

# Case Study: Warm Springs to Madras Shuttle Service

By Veronica Yellowhair

## Executive Summary

The Warm Springs reservation's shuttle bus provides transportation for tribal members around Warm Springs, Oregon, and travels to the city of Madras. The vehicle is a 2010 Ford E450 with 7.8 average miles per gallon (MPG) (fuelly.com).

## Introduction

In this case study, we:

- Calculate the estimated shuttle bus carbon emissions
- Discuss how switching to an electric vehicle (EV) will help reduce carbon emissions
- Describe the long-term effects of air pollution on health
- Provide data on carbon emissions released in 2023

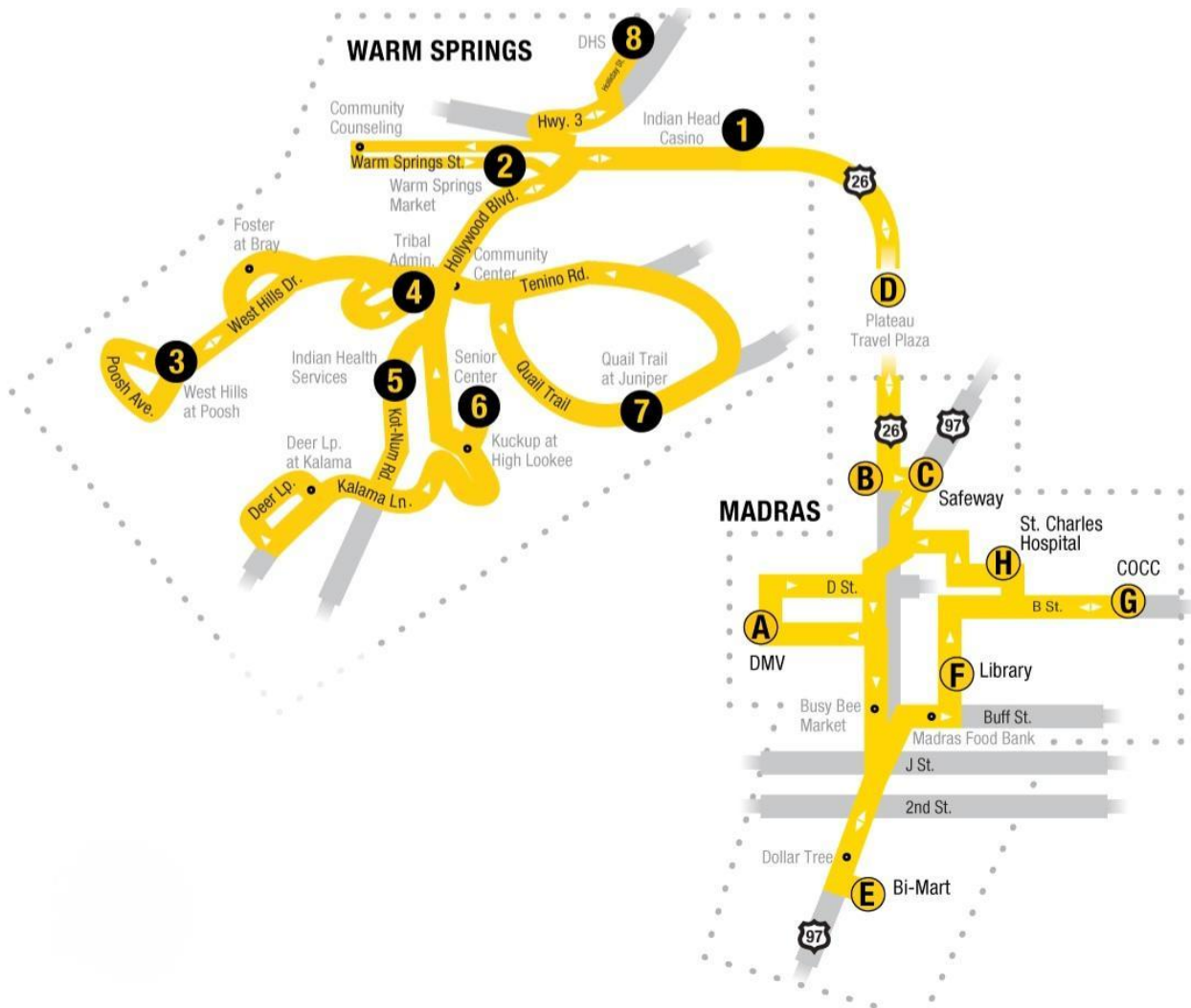
The goal of this report is to persuade the Warm Springs Council to consider replacing their fossil-fueled shuttle with an EV shuttle bus. Key challenges the council will likely consider include capital costs and the readiness of the community to transition to an EV.

