Final Report

Phase I

In our initial proposal we presented two topics that were deciding between, electric powered transportation and food wasted management. Our first topic was to reduce GHG emissions by encouraging carbon free transportation with electric powered vehicles from scooters to cars. The second topic was reducing food waste in schools, by partnering with local farmers markets or having pre-ordered school lunch. Ultimately, we found the data for greenhouse gas emissions much better suited our initial proposal and the data was more precise.

Phase II

We will be exploring ways to reduce the carbon footprint, specifically on-road emissions, of the most energy inefficient countries in New Jersey, specifically through the use of electric vehicles (EVs). Jersey City is not only one of the most energy efficient cities in New Jersey, but, in 2015, was ranked the 10th “greenest” city in America (Panico 2015). Knowing this, our database, and overall vision, will aim to model the energy inefficient cities I mentioned after Jersey City. The way we plan on doing this is to look at Jersey City’s use of EVs, due to their use of Via. Via is a rideshare service launched three years ago with a fleet of EVs (ridewithvia.com).

The data that will be analyzed focuses on the amount of green house gas emissions released into the atmosphere based on municipality and its correlation with the amount of electric vehicle owners. Population will also be taken into consideration and charging station infrastructure. In order to lower GHG emissions, carbon-free transportation is one of the most effect ways to improve sustainability at a municipal level. The selected data will answer the following questions:

1. Which municipalities are the most energy efficient?
2. How does population density affect GHG Emissions?
3. Based on previous and current data are electric vehicles lowering GHG Emissions throughout densely populated areas and by how much?

By gathering data on municipalities that are the most energy efficient, we will be able compare this data to municipalities that have a similar population density in order to establish that there is a need for carbon-free transportation. Jersey City has become one of the most energy efficient cities in New Jersey despite a high population density as a result of multiple projects that include carbon-free transportation (Via). Population density is significant because it allows us to accurately assume if GHG emissions are fairly high or low in a specific area. By using the amount of electric vehicle usage based on municipality, we can correlate this data with both the level of GHG emissions and population density to determine which municipality would benefit from encouraging carbon-free transportation. This will lead to charging infrastructure and encourage individuals to either purchase electric vehicles, use apps that focus on EV based transportation such as Via or use electric scooters as a form of transportation. According to the United States Environmental Protection Agency (EPA) as of 2020, carbon dioxide accounts for 79% of green house gas emissions (United States Environmental Protection Agency 2022) The main sustainability problem that we are identifying is air pollution and opportunities to lower GHG emissions benefit the environment on a broader scale starting at a municipal level to evoke positive change.

A major factor for our project will be the data we will gather to incorporate into our project. Our main idea that we are trying to show is how the use of electronic vehicles helps the environment. To demonstrate this we will use data from counties which will display their average greenhouse gas emissions from two separate years, such as 2015 versus 2020. We will then also use data from the same counties where there was an increase in electric vehicle ownership and from there we will show the possible correlation between the two statistics. Additionally we will add another statistic of population in those counties to account for an increase of people in the counties which could potentially lead to higher greenhouse gas emissions than when the population was lower in earlier years. The data about greenhouse gas emissions and electric vehicle ownership will be obtained from Sustainable Jersey's Data Resources. The data for the population of these counties will be obtained from the US Census Bureau and will be from the years 2010 and 2020 which are slightly different from the years being used in the other statistics but will still be useful.

Our database will give the user the ability to add data to a table, edit or remove data from the database, sort the data in the database, or export the data to a csv spreadsheet. By having all four of these capabilities, the user should be able to not only better understand trends in the data, but to also implement it in many other ways. By being able to sort the data, the user will be able to more easily see trends in the data when trying to examine by population size or the amount of electric vehicles in comparison to carbon emissions, and by exporting the data to a CSV file, the data can easily be used in other programs, or put into an excel sheet for better visualization.

In conclusion, the proposed project aims to explore ways to reduce carbon footprint in energy inefficient cities in New Jersey through the use of electric vehicles. The project will analyze data on greenhouse gas emissions, population density, and electric vehicle ownership in various municipalities to determine the effectiveness of carbon-free transportation in reducing emissions. By comparing energy efficient cities like Jersey City to similar municipalities with high population density, the project will provide insights into the need for carbon-free transportation and charging infrastructure. The data will be obtained from Sustainable Jersey's data resources and the US Census Bureau. The project will contribute to efforts to reduce air pollution and promote sustainability at a municipal level.

Our proposal to improve sustainability is based on data gathered from green house gas emissions, the amount of electric vehicles and population between 2015 and 2020. The purpose of gathering data is to get the

Works Cited

Ridewithvia.com, https://ridewithvia.com/case-study/jersey-city.

Panico, Rebecca. “Jersey City Rated 10th Greenest Cities in America by Online Study.” *Nj.com*, 23 Apr. 2015, https://www.nj.com/hudson/2015/04/jersey_city_rated_one_of_the_top-ten_greenest_citi.html.

