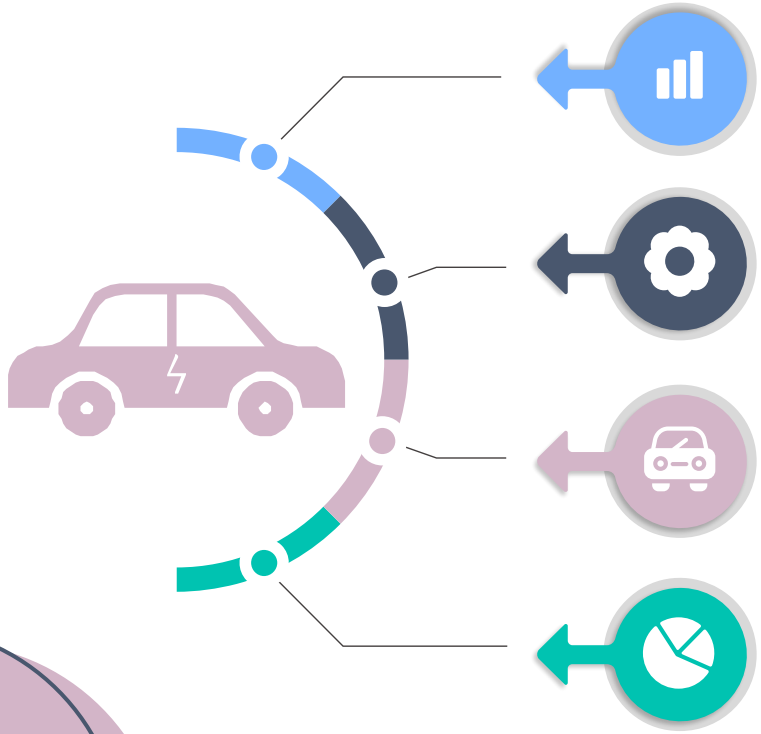
Electric Vehicles: Access and Opportunity

Aida Rahim, PhD
Data Scientist
Recharge WA

electric & hybrid vehicle technology expo | north america

Contents

Introduction



In WA, EVs made up 4.8% of vehicle sales in 2020—well above 1.8% nationally

Consumer interest: reduced fueling costs, minimal maintenance, reduced carbon emissions, and rebates

Big 3 U.S. automakers promise only zero-emission car sales by approximately 2035

Almost 100 pure electric EV models set to debut by the end of 2024

On **April 16, 2021**, the Washington state legislature passed the **Clean Cars 2030** bill, which will require that by 2030, all new light-duty vehicles sold or registered in the state be electric, with the exception of emergency vehicles.

Problem Statements

01 **Ownership and Economic Means**

What is the difference in ownership growth rate and access to charging facilities between higher and lower income owners?

02 **Garage Orphans**

What is the difference in availability of single-family vs multi-unit housing in Seattle?