- EV shuttle buses prices range from \$60,000 to \$100,000. However, the maintenance cost of EVs are minimal compared to fossil-fueled vehicles.
- Another key question is the readiness of the community to transition to an EV. The motto, "If it's not broken..." does apply in decisions that affect the entire community. However, with our Mother Earth in peril, we hope that information such as this could open dialogue and support for EVs in the Warm Springs Community.

## Findings

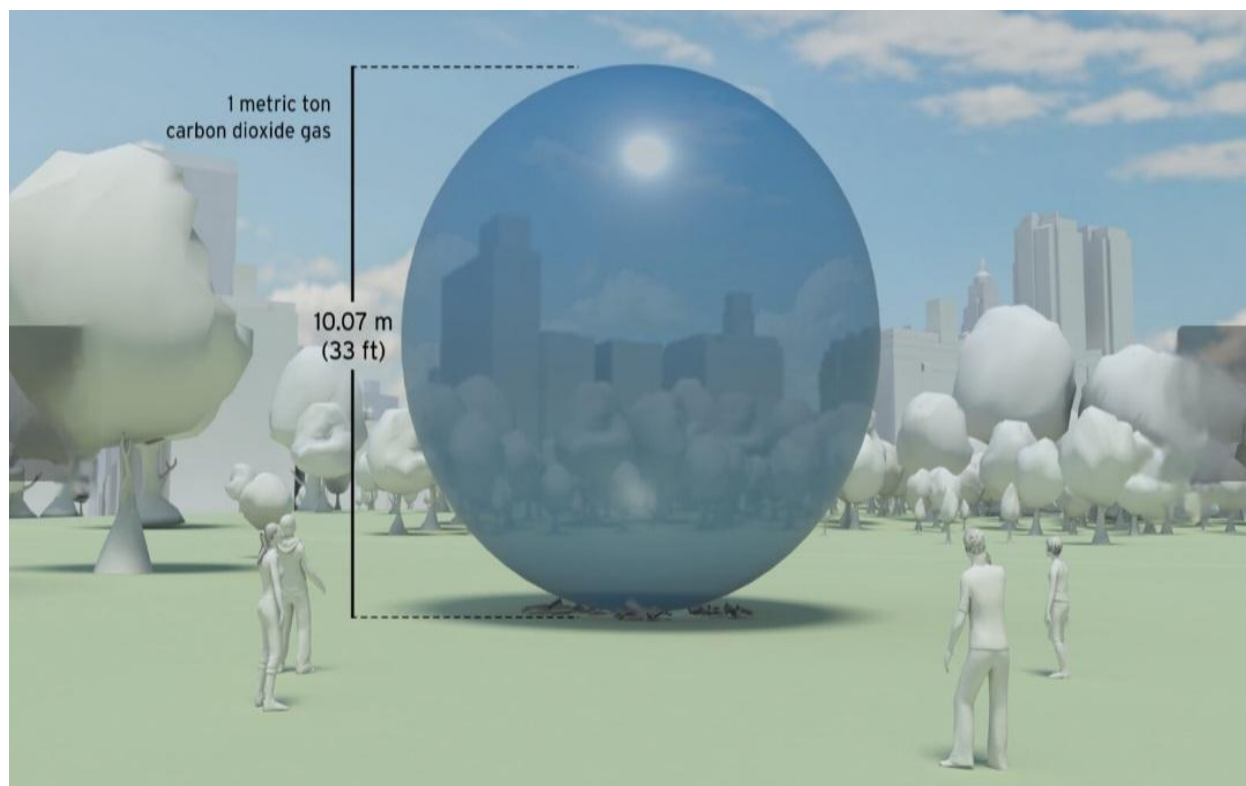
Warm Springs Reservation in northern Oregon consists of three tribes: Wasco, Paiute, and Warm Springs. The Warm Springs transit makes 16 stops in addition to their new route to Madras, Oregon. Each day, the total

miles covered for three round trips is 56 miles (Google Maps), with 34.7 miles in and around Warm Springs to the city of Madras, Oregon. This does not include *Flex Stops* the shuttle bus offers. *Flex Stops* is a service Warm Springs offers that makes stops that are outside of the bus route.



