A SOLUTION FOR AIR POLLUTION

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Research Questions:

- What factors are the main contributors to climate change in the area of Gulfport?
- What pollutants are most negatively impacting the area of Gulfport?
- How has the introduction to new projects affected the environment in the area of Gulfport?
- What are the most common pollutants in the most polluted areas of the U.S.?
- What is a possible solution to air pollution?

Abstract:

The City of Gulfport is the second largest city in Mississippi, and is located on the coast of the Gulf of Mexico. As the population increases, so do businesses, restaurants, transportation methods, etc. Many of these new introductions also cause a significant change in our environment. Emissions from buildings, plants, airports, ports, and many methods of transportation cause a change in the way we adapt and live with pollutants surrounding us. The purpose of this research is to find a solution to air pollution that is caused by emissions like greenhouse gasses, carbon dioxide, and any other pollutants that harm the environment. We recorded the air quality for following different locations throughout the time period of January 2023-February 2023:

- Gulfport, MS, USA
- San Fransisco, CA, USA
- Seattle, WA, USA
- New York CIty, NY, USA.

We also recorded other pollutants in the areas that were researched, as well as their air quality levels, and their concentration of those pollutants. We also discovered a possible solution to this problem, which was green roofs. Green roofs allow for a cooling in the air's atmosphere and provide shading, as well as providing new habitats for animals and plants, causing a boom in biodiversity. Throughout our process of researching and recording, we discovered that the common pollutant of these areas was PM2.5, which caused short-term health effects. According to our results and research throughout this project, we discovered the green roofs are a great and affordable solution to our problem in our environment.

Introduction:

Literature Review

Climate change is a significant problem in the world and affects millions of species. Climate change has brought many impacts to the world, according to the National Oceanic and Atmospheric Administration, or, NOAA, stating how "impacts of climate change on different sectors of society are interrelated. Drought can harm food production and human health. Flooding can lead to disease spread and damages to ecosystems and infrastructure. Human health issues can increase mortality, impact food availability, and limit worker productivity." Climate change is seen everywhere in the world, not just in your local city. However, climate change can vary from different locations around the world, from neighborhoods, towns, cities, states, or countries. Climate change can cause catastrophic events, which can affect everyone around the world.

There are many factors that can contribute to climate change, much of it coming from fossil fuels and greenhouse gasses, as stated from the United Nations. "Fossil fuels, coal, oil and gas are by far the largest contributor to global climate change, accounting for over 75 percent of

global greenhouse gas emissions and nearly 90 percent of all carbon dioxide emissions." These emissions blanket the Earth, which then trap the Sun's heat, causing the world to warm much faster. Many other factors, caused by human activities, such as deforestation, generating power, manufacturing goods, using transportation, constructing new buildings, and over-consuming.

Description of the Problem

As Gulfport expands with many more businesses, buildings, and centers, so does the pollution around us. Gulfport has a power plant, airport, and port that are considered significant contributors to the amount of pollution in the city. The city of Gulfport is heavily populated, as it is the 2nd largest city in the state of Mississippi. The local Sun Herald states how "Gulfport has seen new shops, restaurants and other businesses pop up this year in white buildings on Cowan and Pass Roads." Many of these new projects mainly consist of apartments, new homes, and condominiums. This surge of new sites in a popular area causes more emissions to be produced. Triple Pundit explains how "Building a typical two-bedroom house produces around 80 tons of carbon dioxide emissions, which is equal to the emissions of about five new cars. Building bigger buildings, such as commercial and industrial facilities, naturally creates more emissions". Reports show how buildings are 41% of the energy in the U.S., making them responsible for around 40% of carbon emissions.

Electric power, mostly coming from power plants, is the second largest share of greenhouse gas emissions, coming from burning fossil fuels, mostly coal and natural gas. Aviation emissions are responsible for 1.9% of all greenhouse gas emissions, 81% of which come from passenger travel and 19% from freight travel, 60% of emissions from passenger travel are from international travel and 40% are from domestic travel. The Gulfport-Biloxi Airport reports how "over 88 percent of the Airport's GHG emissions are from jet fuel". Studies

prove how “aviation gas emits 18.3 pounds (lb) and jet fuel 21.1 lb of CO2 per gallon combusted, and flying one mile on average emits 53 pounds of CO2. It directly contributes to climate change and has various negative environmental effects.”. These negative environmental effects are headache, nausea, vomiting, dizziness, fatigue, in coordination, irritability, problems with attention and memory, narcosis, and gait disturbances.

