

Electric Vehicle Adoption Trends & Charging Stations

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Thank You for Your Time!

- Driving Change, One Charge at a Time!
- Questions? Let's Discuss!
- Your thoughts matter! Feel free to share your insights.
- The road to sustainability starts with us!

Case Studies in Electric Vehicle Adoption



EV Sales vs Charging station analysis:

- Geographical Visualization



Introduction: analysis and insights on global ev adoption and charging infrastructure



Global Adoption Trends



Charging Stations Analysis

Objective:

Examining the availability and distribution of charging stations

Method:

Analyzing the Open EVSE dataset to assess coverage in the USA

Data:

The map shows great areas have higher or lower densities of charging stations, including regions with high population and infrastructure support for electric vehicles (EV). California has the highest density of public charging stations and charging outlets in the USA. This is due to its high EV adoption rate. Because of the driving patterns and incentives for EVs, California, North Dakota and Montana have higher densities of public charging stations than other states due to a combination of the number of EVs on the road, the number of EVs adopted, and the number of EVs on the road.

Observations:

- EVs in states with better access to fast chargers, and regions like California, have higher adoption rates.



Factors Influencing Adoption



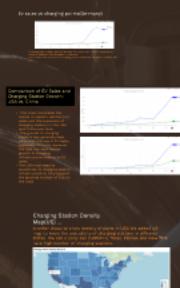
Government Policies and Incentives



Technological Advancements



Charging Infrastructure



Charging Station Density

Charging stations are becoming more widespread as more people purchase electric vehicles.

California has the highest density of public charging stations in the USA.

Other states like Texas and Florida also have significant numbers of public charging stations.

Private charging stations are also becoming more common in residential areas.

Overall, the density of charging stations is increasing rapidly as more people adopt electric vehicles.

Introduction: analysis and insights on global ev adoption and charging infrastructure

Datasets Overview

I4A Global EV Outlook Report
Detailed analysis of electric vehicle adoption, market trends, and policy impacts.
Key Features:
• EV sales data by year and region
• EV charging infrastructure data
• Insights into adoption patterns across different regions

EVgoEV Charging Station Data
Data and information about EV charging stations in the US.
Key Features:
• Locations of charging stations
• Availability and accessibility
• Regional distribution patterns

Types of Electric Vehicles

There are three main types of electric vehicles: battery electric vehicles (BEVs) run solely on electricity, plug-in hybrid electric vehicles (PHEVs) combine a conventional engine with an electric motor, and fuel cell electric vehicles (FCEVs) use hydrogen to generate electricity.



Introduction



Objective: Explore global EV adoption trends, analyze the role of charging stations, and examine regional patterns.

Types: BEVs (Battery Electric Vehicles) & PHEVs (Plug-in Hybrid Electric Vehicles).

Purpose of the Project:
Analyze EV adoption trends globally, examine charging station distribution and infrastructure gaps.

Key Techniques: Time series analysis, regional comparisons, regression analysis and data visualization.

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Datasets Overview

1. IEA Global EV Outlook Report

Comprehensive global statistics on EV adoption, market trends, and policy impacts.

Key features:

- EV sales data by year and region.
- Market share and growth over time.
- Insights into adoption patterns across different countries.

2. OpenEVSE Charging Station Data

Detailed information about EV charging stations in the USA.

Key features:

- Location of charging stations.
- Availability and accessibility.
- Regional distribution patterns.

IEA Global EV Outlook Report (Source: <https://www.iea.org/reports/global-ev-outlook>)
OpenEVSE Charging Station Data (Source: <https://www.openevse.com/data>)

Global EV Adoption Trends

- Significant growth over the last decade, with annual EV sales doubling in the last 5 years.
- Passenger EVs dominate; buses and trucks show growth in specific regions.
- Top regions: China, USA, Europe.



Historical Adoption Rates

Over the past decade, electric vehicle adoption has increased markedly, with global sales surpassing 10 million units in 2020, marking an impressive 43% annual growth rate.

Market Statistics In 2023

- Nearly 14 million new electric cars were registered globally in 2023.
- Electric car sales increased by 35% year-on-year, reaching 3.5 million more than in 2022. This growth rate is over six times higher than that of 2018.
- Over 250,000 new electric cars were registered per week in 2023, surpassing the total annual registrations in 2013.
- Electric cars constituted approximately 18% of all car sales in 2023, compared to 14% in 2022 and only 2% in 2018.
- Battery electric cars represented 70% of the electric car stock in 2023.