03 **Charging Station Network**

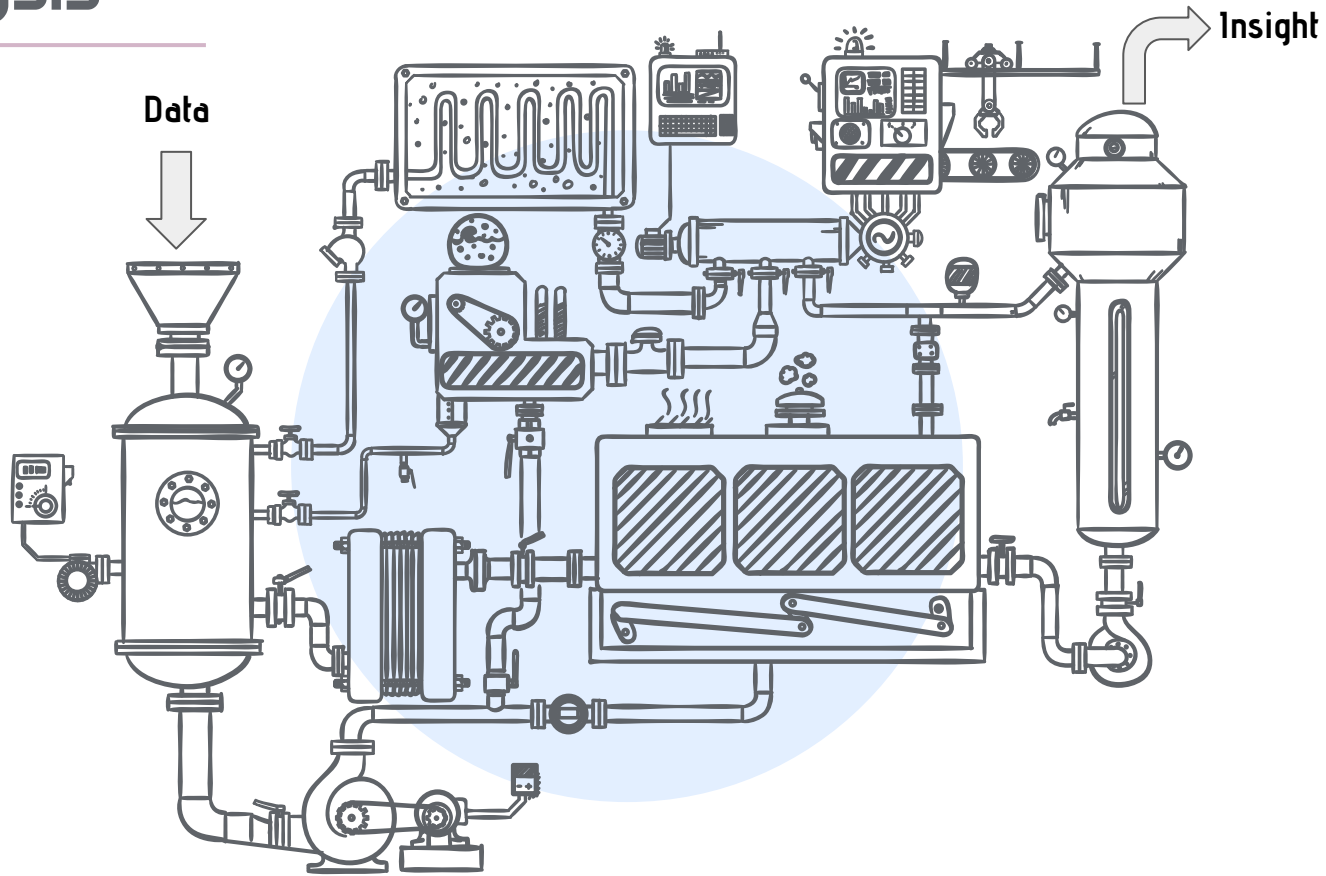
How much improvement in charging facilities is required to make long-distance drives more feasible for an EV?

Opportunities for business owners.