United States Environmental Protection Agency. (2022, May 16). *Overview of Greenhouse Gases*. US EPA; United States Environmental Protection Agency. https://www.epa.gov/ghgemissions/overview-greenhouse-gases

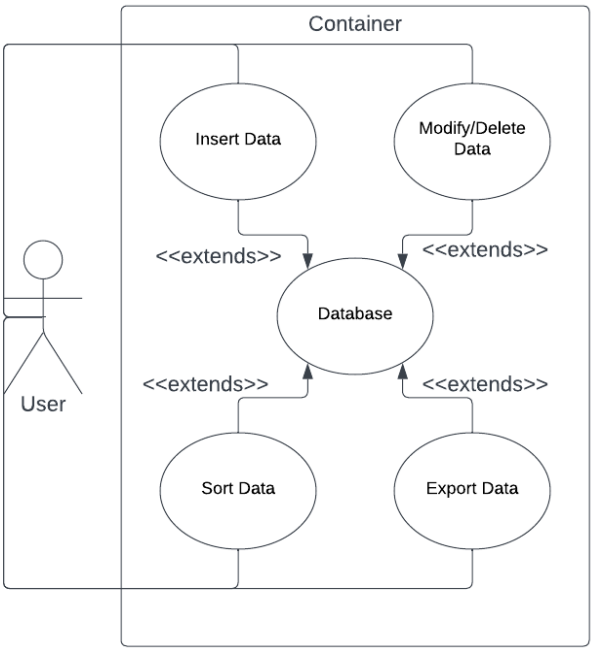
Phase III

A relational database is a collection of data points whose relationship has already been predetermined by the administrators. Relational databases have been in use since the 1970s and are still the most widely accepted model for databases today. The model used for these types of databases stores the logical data structures (the data tables, views, indexes, etc.) separate from the physical storage structures. This allows database administrators to manage the storage of the physical structure without affecting the data itself (renaming a file without renaming the tables within that file). A variety of organizations utilize the relational model to, among other things, track inventories, process transactions, and manage information.

Relational databases are consistent across copies, as well as applications. For example, you can make a change to a document on your phone using Google Docs and instantly see that change reflected on your computer. Another benefit of the relational model is that change is permanently in existence. It is the reason you can hit the undo and redo buttons. This is obviously a lot more intricate and, frankly, complicated, as a relational database won't commit to one thing unless it knows it can commit to all the things. This is called atomicity. Atomicity is what keeps the data in the base accurate and in line with rules, regulations, and policies set by the business. This is another benefit of a relational database. These are just some of the most valuable parts of using a relational model and part of the reason for its longevity and undisputed preference.

Within the diagram provided, population, electric vehicle usage and green gas house emissions are taken into account. For population data is categorized by county, year, and the number of people in each county. This is then linked to the amount of the

population that owns electric vehicles. Electric vehicle data is then specified by county, year, and ownership. Both Population and electric vehicles correlate with green gas house emissions whether they increase or decrease them depending on the total emissions per year within each county. Population, electric vehicle ownership, and greenhouse gas emissions are all being compared on a yearly basis based on the information provided to gain an understanding of the effect that electric vehicles have on the environment and prove that they have lowered greenhouse gas emissions over time in specific counties such as Hudson county, Bergen county, etc. The reason why this is important is that all three variables will be used in order to track counties that will benefit from improving the use of electric vehicles and can predict the amount of greenhouse gas emissions that will decrease based on the increase of electric vehicle owners within yearly increments. With the use of relational databases information from extracted data sets will be arranged specifically according to census data, EV usage, and GHG emissions and stored the data accordingly which then allows users to easily access data according to the county.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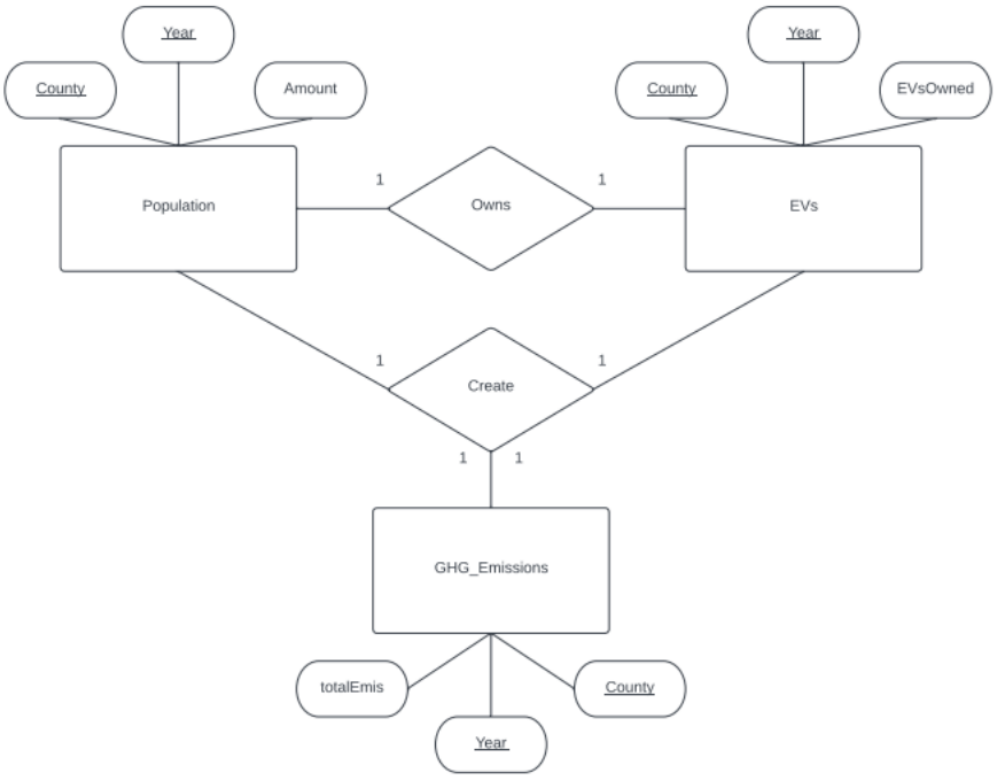
Year
County
Amount
Year
County
EVsOwned
Population
1
Owns
1
EVs
1
Create
1
1
1
GHG_Emissions
totalEmis
County
Year