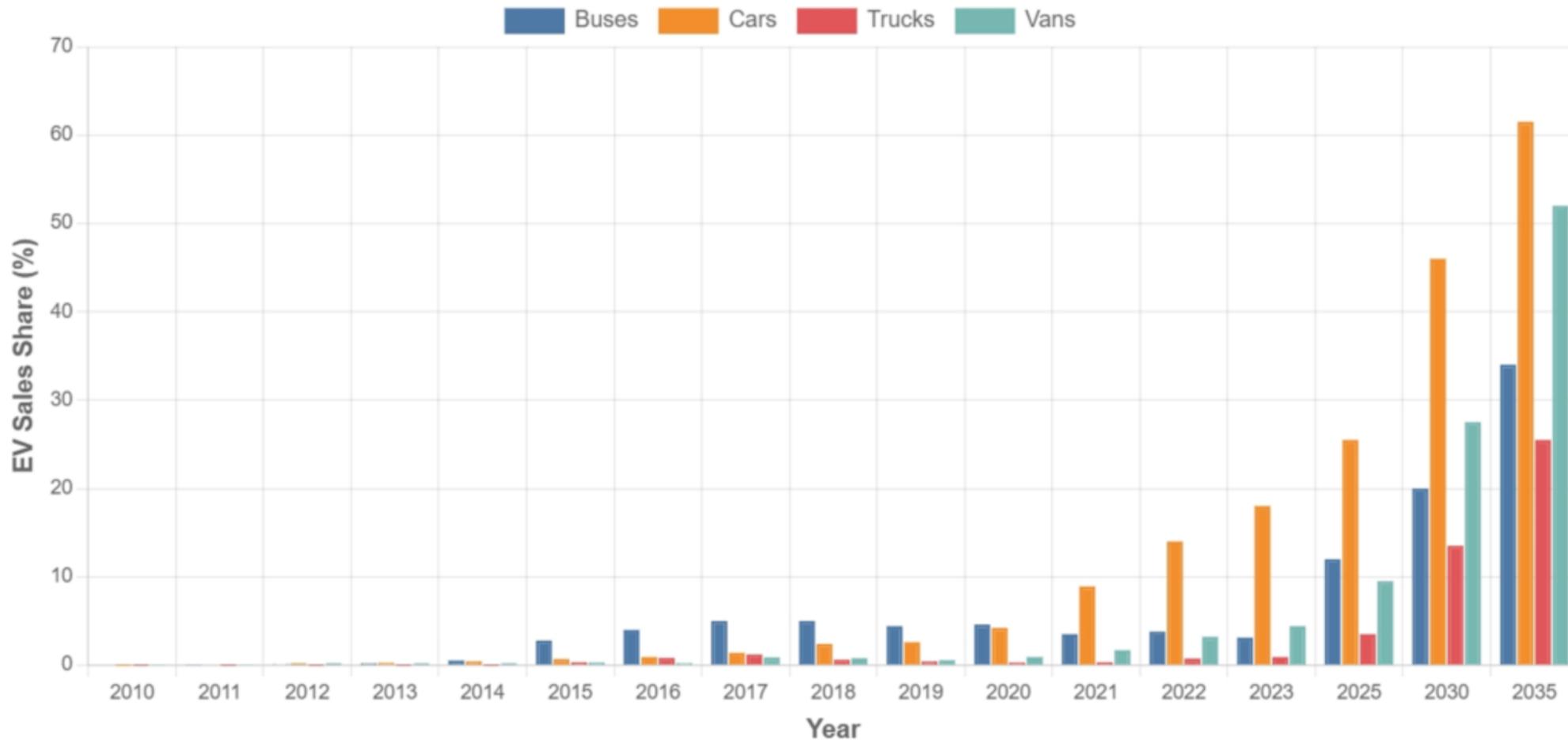


Future Projections

IEA forecasts that by 2035, electric vehicles could comprise up to 50% of global vehicle sales, driven by advancements in technology and stricter emission regulations. The trajectory indicates strong growth potential as more manufacturers enter the EV market.