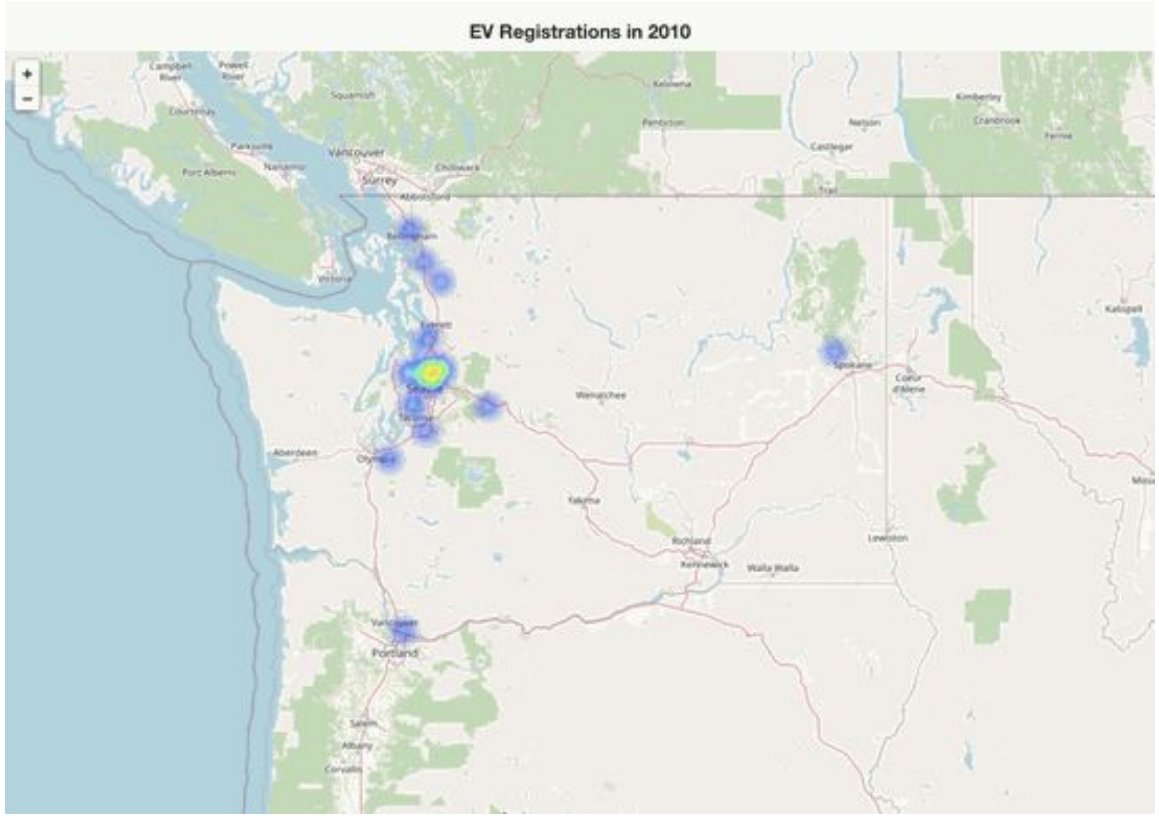
Data Description

Category	Description	Source
EV registration	Records of title activity (transactions recording changes of ownership), January 2010 through March 2021	WA State open data portal
Population	2019 WA state population	U.S. Census Bureau
Income	2019 WA state median income	U.S. Census Bureau
Charging activity	Time series charging data from public domain stations (Palo Alto)	Palo Alto open data portal
	Time series charging data from workplace stations (JPL)	Caltech's Adaptive Charging Network project (ACN)
	Time series charging data from homes in the Midwest	National Renewable Energy Lab (NREL)
Housing permits	Seattle housing permits since 2010	Seattle open data portal
Charging station	Charging station locations in WA	U.S. Dept of Energy

Analysis

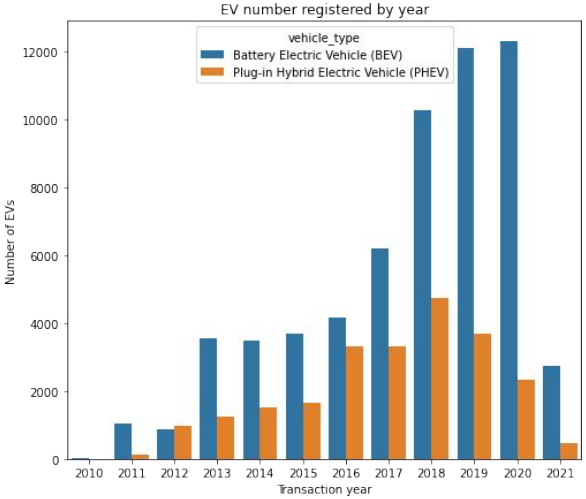


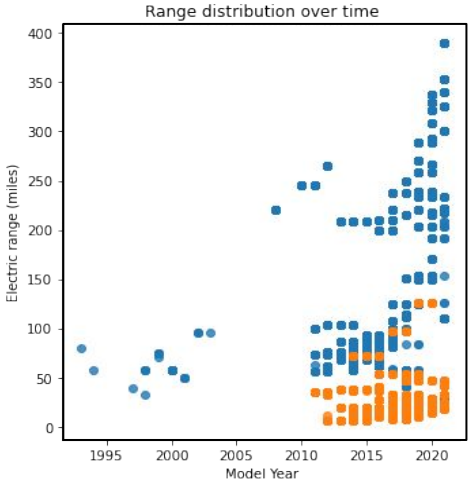
Electric Vehicle Ownership

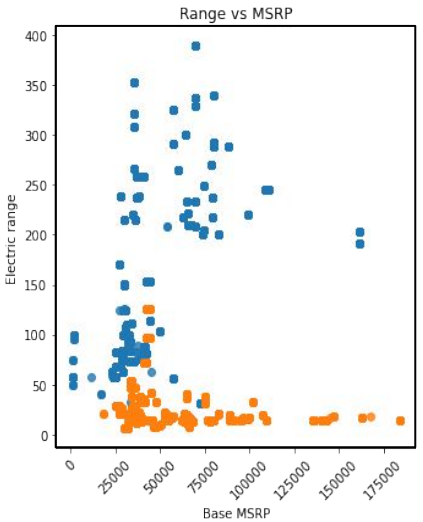


73% of electric vehicles (EVs) in WA state are owned in zip codes with median income higher than the state median income.

