

Exploring Alternative Fuel Availability (AFA) in the Chicagoland Area

Project #1

Team Members G5

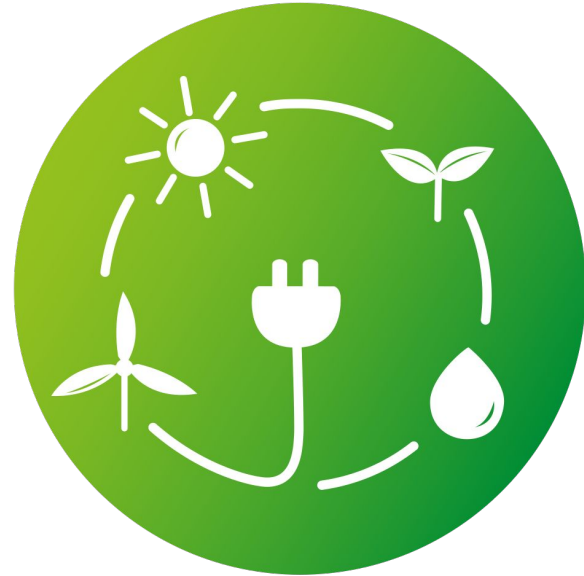
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Project Description / Outline

Exploring alternative fuel availability (AFA) in the Chicagoland area can involve various factors, including the types of alternative fuels available, the number and locations of fueling stations, and the availability of vehicles that can use alternative fuels.

Some alternative fuels commonly used in the transportation sector include electricity, hydrogen, compressed natural gas (CNG), propane, and biodiesel. Each of these fuels has unique characteristics and benefits, and the availability of these fuels can vary depending on the region.

Regarding fueling stations, there are various options for alternative fuels in the Chicagoland area. For example, there are over 150 electric vehicles (EV) charging stations throughout the city and suburbs, including Level 2 charging stations and DC fast chargers. Additionally, several CNG fueling stations are in the area, including stations operated by Trillium and Clean Energy.



Alternative fuels are important for several reasons



- **Environmental Benefits** Alternative fuels emit lower levels of pollutants and greenhouse gases than traditional fossil fuels. Using alternative fuels can help reduce air pollution, positively impacting public health and the environment.
- **Energy Security:** Alternative fuels can help reduce dependence on foreign oil and increase energy security. By diversifying our energy sources, we can reduce reliance on a single energy source and decrease our vulnerability to supply disruptions.
- **Economic Benefits:** Alternative fuels can create new jobs and industries, particularly in the renewable energy sector. Investing in alternative fuels can create new opportunities for businesses and workers and spur economic growth.
- **Innovation:** Developing and implementing alternative fuels requires technological innovation and research. Investing in alternative fuels can lead to discoveries and advances in clean energy technology, benefiting various industries and sectors.
- **Long-Term Sustainability:** Fossil fuels are finite resources, and their continued use can have negative long-term consequences for the environment and future generations. Alternative fuels offer a more sustainable energy source that can be used without depleting natural resources.

Dataset Selected

City of Chicago Public Data

List of locations in NE Illinois, NW Indiana, and SE Wisconsin where alternative vehicle fuels are available.