Our proposal to improve sustainability is based on data gathered from greenhouse gas emissions, the number of electric vehicles, and the population between 2015 and 2020. This information is gathered to determine which municipalities are the most energy efficient, the effects that population density has on greenhouse gas emissions, and if electric vehicles are lowering greenhouse gas emissions throughout densely populated areas. Electric transportation has been proven to reduce greenhouse gas emissions however, the goal is to be able to compare different ranges of the population by the municipality and detect how electric vehicles affect greenhouse gas emissions based on population density. Our research and database allow users to search each county, and its amount of EVs in comparison to greenhouse gas emissions based on its population density. With the use of this database, this project can improve efforts in reducing carbon footprint in locations that specifically need energy efficiency throughout New Jersey by encouraging the use of electric vehicles.

This proposal would then allow the public to have access to an organized website where one can search for their county's GHG emissions, EV usage, and population density to make informed decisions that could potentially reduce carbon footprint such as investing in carbon-free transportation. By showing changes in data from all three data contributors, there are more positive ethical implications as a result. From 2015 to 2020 GHG Emissions have increased overall however energy efficient municipalities have been able to regulate greenhouse gas emissions with the use of carbon-free transportation. Unintended risks through encouraging investments in electric vehicles may be the process of sourcing materials to create electric vehicle batteries, the possible lack of charging stations available, and/or the amount of

electricity used for producing and sustaining electric vehicles. These risks can be approached with other sustainable projects such as solar-powered charging stations and sustainable sourcing when extracting raw materials for EV batteries. This proposal is worth pursuing because it is an attainable and cost-effective leap in the right direction to reduce GHG emissions and inform the public of useful information that is easily accessible.

Sources

https://nj.gov/health/fhs/primarycare/documents/Rural%20NJ%20density2015-revised%20municpalities.pdf

https://www.sustainablejersey.com/resources/data-center/sustainable-jersey-data-resources/

What is a relational database? Oracle. (n.d.). Retrieved March 8, 2023, from https://www.oracle.com/database/what-is-a-relational-database/

Phase IV

Greenhouse gasses include carbon dioxide, methane, nitrous oxides, and water vapor. Scientists have determined that carbon dioxide's, specifically, warming effect helps stabilize Earth's atmosphere. Without carbon dioxide, Earth's surface would be some 33°C (59°F) cooler and therefore inhabitable. In the last century or so, humans have been interfering with the planet's energy balance, mainly through the burning of fossil fuels, through factories and cars, all of which add carbon dioxide to the air. The level of carbon dioxide in Earth’s atmosphere has been rising consistently for decades and that traps extra heat near Earth's surface, causing temperatures to rise. This is what we know as global warming which is causing what we know as climate change.

New Jersey has the second highest population density in the nation, only after D.C. New Jersey’s total Greenhouse Gas Emissions by vehicle (including motor home, motorcycle, passenger cars and trucks, school and transit bus, refuse truck, and single unit long and short haul trucks) totals 124,629.00. We will explore ways to reduce the carbon footprint of energy inefficient cities in New Jersey through the use of electric vehicles. The project will analyze data on greenhouse gas emissions, population

density, and electric vehicle ownership in various municipalities to determine the effectiveness of carbon-free transportation in reducing emissions.

Sources

https://www.states101.com/populations

https://climate.nasa.gov/faq/19/what-is-the-greenhouse-effect/#:~:text=Greenhouse%20gases%20include%20carbon%20dioxide,effect%20helps%20stabilize%20Earth's%20atmosphere.