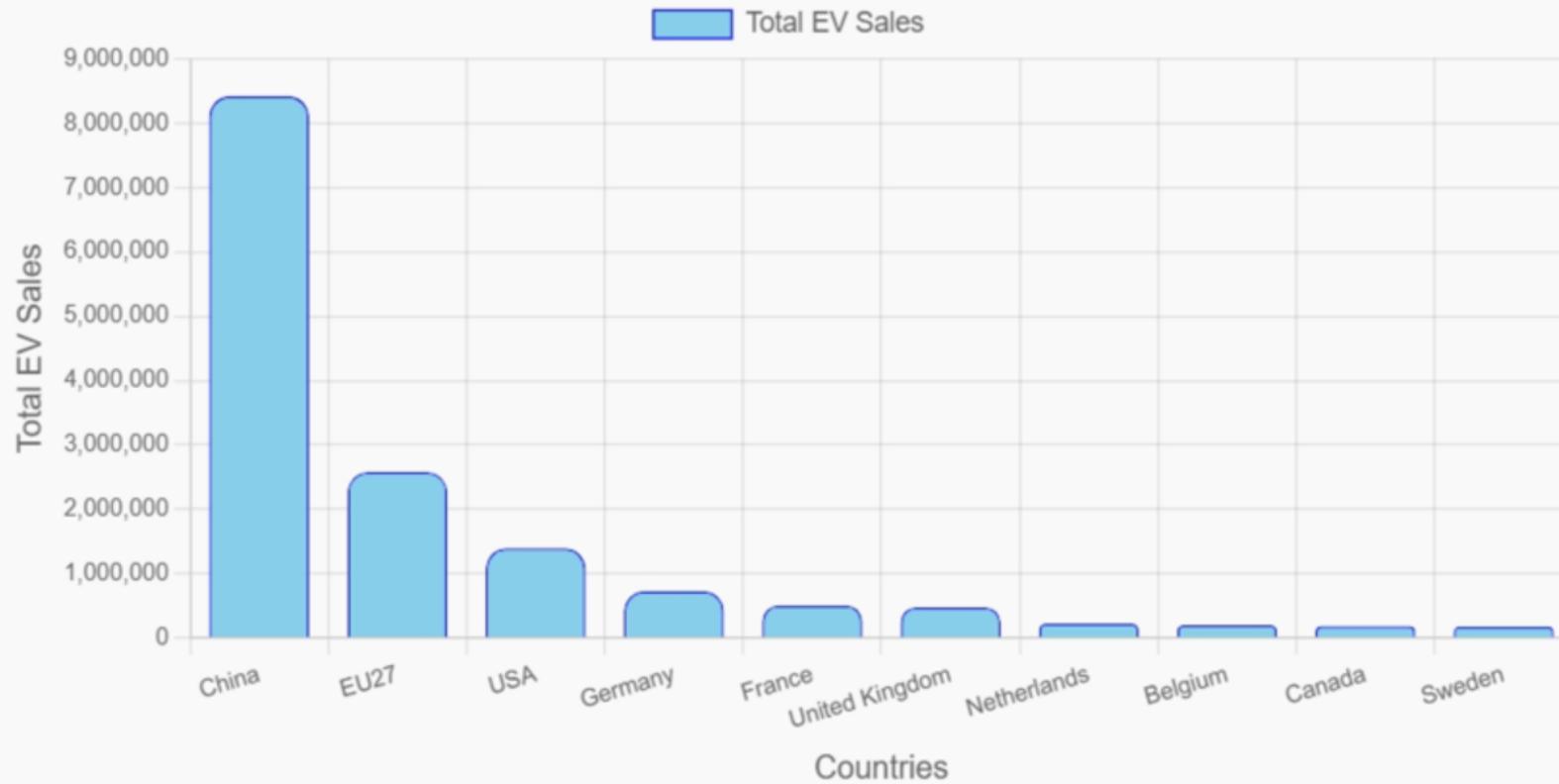


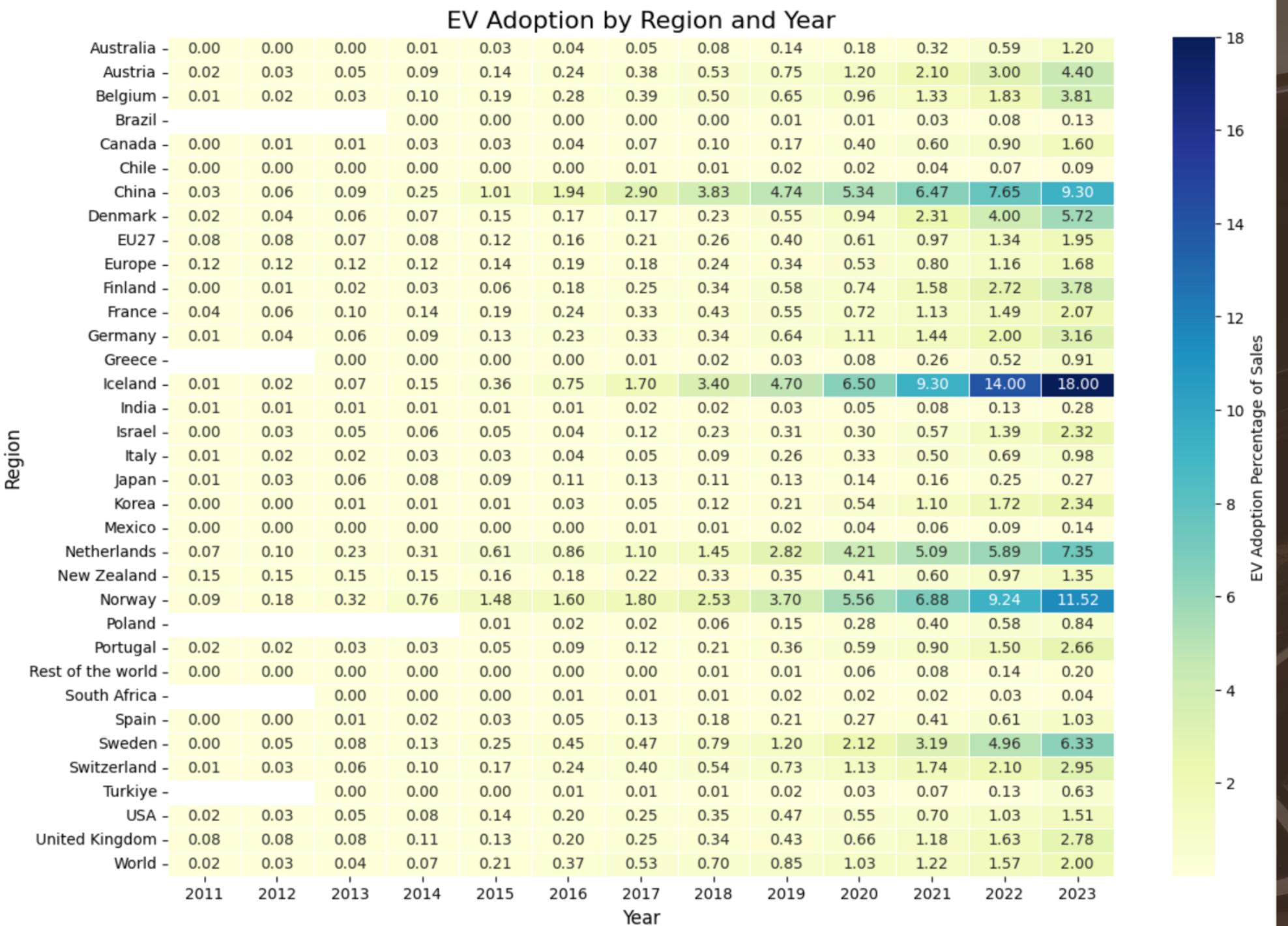
EV Sales Share by Mode (Grouped Bar Chart)



Top 10 regions by EV sales(2023)