Updated April 12, 2023

Key Words: Sustainability and Transportation

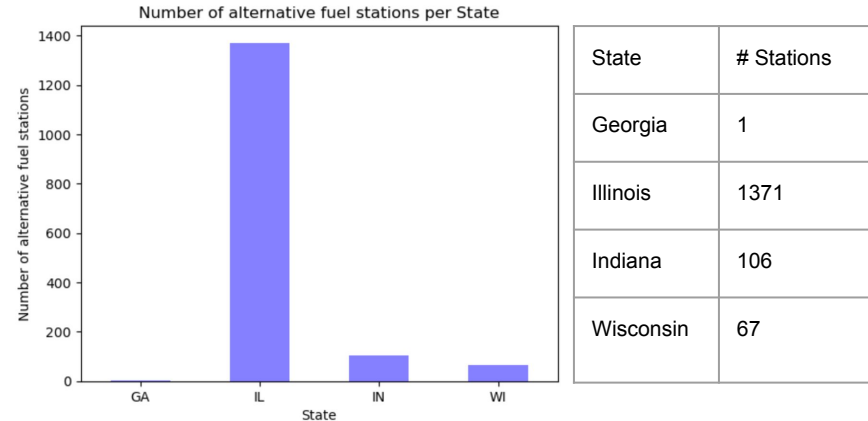
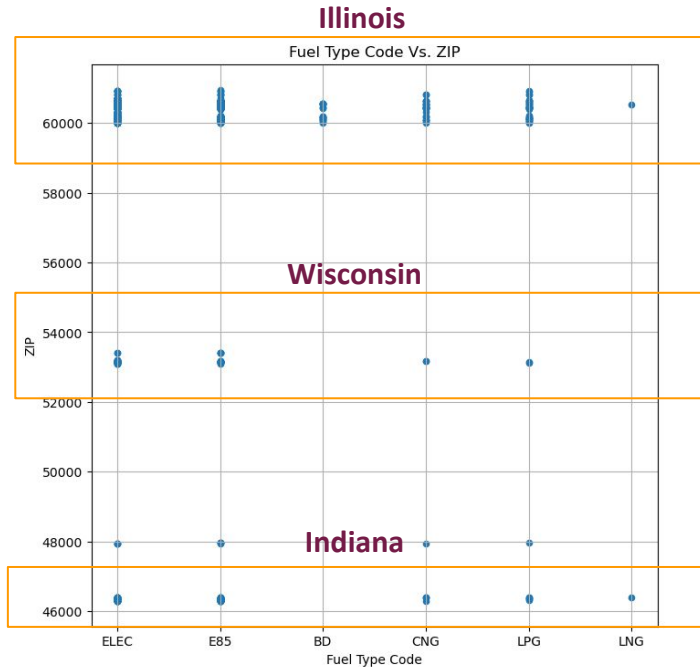
[Link here!](#)



Findings / Results

1. What is the Alternative Fuel Availability (AFA) across ZIP codes?

- Over all, the ZIP codes corresponding with the State of Illinois showed the highest occurrence of alternative fuel stations, across all fuel types analyzed.
- Since this list is probably not exhaustive for Indiana, Wisconsin or Georgia, we analyzed tendencies only in Illinois after this point.