(Warm Springs Shuttle Bus Route)

The 2010 Ford E450 shuttle bus has a 6.8-liter gas engine (Tesco Bus.com) and the average MPG is 7.8 (Fueelly.com). According to *Greenhouse Gas Emissions from a Typical Passenger Vehicle* by EPA.gov, one gallon of gasoline produces 8,887 grams of CO<sub>2</sub> in tailpipe emissions (approximately 20 pounds). A typical passenger vehicle gets about 22.2 MPG, and driving 11,500 miles per year can emit 4.6 metric tons of carbon into our atmosphere.



(Flicker.com)

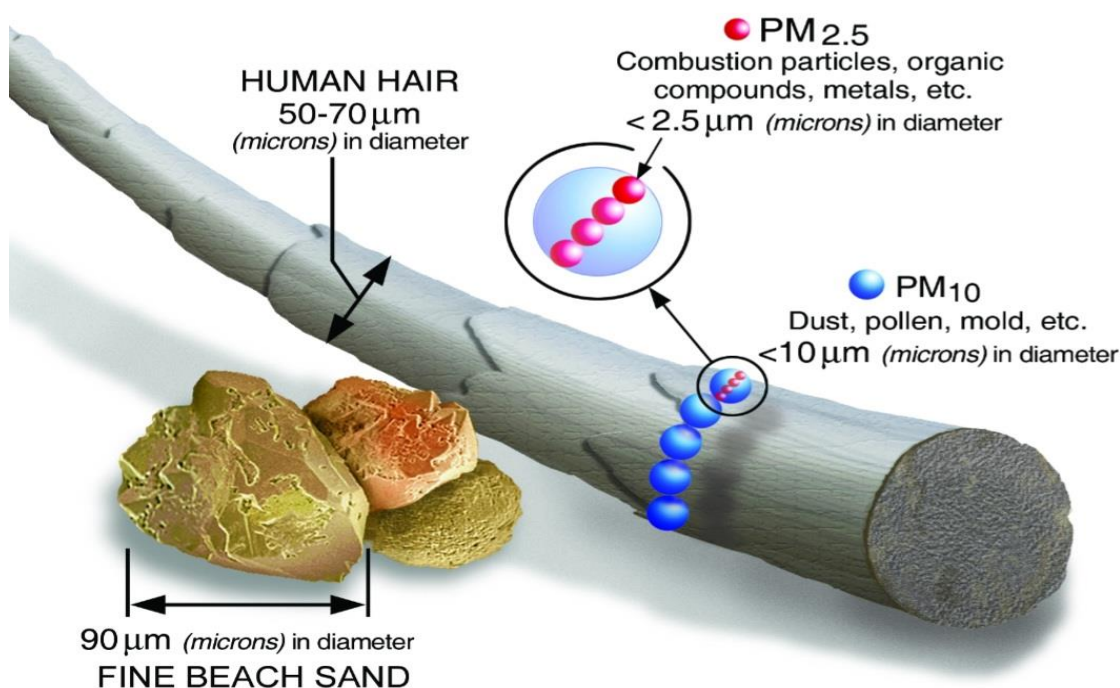
The image above is only 1 metric ton of CO<sub>2</sub>. The Warm Springs Shuttle bus releases three times or more CO<sub>2</sub> into our environment. Due to the age of the shuttle bus, MPG, odometer miles, and engine idling, the CO<sub>2</sub> emissions could be even greater. (To calculate a more accurate volume of CO<sub>2</sub> emissions, the mileage of the vehicle will need to be determined. We will update this case study once that information is received.)

### **Air Pollution and Our Health**

Carbon emissions not only affects the well-being of Mother Earth, but also the health of Americans. In a study from 2014, 1 in 14 adults and 1 in 12 children have asthma (EPA. Particle Pollution & Respiratory Effects), which totals 24 million Americans who suffer from asthma. With asthma, respiratory system (lungs, airways, diaphragm, voice box, nose, and mouth) functions are affected by particulate matter (PM), which can cause many health problems like lung and heart disease, chronic obstructive pulmonary disease (COPD), and lung cancer.

**What is particulate matter?** PM is a mixture of solid and liquid droplets found in the air (EPA. Particle Matter Basics). PM can consist of dust, soot, dirt, or smoke. There are two types of PM: PM10 and PM2.5.

- PM10 is 10 microns in diameter, which is much smaller than one strand of human hair (50-70 microns in diameter).
- PM2.5 is so small that it can be seen only with an electron microscope. PM2.5 consists of combustion particles, organic compounds, metals, etc.