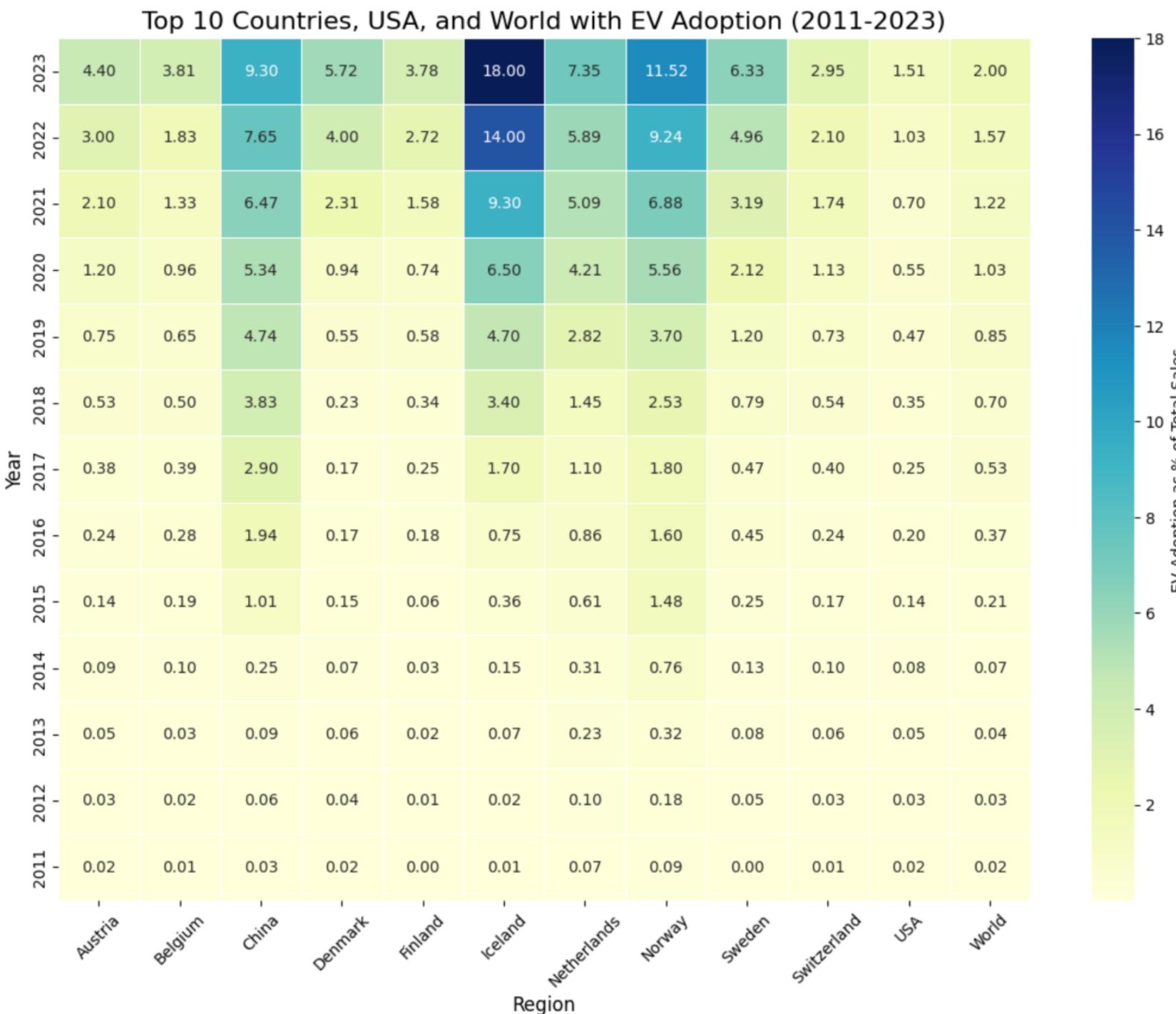
Top 10 Countries by EV Sales for 2023





Iceland, Norway, and China

- Financial Incentives
- Environmental Policies
- Investment in Charging Infrastructure
- Access to Renewable Energy
- Domestic Manufacturing



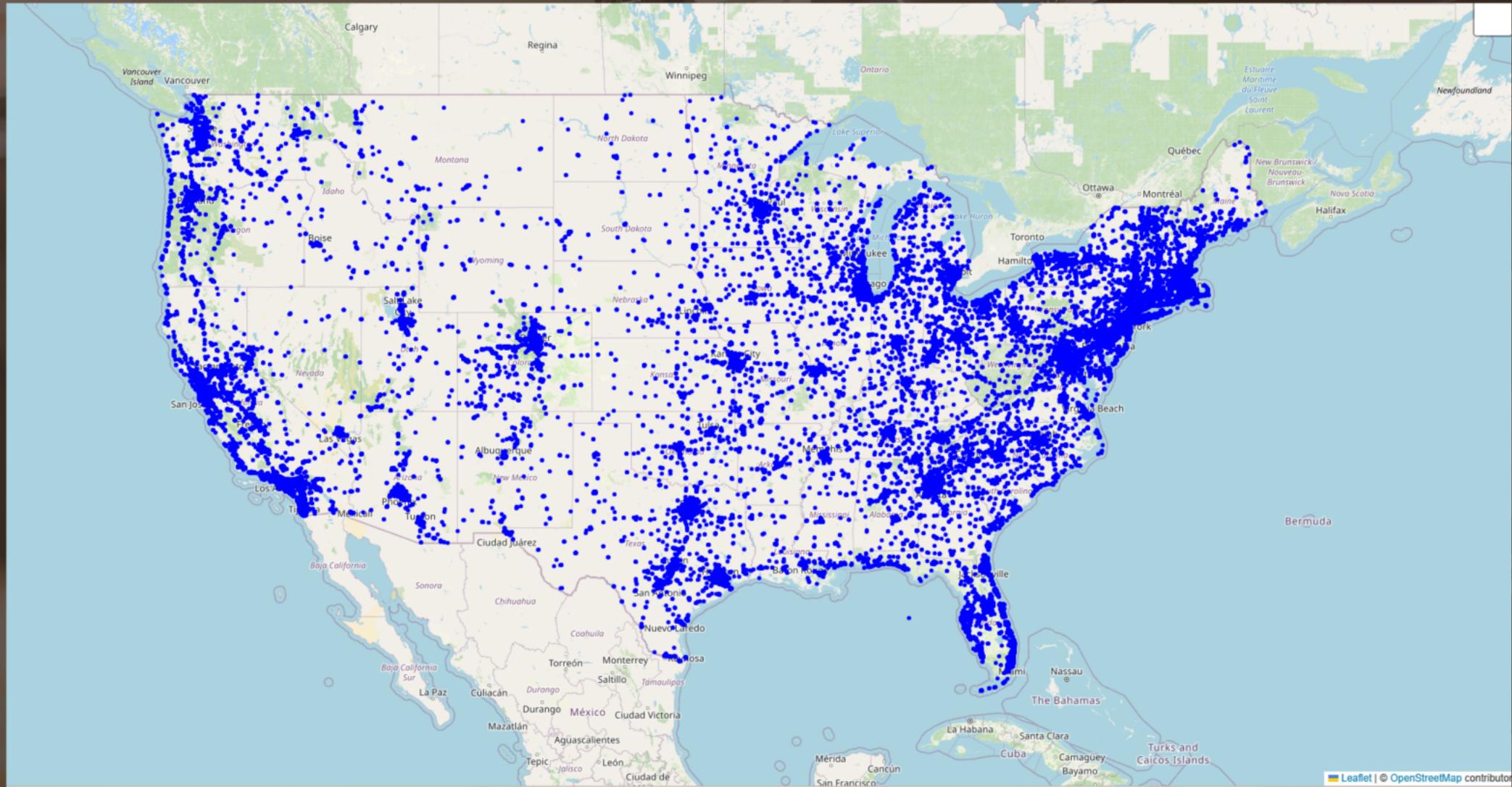
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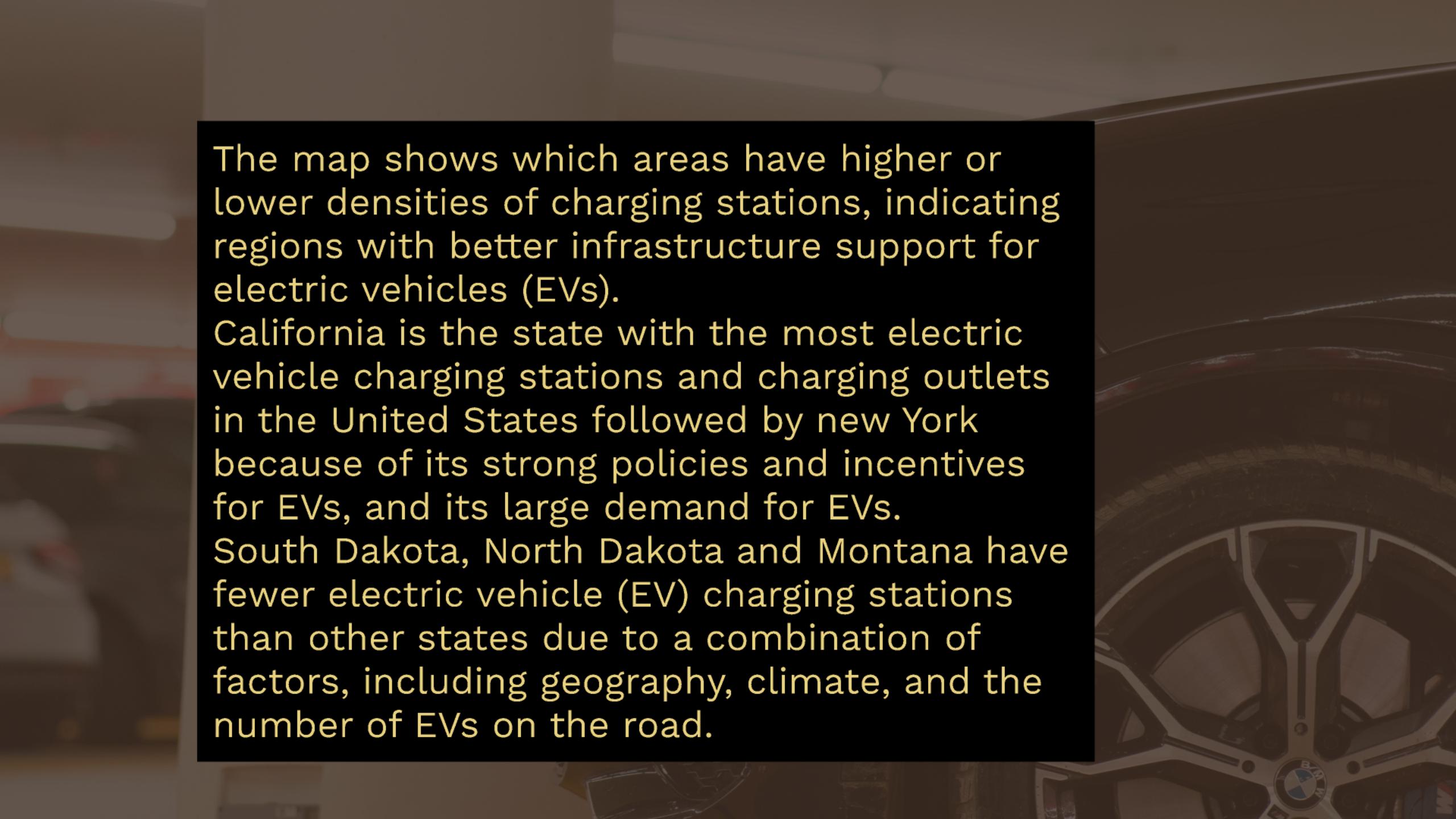
Visuals:

Interactive map showing charging stations in the USA



Observations :

- Urban areas have better access to fast chargers, rural regions lag.
- Public charging infrastructure critical for non-home adopters.



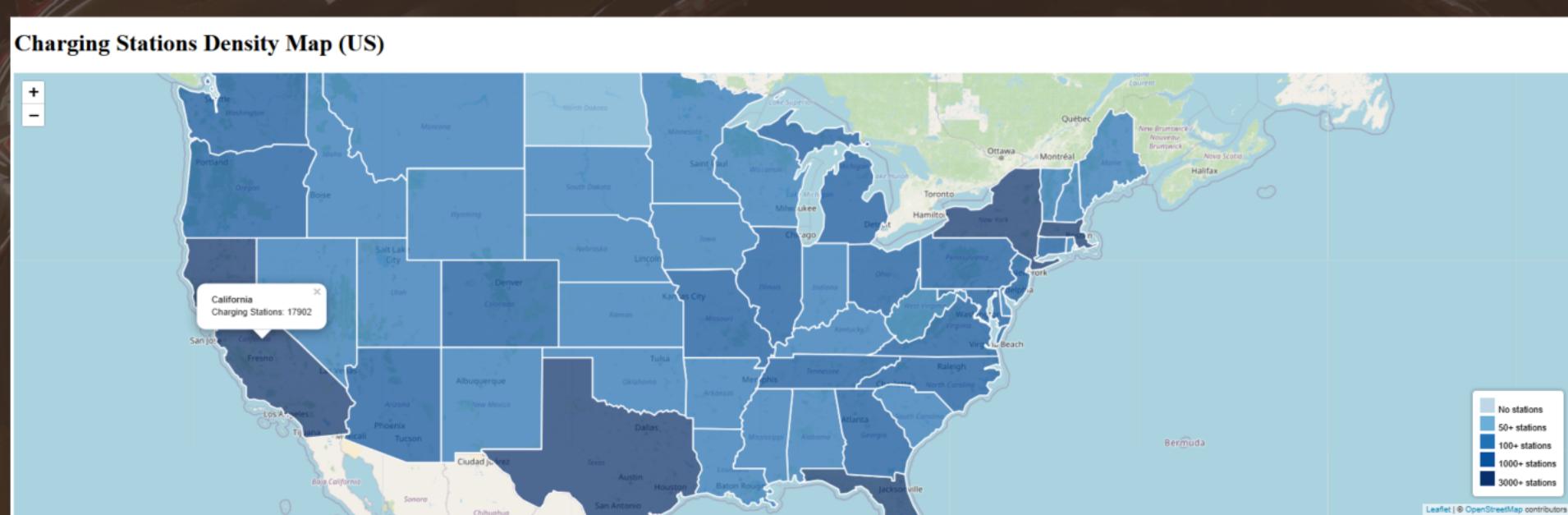
The map shows which areas have higher or lower densities of charging stations, indicating regions with better infrastructure support for electric vehicles (EVs).

California is the state with the most electric vehicle charging stations and charging outlets in the United States followed by New York because of its strong policies and incentives for EVs, and its large demand for EVs.

South Dakota, North Dakota and Montana have fewer electric vehicle (EV) charging stations than other states due to a combination of factors, including geography, climate, and the number of EVs on the road.

Charging Station Density Map(US) ...

Another visual to show density of ports in USA We added US map to know the availability of charging stations in different states. We can clearly see California, Texas, Florida and New York have high number of charging stations.



Types of Charging Stations

Charging stations are categorized into three types: Level 1 (home charging, 120V), Level 2 (public charging, 240V), and DC Fast Charging (rapid charging for long distances). Each type serves different user needs, from overnight home charging to quick stops on long trips.