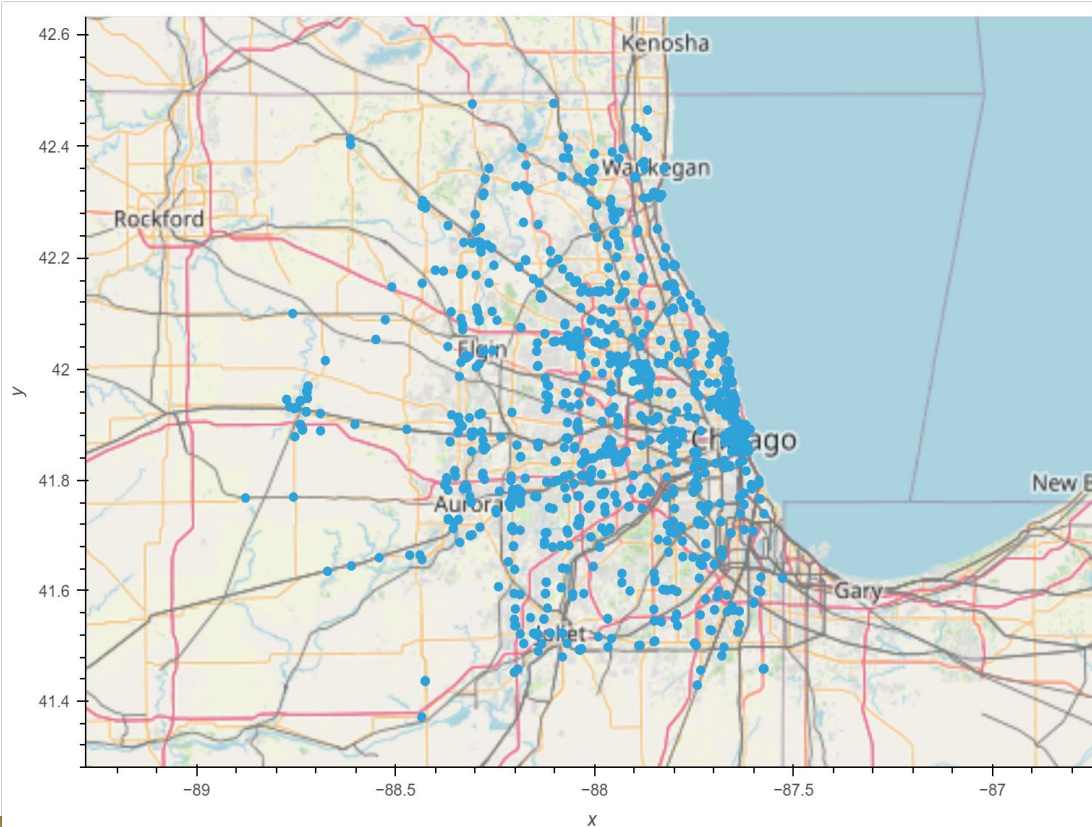


Available fuel types: Electric, E85, Bio-Diesel (BD), Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LPG) and Liquefied Natural Gas (LNG). From the Dataset Electric is widely used and competes favorably with E85, LPG and LNG.

The Chicago metro is therefore potentially good to support the growing push for EVs (Electric Vehicles) for environmental sustainability and other economic benefits in the study focus.

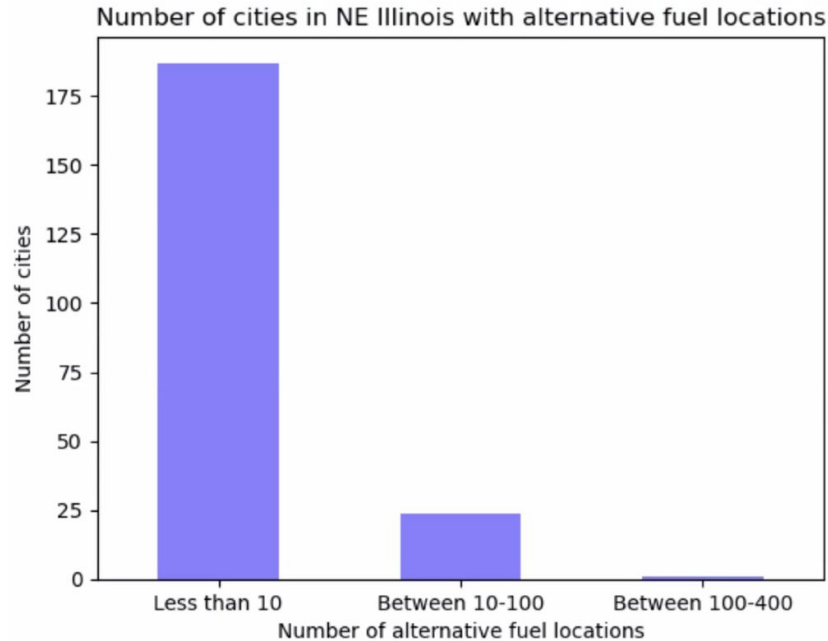
2. How abundant this locations are across North Eastern Illinois?

AFA Distribution Map By ZIP Code



The map shows the distribution of the alternative fuel stations, centered in Chicago and surrounding cities. The AFA density per square mile should be considered in meeting the study objectives (Environmental Benefits, Energy Security, Economic Benefits, Innovative Support for EVs and Long-Term Sustainability due to the finite nature of fossil fuels)

2. How abundant this locations are across North Eastern Illinois?



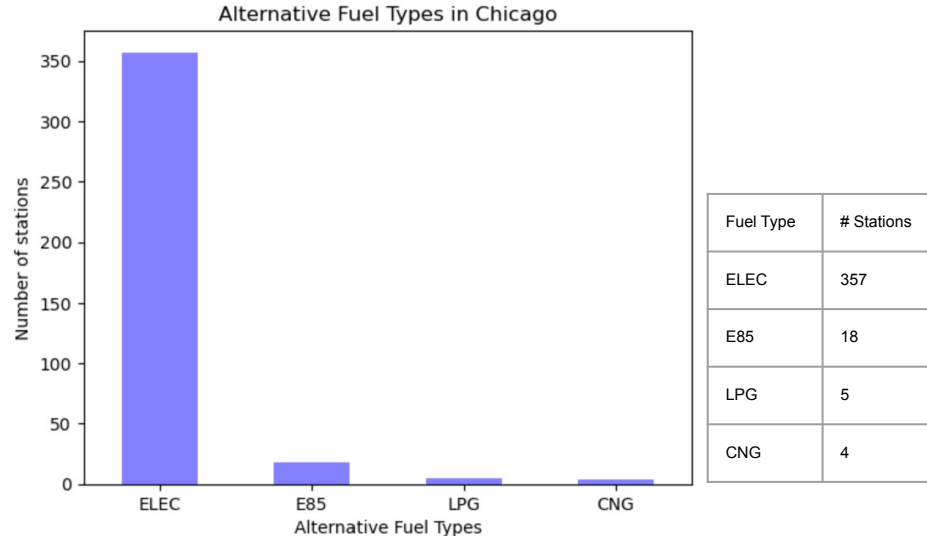
# Locations	# Cities
Less than 10	187
Between 10 - 100	24
Between 100-400	1