(EPA.gov)

PM is produced by burning fuels in woodstoves, fireplaces, and vehicles. It also comes from construction dust, agriculture, outdoor burning, industrial facilities, and wildfires. Washington's Dept. of Ecology staff say, "When we breathe, our nose or sinuses capture many particles in the air before they get into our lungs. However, smaller particles may escape these defenses and move deeper into our lungs, causing health problems." (WA Dept. of Ecology). If the fine particles enter our bloodstream, this may cause cancer.

Four of the top 20 most polluted cities in the U.S. are in Oregon and Washington (Decarbonization Channel). Following the number one most-polluted city of Bakersfield, California, with a PM rate of 18.8, are:

1. Eugene, Oregon, at 14.7PM;
2. Medford, Oregon, at 13.5PM;
3. Yakima, Washington, at 11.8PM; and
4. Spokane, Washington, at 11.6PM.

As the climate changes and our need for fossil fuels evolves, our health is in peril. *Carbon Pollution* reports that transportation sources (personal vehicles, diesel, trains, fleets, etc.) are responsible for 33% of our greenhouse gas emissions. In the 21st Century, we are living with the new threat of climate change; as the planet warms up, air quality is in constant jeopardy. Wildfires caused by drought conditions due to the lack of precipitation and forest clearing, make climate change concerns even worse because trees absorb CO<sub>2</sub>.

Suppose we continue using vehicles that burn fossil fuels. In that case, our respiratory systems will suffer, our communities will likely see more premature deaths due to heart and lung disease, people will suffer from decreased lung function, non-fatal heart attacks, aggravated asthma, irritation of airways and coughing, and irregular heartbeats. Swapping a gasoline shuttle bus for an EV will help reduce local concentrations of PM, which can improve lung health and help fight climate change. Once Warm Springs Transit makes the change and installs an EV charger, it will no longer contribute 4.6 metric tons of fossil fuel into our atmosphere. This will help heal Mother Earth.

### **Carbon Emissions Released in 2023**

The Department of Transportation (DOT) has set a net-zero greenhouse gas emissions goal for the United States by 2050. The interim target is emissions that are 50 to 52% below 2005 levels by 2030 (DOT Report to Congress: Decarbonizing U.S. Transportation). In 2023, CO<sub>2</sub> emissions decreased slightly compared to the 2022 levels. According to the DOT, 80% of these emissions reductions were in the electric power sector. For

transportation, 1,856 metric tons of CO<sub>2</sub> were released into the atmosphere, which is a 16 metric ton increase compared to 2022.