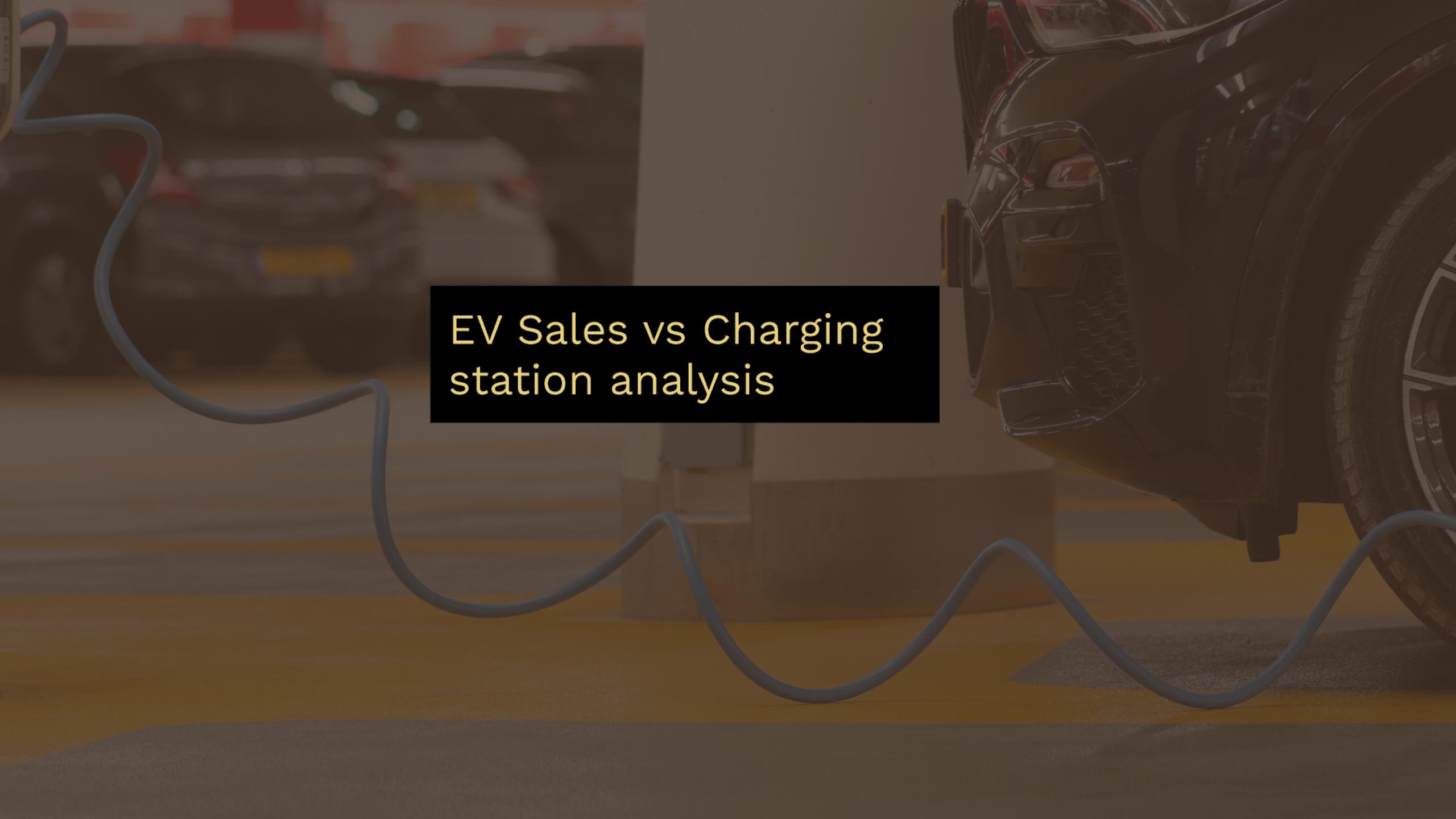
Current Distribution of Charging Stations

As of 2023, there are approximately 130,000 public charging stations in the U.S., with California leading in availability. Urban areas demonstrate higher concentrations, reflecting the demand from residents and commuters living in denser populations.

Challenges in Expanding Infrastructure

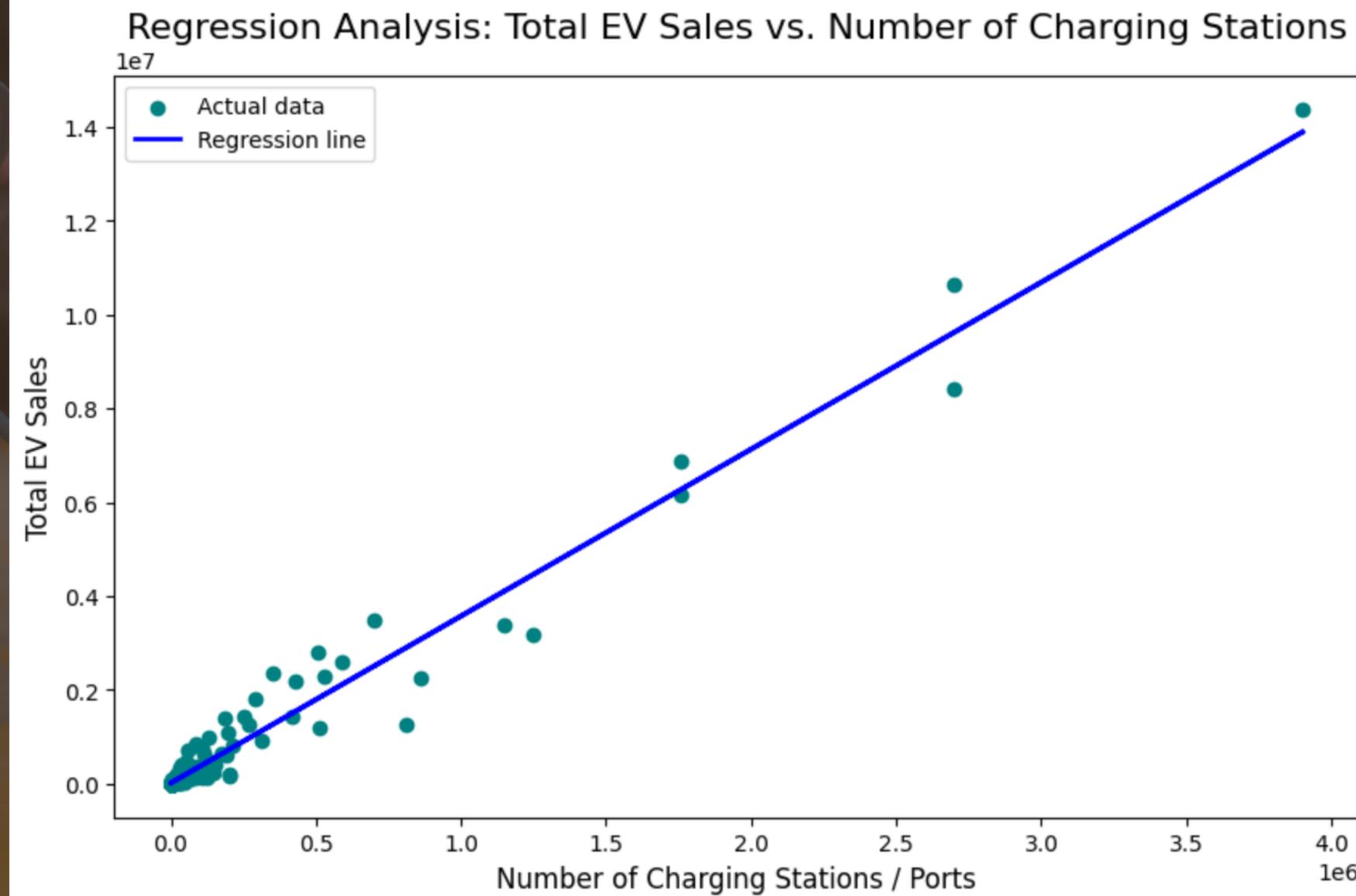
Significant obstacles in expanding charging infrastructure include high installation costs, land use regulations, and grid capacity limitations. Additionally, public perception and demand for charging locations can hinder rapid deployment despite increased electric vehicle sales.