Chicago

Aurora
Barrington
Bolingbrook
Crystal Lake
DeKalb
Des Plaines
Downers Grove
Elgin
Evanston
Geneva
Great Lakes
Joliet
Lemont
Libertyville
Lombard
Montgomery
Naperville
North Aurora
Northbrook
Oak Brook
Oak Park
Oakbrook Terrace
Schaumburg
Skokie

The highlighted cities had over 20 fuel locations

3. How many alternative fuel types does Chicago offer?



Chicago offers 4 types of alternative fuel:

→ Of all these, the number of electric stations was notably bigger when compared to E85, LPG and CNG numbers.

it appears that the dataset regarding the Total Fuel Type Code has a large standard deviation compared to the mean and the median. This suggests that the data points are widely spread out and possibly have a significant number of outliers or extreme values.

The mean value of 257.67 suggests that the average Total Fuel Type Code in the dataset is relatively high. However, the median value of 42.0 is significantly lower than the mean, indicating that there may be a few very high values that are pulling up the mean.

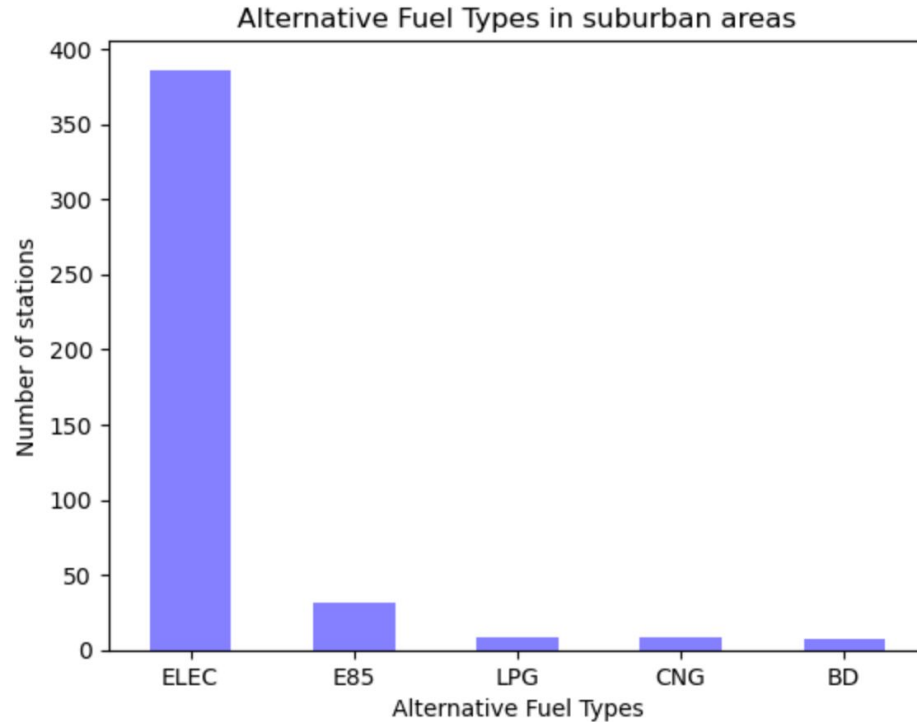
Overall, these results suggest that the dataset regarding the Total Fuel Type Code may have some variability and potential outliers. It would be important to further investigate the distribution of the data and identify any potential reasons for the high values to better understand the nature of the data.

