourage people to keep their family size small?
- Many people have a cultural or personal preference for large families.
- Many people have a cultural, religious, or personal belief against contraception.
- Is it a violation of human rights to enforce this?
- When the Chinese government set a one child rule, a preference for sons led to a gender imbalance and poor treatment of daughters.[3]
- Younger generations support older generations through social security, Medicaid, etc. When there are more older than younger people, there are fewer resources to support the elderly.



Total carbon emissions of a typical US household 48 tons (CO_2/year)
Jones, C. M., & D. M. Kammen 2011.Environmental Science & Technology.



Source: United Nations, 2017

Image Credit: The Medium
(https://medium.com/altering-climate/population-control-the-most-effective-way-to-reduce-carbon-emissions-altering-climate-a6efe56db2b)

1. Wynes, S. and Nicholas, K.A. 2017. The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters: 12.

2. Wodon, Q., C. Montenegro, H. Nguyen, and A. Onagoruwa. 2018, Missed Opportunities: The High Cost of Not Educating Girls. The Cost of Not Educating Girls Notes Series. Washington, DC: The World Bank.

3. Johnson, Kay Ann (2016). China's hidden children: Abandonment, adoption, and the human costs of the one- child policy. Chicago: University of Chicago Press. 2016.