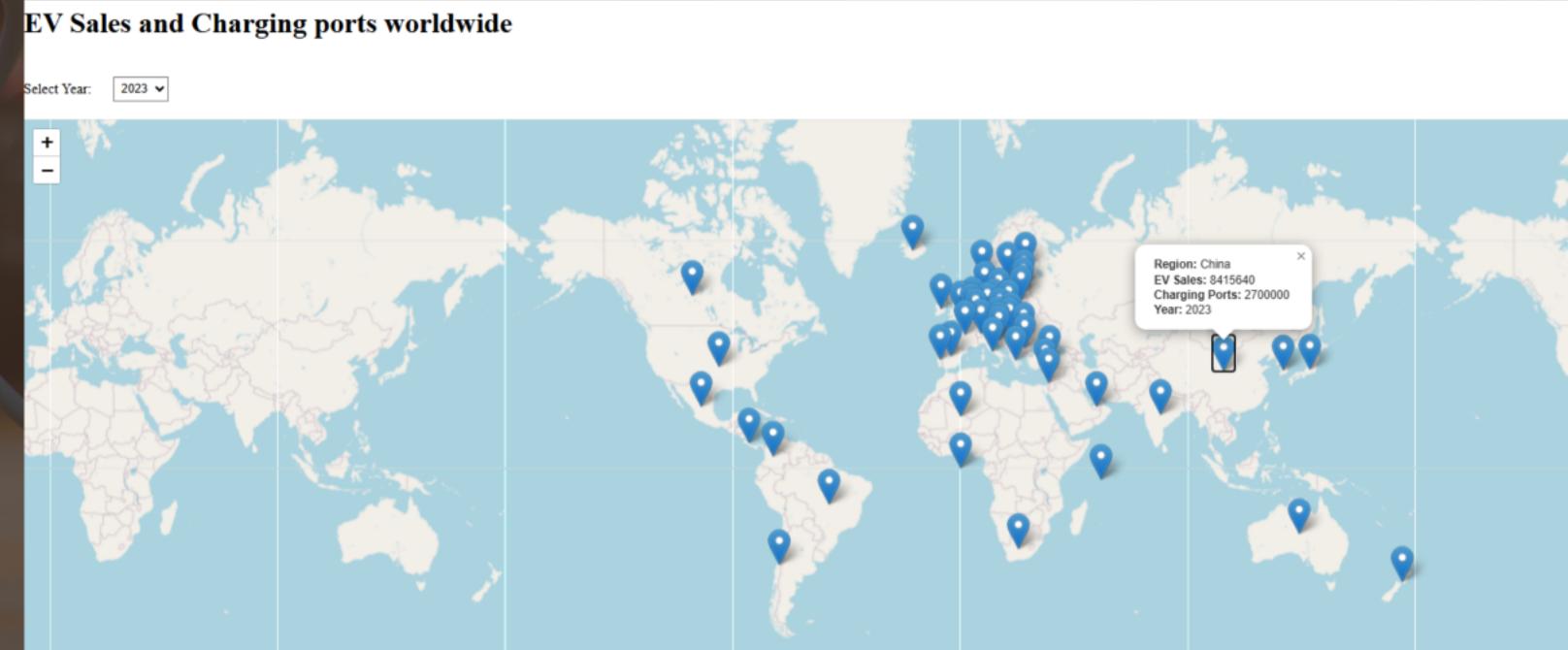
EV Sales vs Charging station analysis

- R-squared: 0.985
- F-statistic: 2154
- P-value : 6.28e-31
- t-statistic (46.408)