The mean for this data set regarding the Total Fuel Type Code is: 257.67

Standard Deviation: 463.66999759167794

Median: 42.0

3. How many alternative fuel types do the suburbs offer?

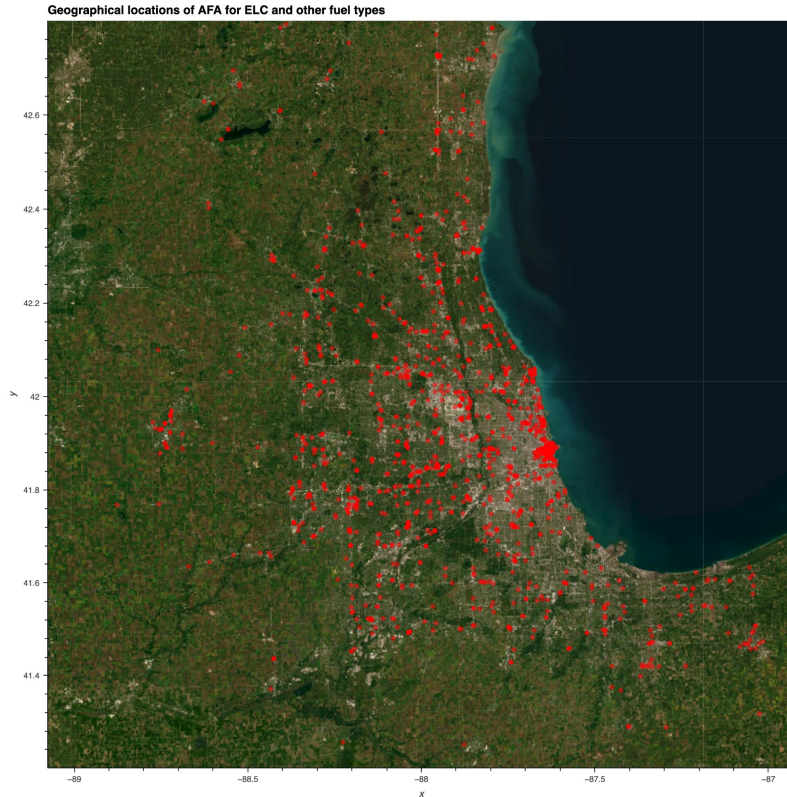


The suburbs offer 5 types of alternative fuel:

- Of all these, the number of electric stations was notably bigger when compared to E85, LPG, CNG and BD numbers.
- The suburban areas offer comparable number of electric charge stations to the ones in Chicago, which is a good sign towards implementing cleaner sources of energy

Fuel Type	# Stations
ELEC	386
E85	31
LPG	9
CNG	9
BD	7

4. Explore the geographical locations of AFA for ELC and other fuel types

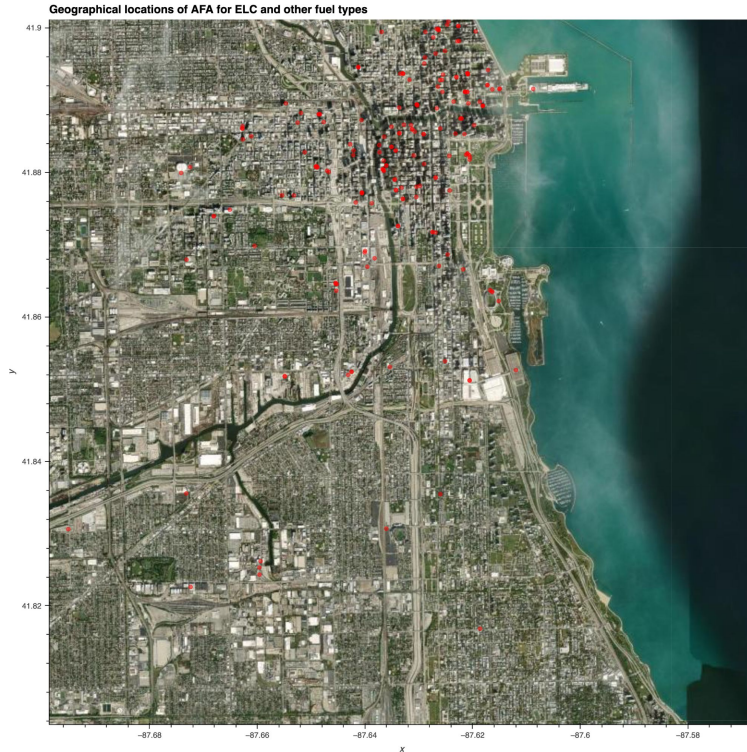


→ Stations are mostly concentrated in the Downtown Area, fact that might be explained based on the reasons below:

- High Population Density: more population means there are more potential electric vehicles (EV) drivers in the area who would require access to charging stations.
- Greater Business Activity: may provide incentive for charging station providers to install their stations in the area to attract EV-driving customers.
- Accessibility: more accessible infrastructure, including power grids and road networks, making it easier to install charging stations.
- Government Support: at local and national levels, incentives and subsidies encourage the adoption of EVs, which may result in a higher concentration of charging stations in areas where such policies are in place.

