RISE RESEARCH INNOVATION SCHOLARSHIP ENTREPRENEURSHIP

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Subject/Category : DS2001
Class : Data Science
Group # : 21

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Greenhouse Gas Emissions in Boston

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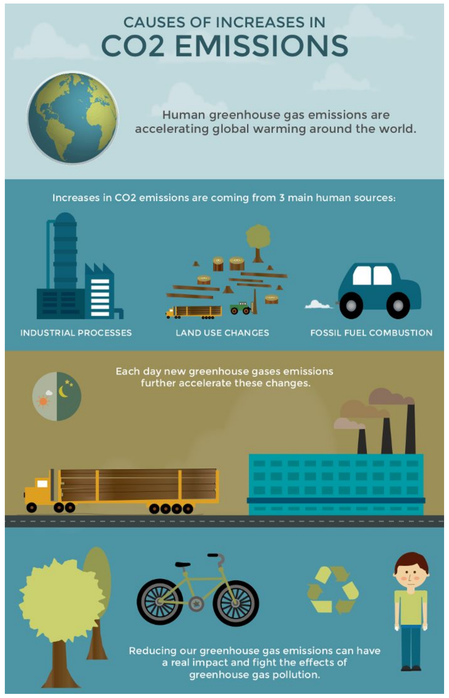
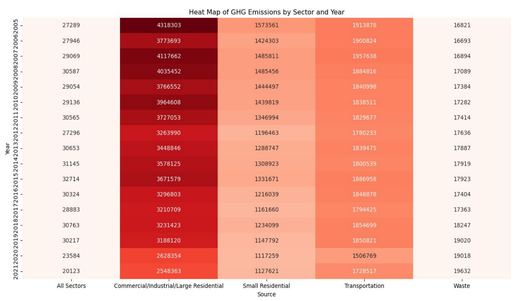
Motivation and Goals:

The main goal of this project is to compare greenhouse gas emissions by sector and by source. We want to find out which source is most efficient in each sector so we utilize them and optimize each source for environmental sustainability. The goal of the project is to analyze the data of emissions from large commercial/industrial residentials, small residentials, and transportation from 2005 to 2021 to see what sources are most efficient in each sector and compare them with one another.

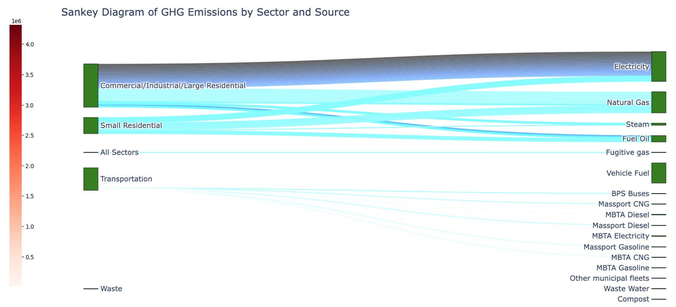


Process and Methods:

- Use Public CSV Data from the City of Boston.
- Read and cleaned the data using python and the Pandas DataFrame.
- Used Plotly Seaborn and Matplot to visualize and interpret the data.



heatmap showing emission by sector and year



sankey diagram showing emission by sector and source

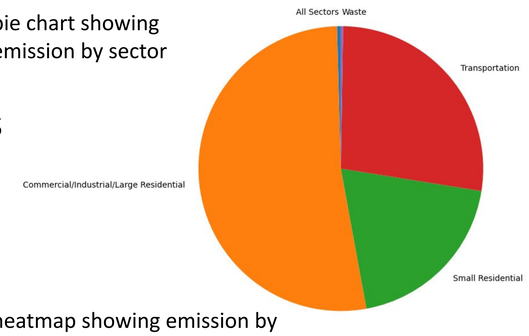
The Commercial/Industrial/Large Residential sector consistently has the highest GHG emissions, showing showing minimal improvement. The Transportation sector also shows significant emissions but appears to have some variability over the years.

Certain sources, such as Electricity and Natural Gas, have a significant contribution to GHG emissions across several sectors, which is depicted by the thicker flow lines. The width of flows suggests a higher volume of GHG emissions is tied to those sources.

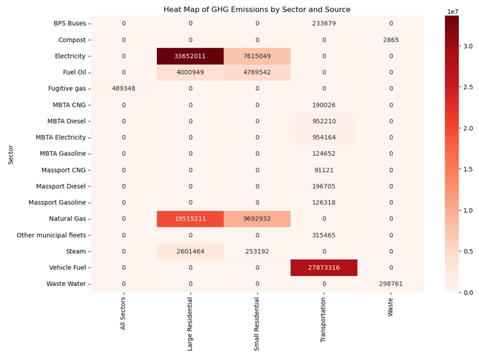
Findings:

- Most damaging cause of GHG emissions is **electricity** used in **Commercial Real Estate**
- **Most Efficient** Source by Sector
  Commercial/Industrial/Large: **Steam**
  Small Residential: **Steam**
  Transportation: **Massport CNG**
  Waste: **Compost**
- **Most Inefficient** Source by Sector
  Commercial/Industrial/Large: **Electricity**
  Small Residential: **Natural Gas**
  Transportation: **Vehicle Fuel**
  Waste: **Waste Water**

pie chart showing emission by sector



heatmap showing emission by sector and source



Conclusions & Recommendations:

By identifying the sectors and energy sources responsible for the highest emissions, we have pinpointed where interventions can have the most substantial impact on the city's carbon footprint.

1. **Substituting electricity in commercial real estate** with alternatives, such as solar power, wind power, and hydroelectric power
2. Incentivising commercial real estate units, such as offices, warehouses, and retail spaces, to **use electricity more conservatively**
3. Incentivise use of **public transport** and subsidize purchase of **electric** or **hybrid cars** to decrease use of vehicle fuel

In the immediate future, we plan to delve deeper into more complex datasets, about specifically commercial real estate with key indicators of its usage (i.e. retail, office, warehouse, hotel etc.) to make more specific recommendations on how to mitigate use of electricity.