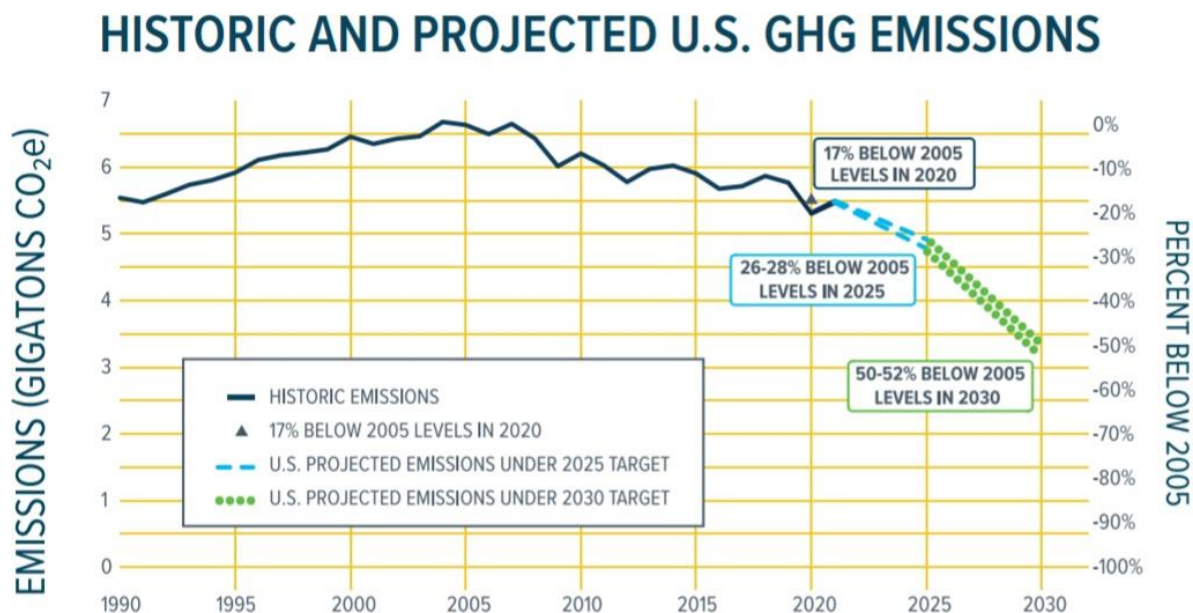


Figure 1: This figure shows the historical trajectory of U.S. net GHG emissions from 1990 to 2019, the projected pathway to the 2030 Nationally Determined Contribution (NDC) of 50-52% below 2005 levels, and the 2050 net-zero goal.<sup>9</sup>

(transportation.gov)

One-third of the U.S greenhouse gases are from transportation. The Earth's temperature has risen two degrees Fahrenheit (1 degree Celsius) since the pre-industrial era (1850-1900) (Climate.gov). Although CO<sub>2</sub> emissions have decreased slightly, 2023 was the world's warmest year on record. Since 1994, the Earth has warmed rapidly, indicating a troublesome long-term trend.

## 2022 U.S. GHG EMISSIONS

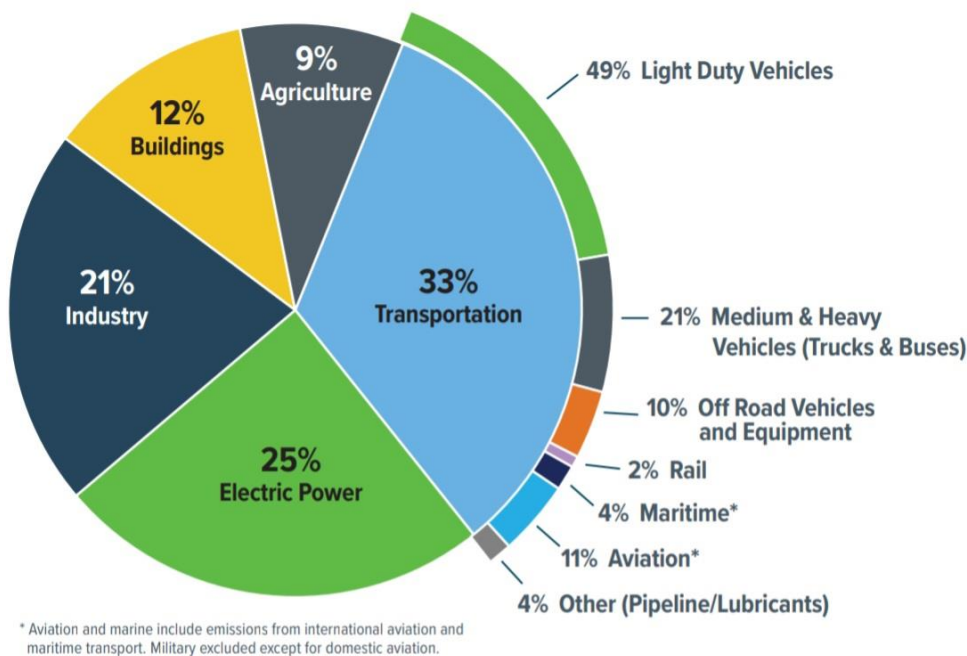


Figure 2: Total 2022 U.S. GHG emissions with transportation and mobile sources breakdown. Data derived from the EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks.

(transportation.gov)

### Cleaning up transportation is key

Transportation is the leader in environmental pollution. Light duty vehicles—cars, trucks, and motorcycles—contribute 49%. Heavy-duty vehicles—transit buses, fire trucks, and commercial trucks—contribute 21%. By switching to EVs, we can help reduce greenhouse gases in our environment.

### With more car models available, customers have more options

Every make from Chevrolet, Ford, Kia, Acura, and Hyundai to luxury brands like Mercedes, BMW, Volvo, Audi, and many more offer 40 battery EVs in the U.S. market (Evadoption.com). When heavy-duty vehicles like transit buses, school buses, fire trucks, and commercial trucks switch to electric models, we can quickly reduce this pollution.

EV affordability and technologies have improved significantly over the past five years, to the point that there are models available at almost all price points. EVs can typically go from 150 to 400 miles between charges. Many

states offer rebates and incentives for EVs. Public charging stations have doubled since 2019 (energy.gov), from 87,352 to 161,562.