It's important to note that these are only possible reasons, and there may be other factors at play in the distribution of charging stations in Chicago or any other city.

4. Explore the geographical locations of AFA for ELC and other fuel types (cont.)

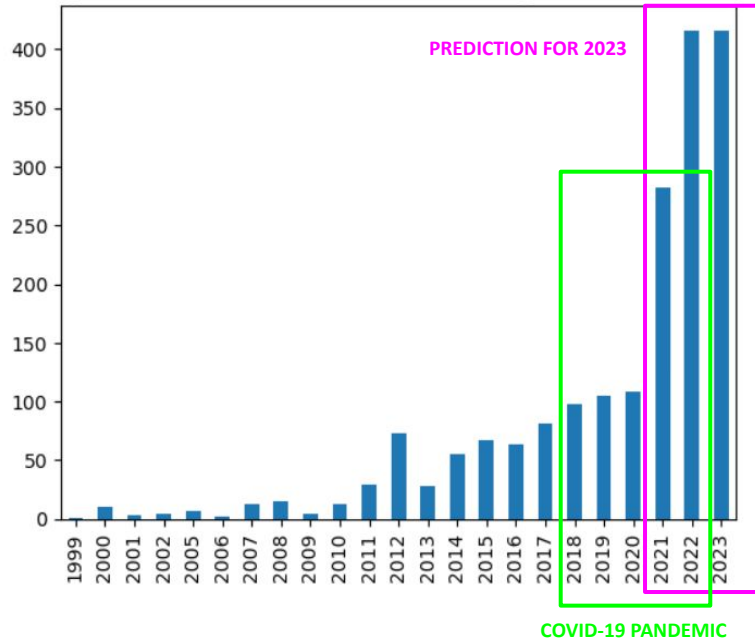


Some of the reasons we observed the diversity of stations in the suburbs are related to:

- Home charging: suburban areas tend to have more residential properties with garages or driveways where EV owners can install charging stations.
- Parking facilities: more parking facilities, such as shopping malls, grocery stores, and public parking garages, which may provide EV charging stations as an added service for their customers.
- Long-distance travel: often located on the outskirts of urban areas, may serve as a convenient stopping point for EV drivers who need to charge their vehicles during long-distance travel.
- Government incentives: Local governments may offer incentives for businesses to install EV charging stations, which may make it more attractive for businesses located in suburban areas to install them.
- **** Public transportation**

5. Has AFA increased over the recent years?

Fuel Type vs Number of New Stations in Chicagoland - 2023 Prediction



The growth of electric vehicles (EVs) since 1999 has been relatively slow. Still, it has accelerated significantly in recent years due to factors such as government incentives, technological advancements, and increased public awareness of the environmental benefits of EVs.

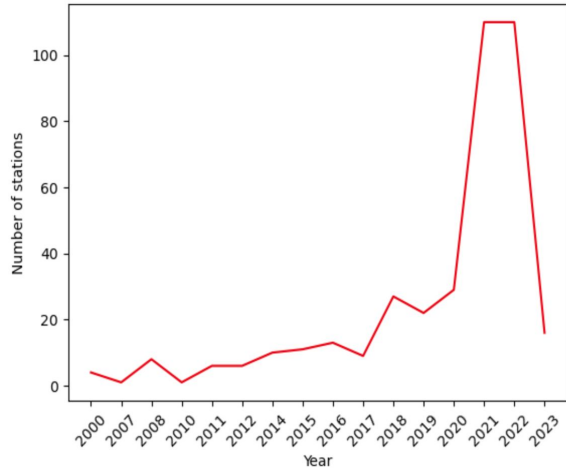
Using regression, we estimated the number of stations for the rest of 2023 at around 450, representing 10% growth.

The green line highlights the stability of the number of new stations from 2019 to 2020, probably as a consequence of the global pandemic.