Overview by Type (BEV, PHEV)

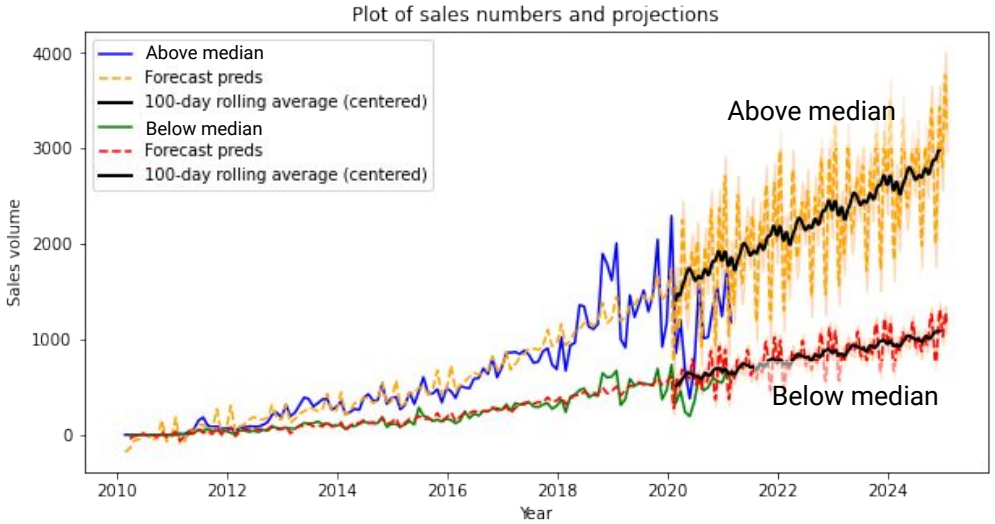


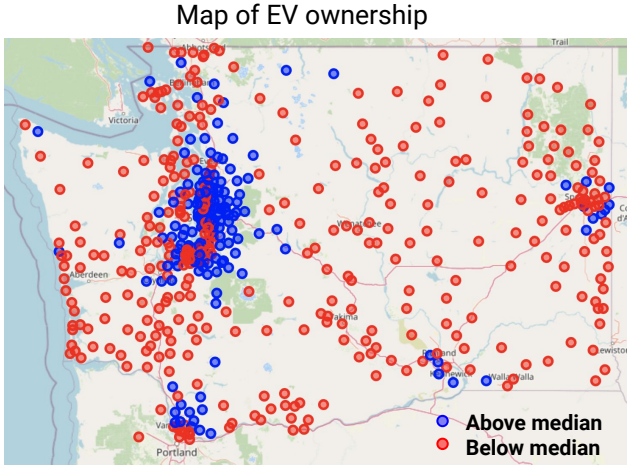




- EV registrations have been increasing over the last 10 years, with a drop in 2020
- BEV sales increase outpaces that of PHEV sales
  - BEV: battery -> electric motor (Tesla, Chevy Bolt, Nissan Leaf)
  - PHEV: electric powertrain + ICE (Toyota Prius, Chevy Volt, Mitsubishi Outlander)