Gulfport also has a port that is 300-acre deep-water port and a 116-acre inland port facility. The United States Environmental Protection Agency states “Ports rely on a wide range of vehicles with diesel engines, which are a source of greenhouse gas (GHG) emissions and affect climate change.” They also state “Air pollution is a significant concern at port facilities. Mobile sources at ports release pollutants including particulate matter (PM), nitrogen oxides (NOx), sulfur oxides (SOx), volatile organic compounds (VOCs) and air toxics.” Many of these pollutants can cause serious health problems, such as premature mortality, increased hospital admissions for heart and lung disease, increased cancer risk, and increased respiratory symptoms. All of these pollutants, from the greenhouse gasses that come from the power plant, airport, and port, cause serious health concerns, along with many climate change concerns as multiple new developments are evolving in the city of Gulfport.

Research Methods:

Many graphs for air quality of different locations throughout the world were observed, such as the most polluted and harmful cities or countries, compared to the air quality in Gulfport. The air quality was observed for around a month for different locations, as well as the primary pollutants. We collected data for the air quality each day throughout the month of January 2023-February 2023 for 4 locations. Gulfport, MS was our main location, but we took observations from other places as well to compare different air qualities and pollutants.

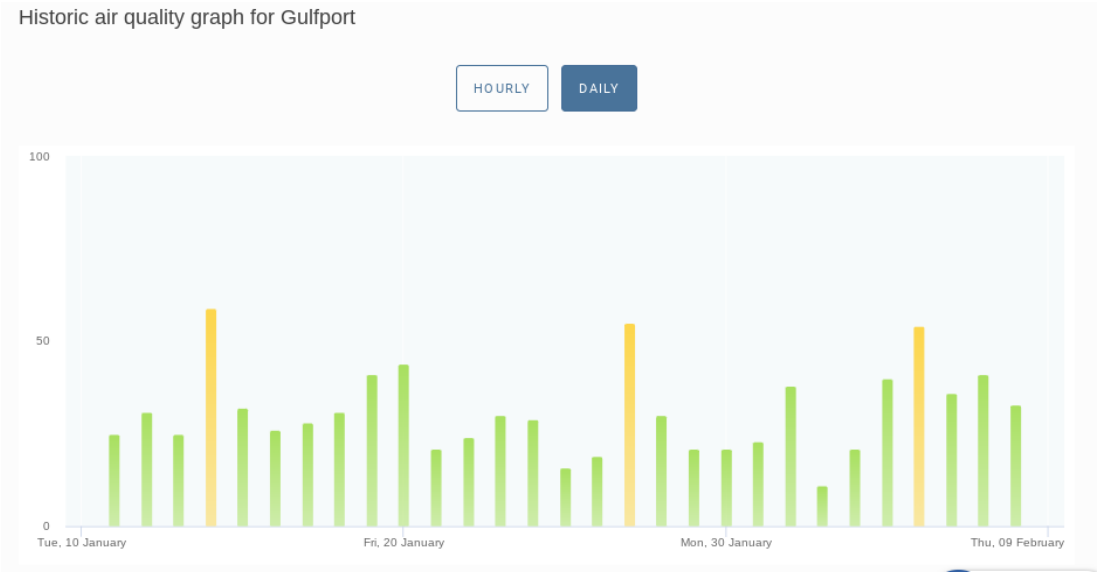
- Gulfport, MS, USA
- San Fransisco, CA, USA
- Seattle, WA, USA
- New York CIty, NY, USA

Results:

All graphs were collected from the IQAir air quality website. From observing the graphs, all graphs are throughout a month. Most of the data charts show the PM2.5 is the most common primary pollutant throughout all of the cities observed. Most of the graphs show that these different locations don't have such bad air quality. The first three graphs had around 3-5 moderate days of air quality. New York City had the highest number of moderate days for their air qualities. As Data 4 shows, New York City's PM2.5 concentration is currently 3.5 times the WHO annual air quality guideline value. New York City also had many other pollutants such as PM10, O3, NO2, SO2, and CO. Although all of these pollutants weren't really seen in the other locations, they were at a good level.