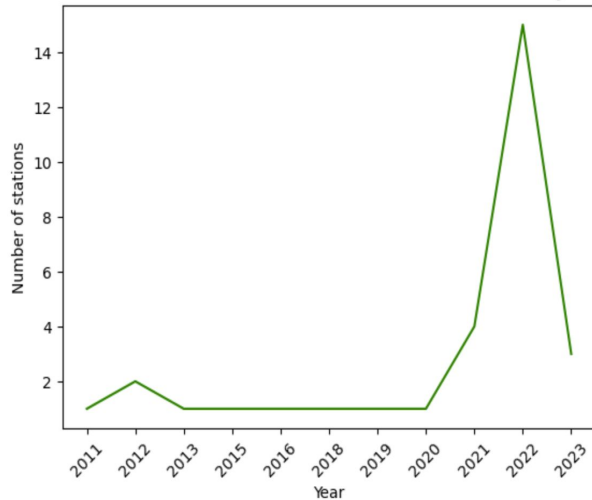
5. Has AFA increased over the recent years?

- Chicago had a big increment in the number of stations, particularly observed from the year 2020
- Naperville and Joliet also observed an increment in the number of alternative fuel stations, although at a very lower scale.
- Overall the main cities in Northeastern Illinois consistently show a shift towards other fuel resources, complementing our data observed before in point #3.

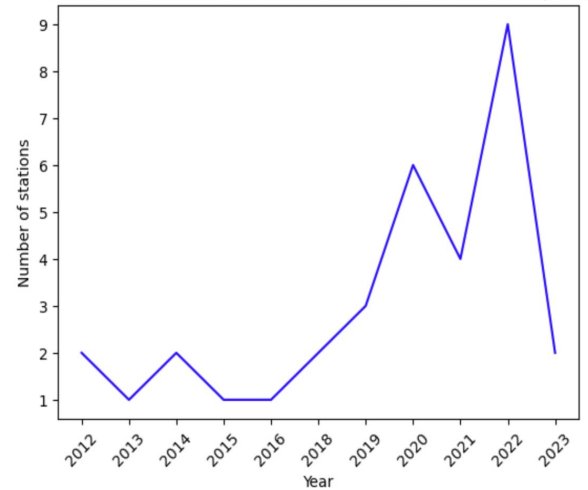
Growth of alternative fuel station numbers over time in Chicago



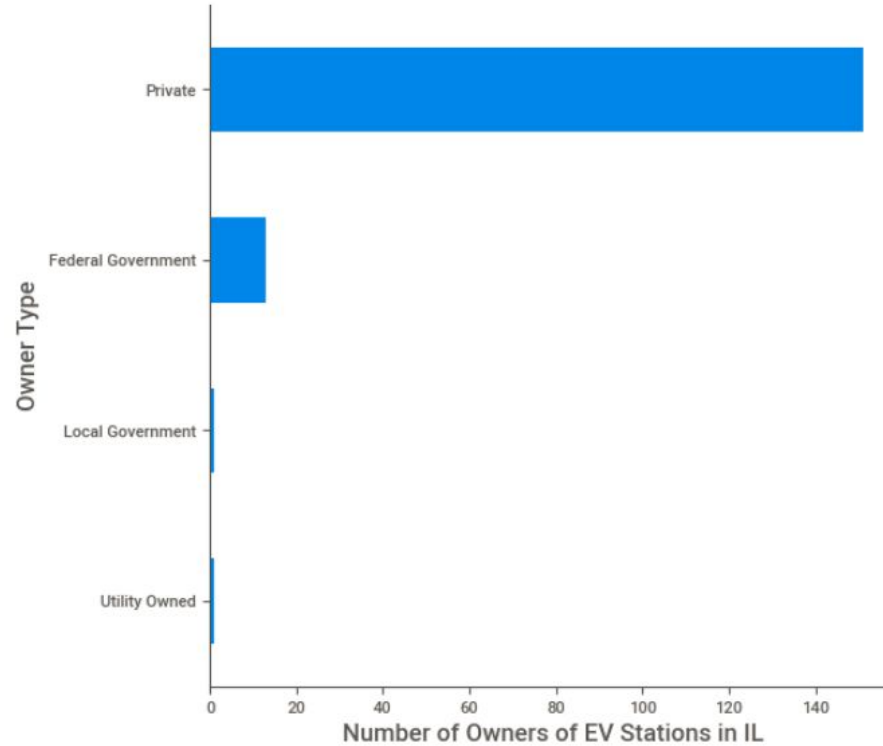
Growth of alternative fuel station numbers over time in Joliet