### **Conclusion**

Warm Springs's transit can make an environmental contribution to its people and the environment. The average vehicle travels an estimated 11,500 miles per year, producing 4.6 metric tons of CO<sub>2</sub>. However, the older the car, the more emissions it produces. Continuing this trend can result in more pollution and negatively affect health.

Four cities in the Pacific Northwest have some of the country's worst air qualities. PM varieties can be smaller than a strand of hair, and some are visible only with a microscope. Warm Springs can help reduce the risk of premature deaths from heart and lung disease, decreased lung function, non-fatal heart attacks, aggravated asthma, irritation of airways and coughing, irregular heartbeats, and lung cancer.

Transportation produces one-third of the greenhouse gases in the U.S. We know that 2023 is the warmest year on record; what will 2024 produce? DOT's goal is to reach net-zero greenhouse gas emissions by 2050; if Warm Springs replaces its gasoline shuttle with an electric one, the city can help DOT reach its goal for our country, reduce 4.6 metric tons of CO<sub>2</sub> in our atmosphere, help lower the health risk in the community, and help fight climate change.

We, as people, have a humanitarian right to help and heal Mother Earth in this generation and the next. Warm Springs now has the knowledge and ability to contribute to the correct change.

## About the Author

Veronica Yellowhair lives in Portland, Oregon with her husband and German Shepard. She is Tribal Outreach Specialist intern for Washington State University's Energy Program. Veronica enjoys dancing women's fancy shawl, writing, reading, and learning her Dine' (Navajo) language and culture from her mother.

## References

Fuelly. *Ford E-450 Super Duty MPG*. Online. 2019. [https://www.fuelly.com/car/ford/e-450\\_super\\_duty](https://www.fuelly.com/car/ford/e-450_super_duty)

Cascades East Transit. *20 Madras to Warm Springs*. Image. Online. 2016. <https://cascadeseasttransit.com/routes-schedules/warm-springs-madras-route-20/>

Tesco. *2010 Starcraft Ford E450 25 Passenger Shuttle Bus*. Online. 2024. [https://www.tescobus.com/buses-for-sale/2010-Starcraft-Ford-E450-25-Passenger-Shuttle-Bus\\_09469/#:~:text=Vehicle%20Description,at%20800%2D227%2D3572](https://www.tescobus.com/buses-for-sale/2010-Starcraft-Ford-E450-25-Passenger-Shuttle-Bus_09469/#:~:text=Vehicle%20Description,at%20800%2D227%2D3572)

Environmental Protection Agency (EPA). *Greenhouse Gas Emissions from a Typical Passenger Vehicle*. Online. 2024. <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle>

Flicker. *Carbon Visuals*. Image. Online. 2024. <https://www.flickr.com/photos/carbonquilt/15101083158>

EPA. *Particle Pollution & Respiratory Effects*. Online. 2024. <https://www.epa.gov/pmcourse/particle-pollution-and-respiratory-effects>

EPA. *What is Particle Matter (PM) Basics*. Image. Online. 2024. <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM>

EPA. *DOT Report to Congress: Decarbonizing U.S. Transportation*. Image. Online. 2024. [https://www.transportation.gov/sites/dot.gov/files/2024-07/Decarbonizing%20U.S.%20Transportation\\_July%202024.pdf](https://www.transportation.gov/sites/dot.gov/files/2024-07/Decarbonizing%20U.S.%20Transportation_July%202024.pdf)

The National Oceanic and Atmospheric Administration. *Climate Change: Global Temperature*. Online. 2024. <https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature#:~:text=The%20roughly%202%2Ddegree%20Fahrenheit,National%20Centers%20for%20Environmental%20Information>.

Energy.Gov. *The Number of Electric Charging Ports in The U.S. Nearly Doubled in The Past Three Years*. Online. 2023. <https://www.energy.gov/eere/vehicles/articles/fotw-1299-july-17-2023-number-electric-vehicle-charging-ports-us-nearly>

Decarbonization Channel. *The Most Polluted Cities in the U.S.* Online. 2024. <https://decarbonization.visualcapitalist.com/most-polluted-cities-in-the-us/>

Evadoption. *BEV Models Currently Available in the US*. Online. 2023. <https://evadoption.com/ev-models/bev-models-currently-available-in-the-us/>

**This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Vehicle Technologies Office (VTO) Award Number DE-EE0010615.**