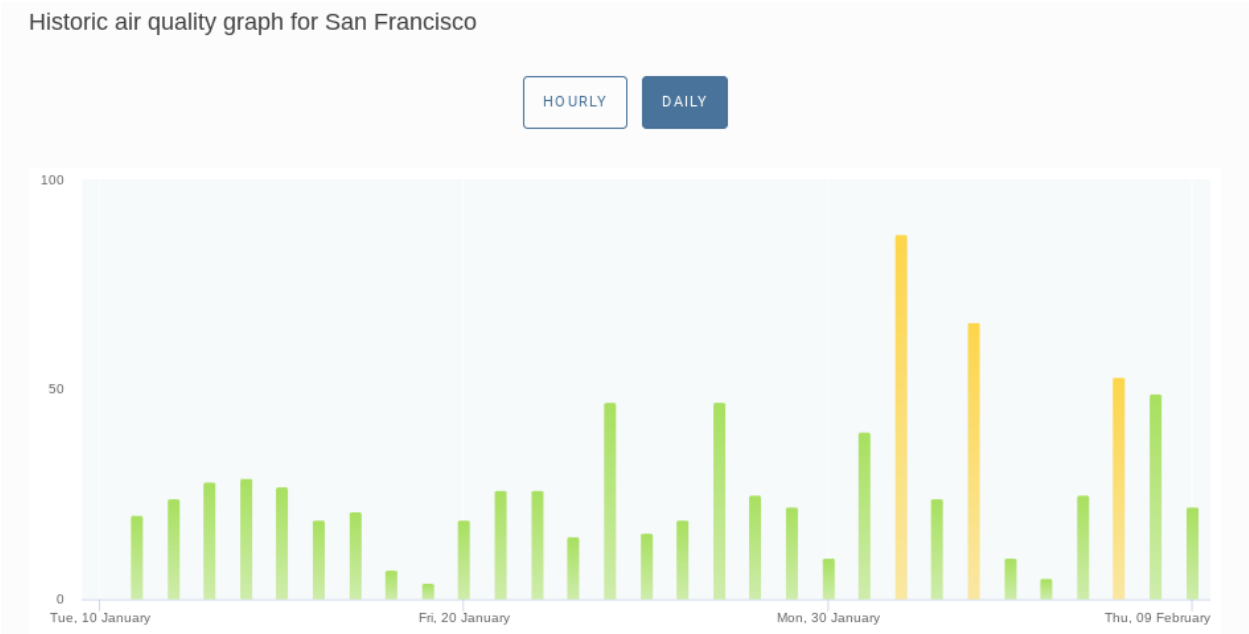
Data Summary:

The following graphs are graphs that we observed for the air quality and primary pollutants. These graphs are each from the 4 different locations observed.