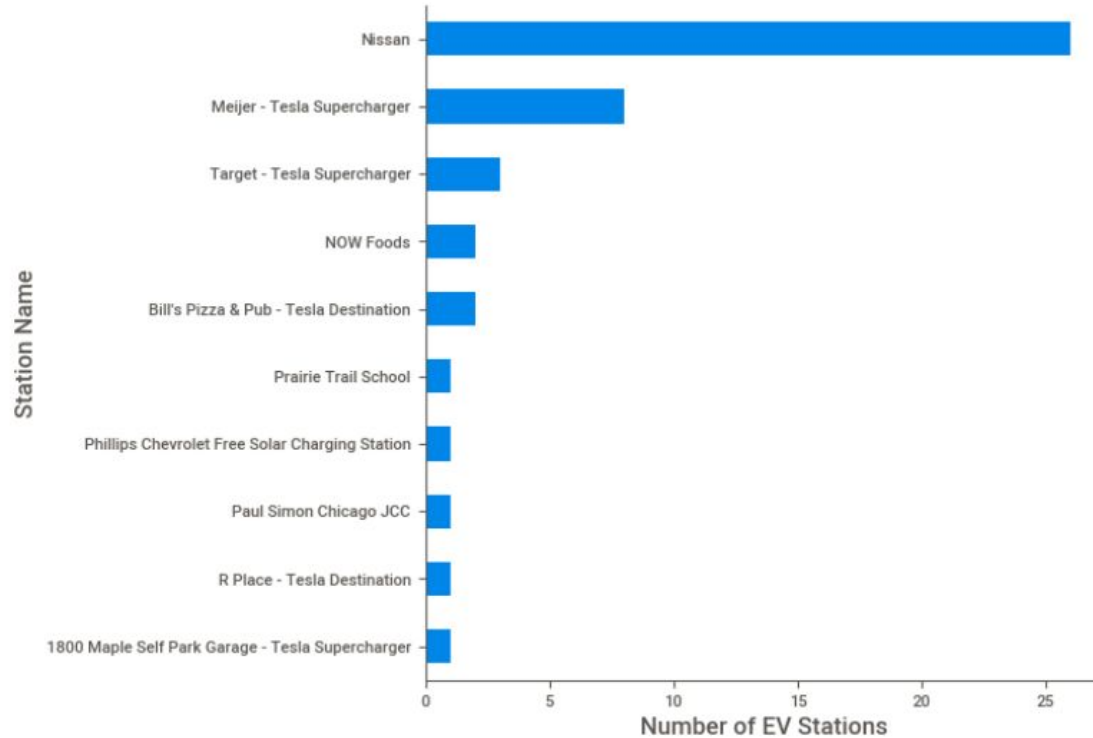
Growth of alternative fuel station numbers over time in Naperville



6. Who owns the majority of electric fuel stations in Illinois?



6. Top 10 EV Stations



Further Research

- Compare geographical locations with median income data
- Analyze accessibility of these electric fueling stations to the public (access and cost)
- Explore growth of cars using alternative fuels in IL
- Contrast Chicagoland area with a similar metropolitan area like Toronto



Conclusions - Present and Future States of Alternative Fuel

The adoption of alternative fuels in Chicagoland can potentially lead to significant benefits such as reducing greenhouse gas emissions and improving air quality. However, the challenges of infrastructure development and cost-effectiveness may hinder the widespread adoption of alternative fuels in the region.

It is important to note that the success of alternative fuels will also depend on consumer awareness and willingness to adopt new technologies. Therefore, efforts to educate and encourage consumers to switch to alternative fuels may play a critical role in achieving a sustainable and clean energy future for Chicagoland.

The impact of COVID-19 on the electric transportation industry has been complex and multifaceted. Here are some key points:

Supply chain disruptions: The pandemic caused major disruptions to global supply chains, which affected the production and availability of components and materials needed for electric vehicles (EVs) and their charging infrastructure.

Sales and demand: Sales of EVs initially declined due to the pandemic as people postponed major purchases and focused on essential goods. However, many analysts believe that the pandemic has accelerated the transition to electric vehicles due to a greater focus on environmental sustainability, lower operating costs, and government incentives.

Government support: Many governments around the world have provided financial support and incentives for the electric transportation industry in response to the pandemic, including funding for EV charging infrastructure, tax credits for EV purchases, and subsidies for EV manufacturers.

Overall, the growth of electric vehicles has been relatively slow and steady since 1999, but it has accelerated significantly in recent years, and many experts predict that the EV market will continue to grow rapidly in the coming years as technology improves, costs decline, and consumers and governments increasingly prioritize sustainability and clean energy.

Further research and data analysis are needed to draw more definitive conclusions about the potential benefits and challenges of alternative fuels in Chicagoland.