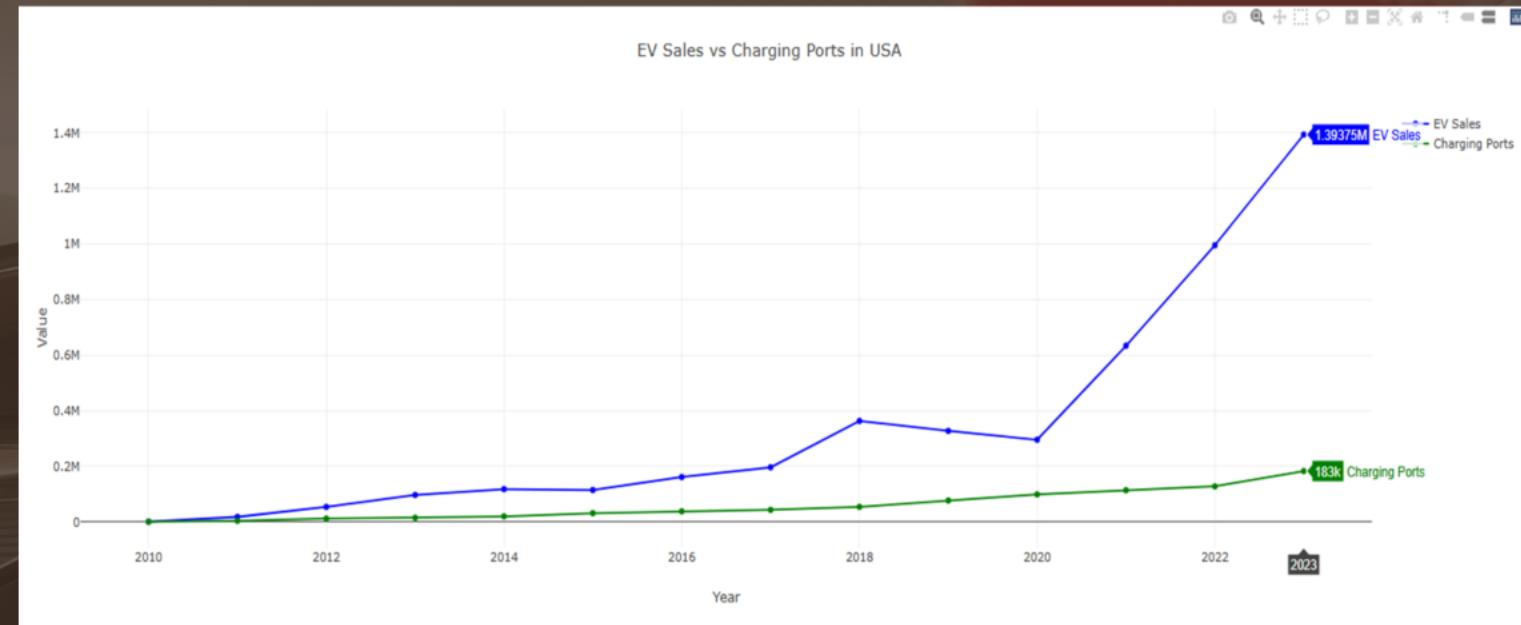
EV Sales vs Charging station analysis:

- Geographical Visualization

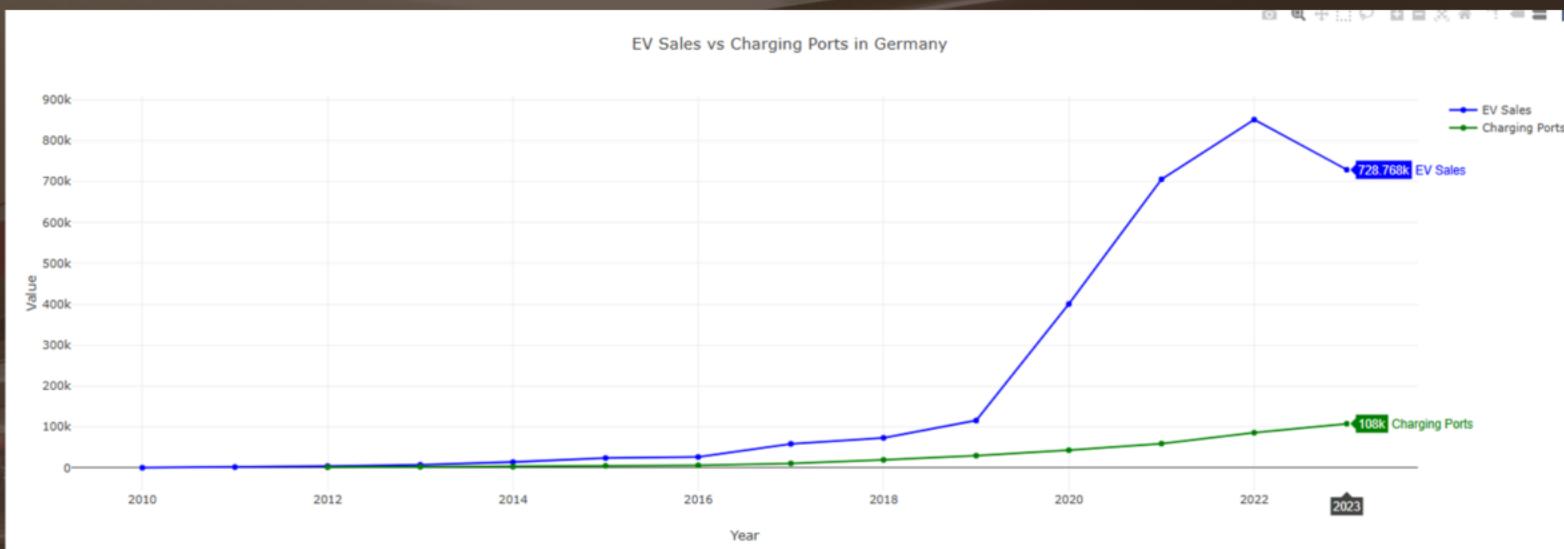


Comparison of EV Sales and Charging Station Growth: USA vs. China

- This chart illustrates the trends in electric vehicle (EV) sales and the expansion of charging stations in the USA and China over time.
- The growth in charging stations has generally kept pace with the rise in EV sales, especially in China. However, the USA has seen slower growth in charging infrastructure relative to EV sales.
- The USA may need to accelerate its charging station infrastructure to fully support the growing number of EVs on the road.



Ev sales vs charging points(Germany)



- Following the sudden end to German EV incentives in 2023, sales of all-electric vehicles have dropped 14 percent.
- Even there was increase in charging ports infrastructure(86k to 108k)in this year

Government Policies and Incentives



- Government initiatives play a crucial role in boosting electric vehicle adoption. Policies such as tax credits, rebates, and grants can significantly reduce the initial cost of EVs, making them more accessible to consumers. Additionally, regulatory mandates for emissions reductions prompt manufacturers to invest in electric vehicle production.

Technological Advancements

Improvements in range, performance, and reduced maintenance costs are making EVs increasingly attractive.

Consumer preferences: EVs are gaining favor as a cleaner alternative to traditional fuel-based vehicles.

Decarbonization efforts: EVs play a crucial role in reducing emissions from road transport and supporting broader decarbonization goals.



Ethical Considerations

Throughout the development of this project, we have considered the ethical implications of data usage, particularly concerning privacy and accessibility. We have used open-source datasets that are publicly available and ensured that all data processing and visualization are transparent and reproducible. No sensitive or personal data has been used, and our visualizations aim to make complex data more accessible to a broad audience. We also considered the ethical impact of presenting accurate, non-misleading insights, ensuring that the visualizations provide clear, digestible information for users of all skill levels.

CONCLUSION

Key Takeaways:

- EV adoption is growing but varies widely by region
- Charging station infrastructure is a key factor in adoption
- Future forecasts indicate a continuing upward trend in EV adoption

Next Steps:

- Address gaps in charging infrastructure
- Promote policies supporting EV adoption
- Further refine forecasting models

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