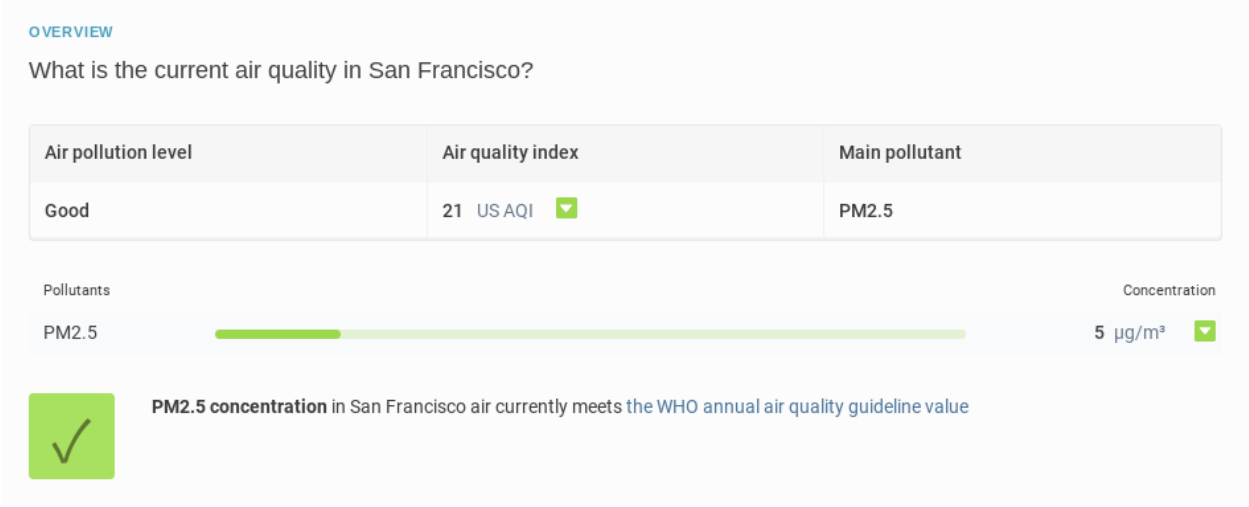


Graph 1: This graph shows the air quality for the city of Gulfport, MS from January 10th, 2023-February 9th, 2023.

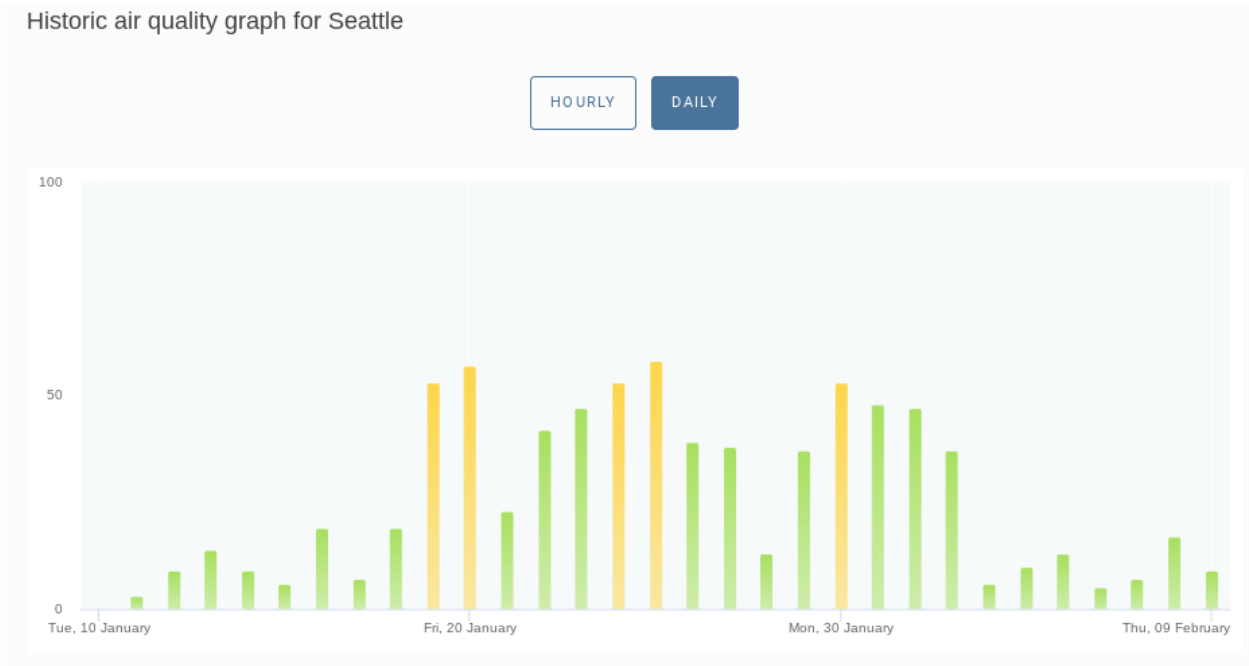
Data 1: This chart shows the primary pollutant for the city of Gulfport, MS, which is PM2.5.



