

Observing factors affecting greenhouse gas emissions in populated cities

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1. Introduction

The problem is pollution. A group of environmental scientists will be the audience and be shown how pollution in Toronto compares to one of the less polluted cities such as Calgary in Canada. They will be shown how the city of Toronto is structured compared to this city and how can Toronto be restructured in a way which makes the city cleaner. What causes Toronto to be more polluted in comparison? Is it the location of certain places such as restaurants, factories? Or is it the amount of people living in one area? Also, the amount of cars in an area and what impact that has. These are just a few possibilities in which the team would like to research what causes Toronto to be more polluted than other cities. The team will present the findings to the group of environmental scientists and international organizations such as the International Panel for Climate Change (IPCC) in order for them to understand how pollution in major cities like Toronto work, and how it can be reduced.

2. Data gathering

Statistical data will be used to solve this problem. All the data gathered was from the year 2016. Knowing the types of transportation people take in Toronto and comparing the modes of transportation in Calgary can enable us to better understand how the city is structured. Thereafter, we can use greenhouse emission data to determine how much pollution is caused by these areas and how much from on-road transportation.

Car data was also used in the city of Toronto and comparing that with the car data in Calgary. This will demonstrate how many cars are present on-road average everyday and in which areas. We can measure the overall air pollution caused by the cars. Air pollution can also be measured from the factories and any other human source of greenhouse gases. As greenhouse gases occur naturally, but this will not be our concern. Only anthropogenic sources will be examined, mainly those caused by on-road transportation

3. Methodology

Pandas was used heavily in order to create dataframes from the data which one can easily work with. Alongside Pandas, Beautiful Soup was also used to parse through a table to get relevant information to help us understand our problem. For visualization, the Seaborn library was used especially the bar plots.

Population data was examined for both Toronto and Calgary, as this information will be useful in understanding how effectively we can reduce greenhouse gas emissions. The

more people, the more policies will have to take place to make greater impact on reduction of these gases.

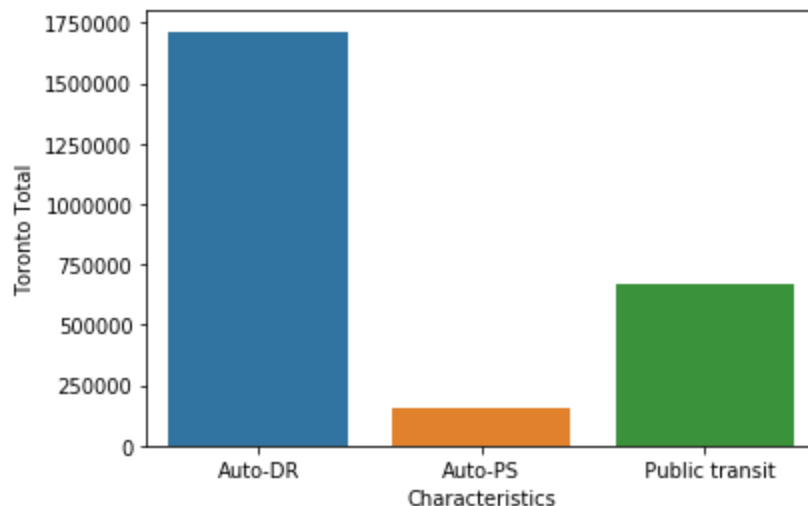
Along with population data, transportation data was also analyzed. How many people commuted to work through which mode of transport. This is one of the most important aspects to consider when answering the question of reducing greenhouse gas emissions as the CO₂ released from automobiles is one of the main sources of greenhouse gas (ghg) by humans.

In addition to the aspects considered above, data about amount of greenhouse gas released in the cities of Toronto and Calgary were analyzed and considered. This showed the amount of greenhouse emissions from different sectors, however focus was made for the sector of transportation, specifically on-road transportation.

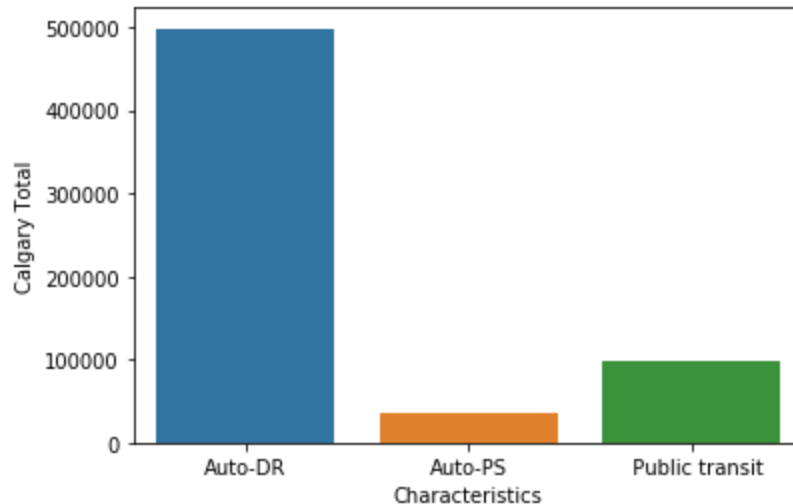
4. Results

It was found that Toronto released more greenhouse gases due to on-road transportation than Calgary. The amount released by Toronto measured in metric tonnes was 6,285,080 while for Calgary it was 5,968,614. It was shown that the population of Toronto was almost 5 times greater than that of Calgary. In terms of modes of transport, people in Toronto used more public transit than people in Calgary while both cities had majority driving to work with them as drivers. Below are some diagrams depicting the results.

Bar chart for Toronto: Amount of people using each respective mode of transport. DR means driver, PS- Passenger



Bar chart for Calgary: Amount of people using each respective mode of transport. DR means driver, PS- Passenger



5. Discussion

Even though enough data was gathered, perhaps more data would have been useful. Specifically more data in terms of where most of the emissions took place, and whether those areas were close to the highway or not. More analysis could have been done and more relationships could have been examined, which is a goal for future editions of this research.

An interesting point to consider is the population of the two cities compared. Toronto had about 6 million people while Calgary had around 1.4 million people. Even with this gap in population the amount of ghg released differed only by about 300,000 metric tonnes.

6. Conclusion

I analyzed the data pertaining to greenhouse gas emissions in Toronto and compared that to Calgary. I used the total amounts released by both cities focusing on on-road transportation. I also observed the modes of transport used by each city and see if that may have an effect on the amount of ghg released. This was a preliminary form of research, of course future research is needed however these results can help environmental scientists better understand the situation in these two cities and what measures can be taken to reduce emissions.