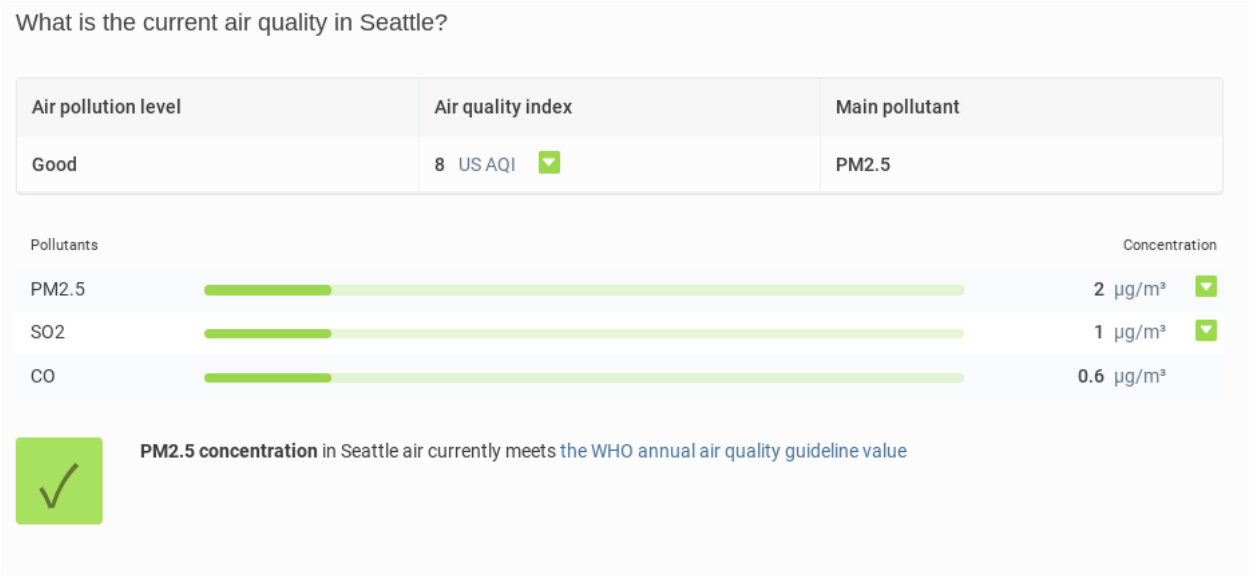
Graph 2: This graph shows the air quality for the city of San Francisco, CA, throughout January 10th, 2023-February 9th, 2023.



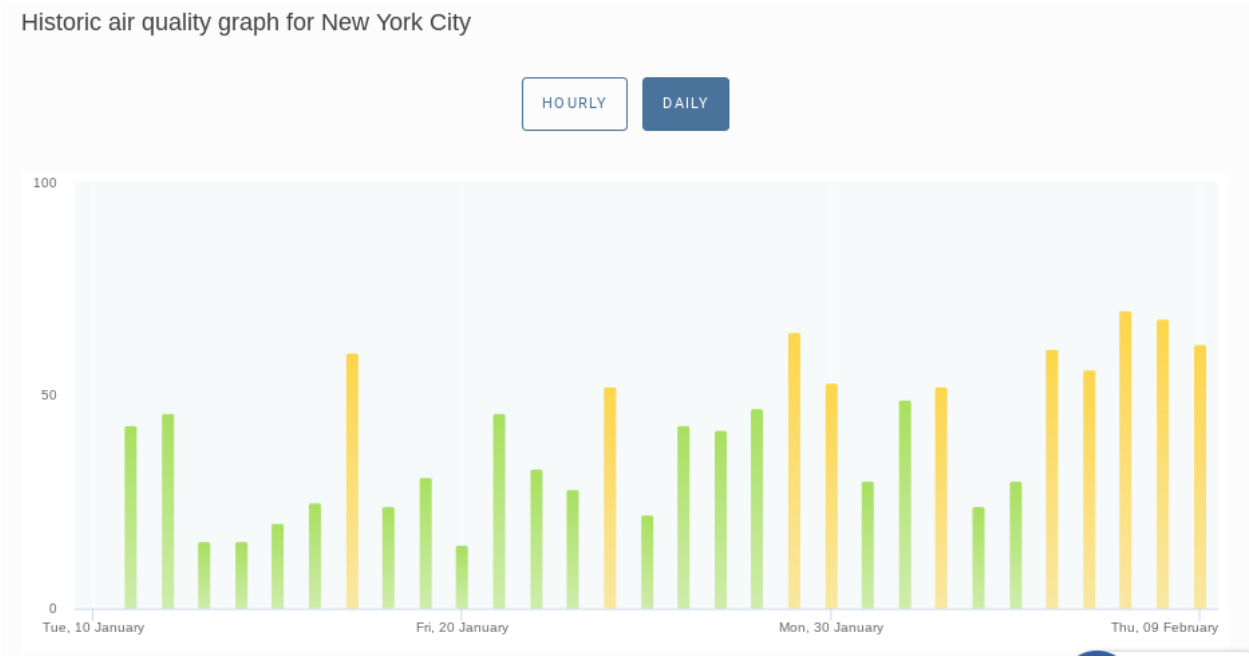
Data 2: This chart shows the primary pollutant for the city of San Francisco, CA, which is PM2.5.



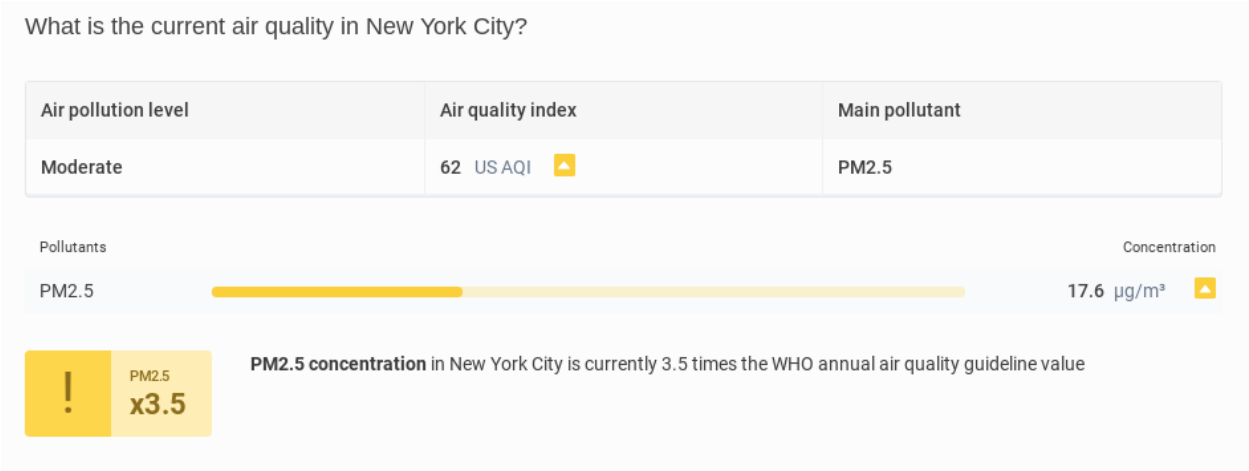
Graph 3: This graph shows the air quality of Seattle, WA, from January 10th, 2023-February 9th, 2023.



Data 3: This chart shows the primary pollutant for Seattle, WA, which is PM2.5



Graph 4: This graph shows the air quality for the city of New York City, NY from January 10th, 2023-February 9th, 2023.



Data 4: This chart shows the primary pollutant for the city of New York City, NY, which is PM2.5. This chart also shows that the PM2.5 concentration in New York City is currently 3.5 times the WHO annual air quality guideline value.

Discussion:

There are many solutions to air pollution, here is one of them. One of these solutions is green roofs. Green roofs are a vegetable layer grown on a rooftop. According to this article, “Green roofs provide shade, remove heat from the air, and reduce temperatures of the roof surface and the surrounding air.” The positive effects of green roofs are tremendous, green roofs can be 30-40 degrees fahrenheit cooler.

In addition to making roofs and the surrounding air cooler, green roofs also reduce building energy use by 0.7%. Green roofs also reduce peak electricity demand and also leads to an annual savings of $0.23 per square foot of the roof’s surface. These benefits are a key contributor to the growing use of green roofs.This growing industry can end up being a really productive solution to climate change and air pollution.

From the charts and data collected, the primary pollutant for most of the cities is PM2.5 concentration. Some of the causes for this pollutant is emissions from combustion of many fossil fuels, which include gas, oil, diesel fuel, or wood. These emissions can cause short-term health effects such as eye, nose, throat, and lung irritation, coughing, sneezing, etc.

Picture 1 of Green Roof.

Picture 2 of Green Roof

Conclusion:

As the graphs above, many locations in the United States don't have such harmful air quality. The most common air pollutant was PM2.5, which was the primary pollutant in all of the locations. From research conducted, new projects and buildings that are built upon cities generate a heavy amount of emissions that are harmful to the environment. Based on our solution, green roofs, which are efficient and beneficial to the environment, help reduce the concentrations of many pollutants, which can cause a significant change for the environment. They can also help reduce climate change and air pollution, which is the main problem for our environment.

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