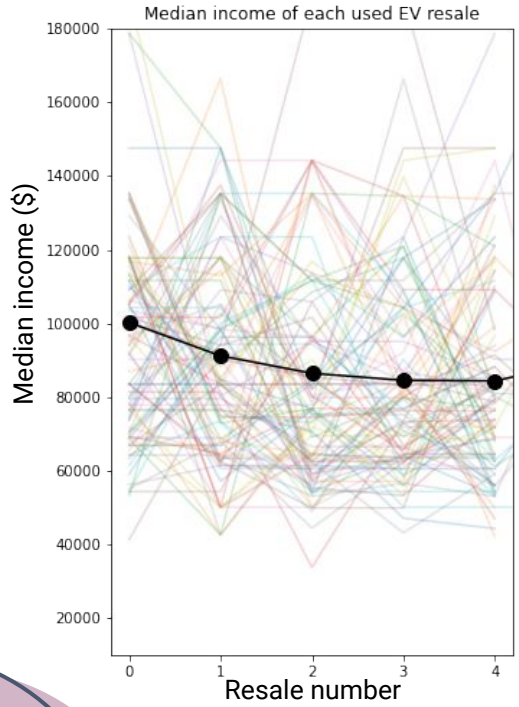
EV Ownership Growth Rate

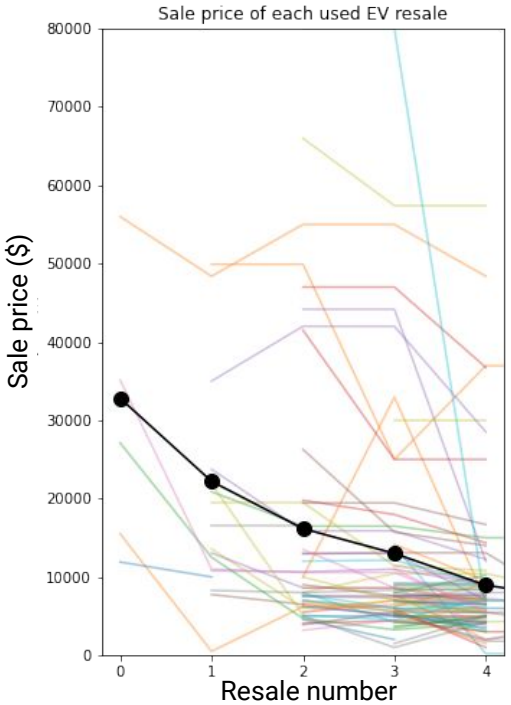




- EV median price ($35,000) is ~1.5X the average price of a gas vehicle ($21,000)
- 73% of EV registrations in WA state were carried out in zip codes with median income above the state median income
- Projected rate of sales increase for above-median income is 3X below-median income

Used Vehicles





- With each resale, the EV goes:
  - From higher to lower median income zip codes
  - From higher to lower sale price
- This bodes well for increased accessibility (price-wise).

70%

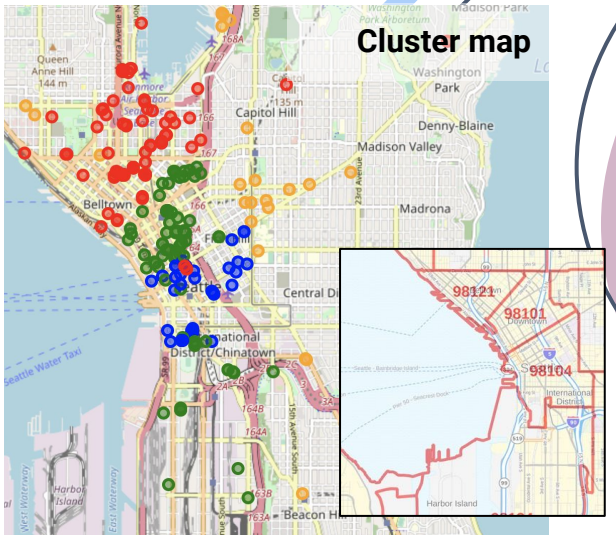
Home permits since 2010 for non-single-family homes

Charging Stations

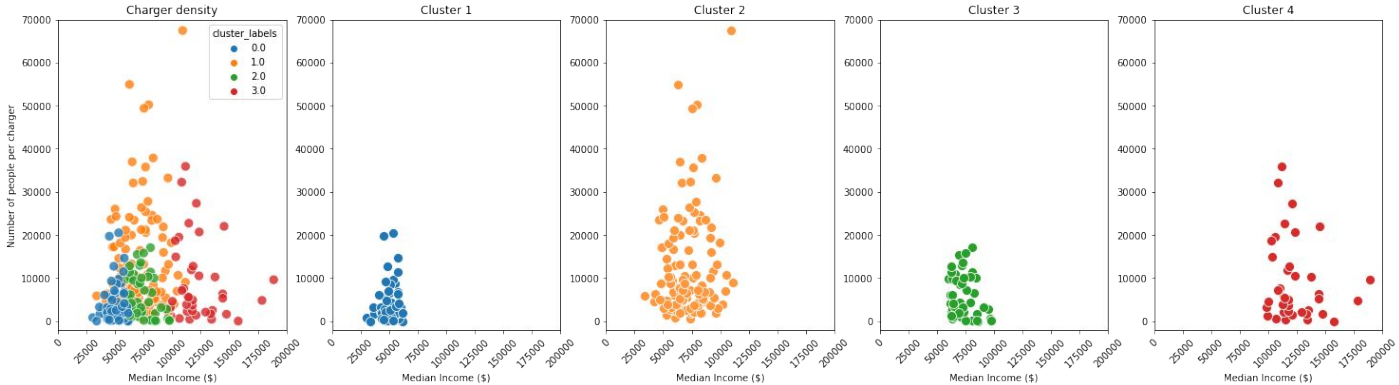
K-Means Clustering

- Input: population & income by zip code
- Output: maps geographically

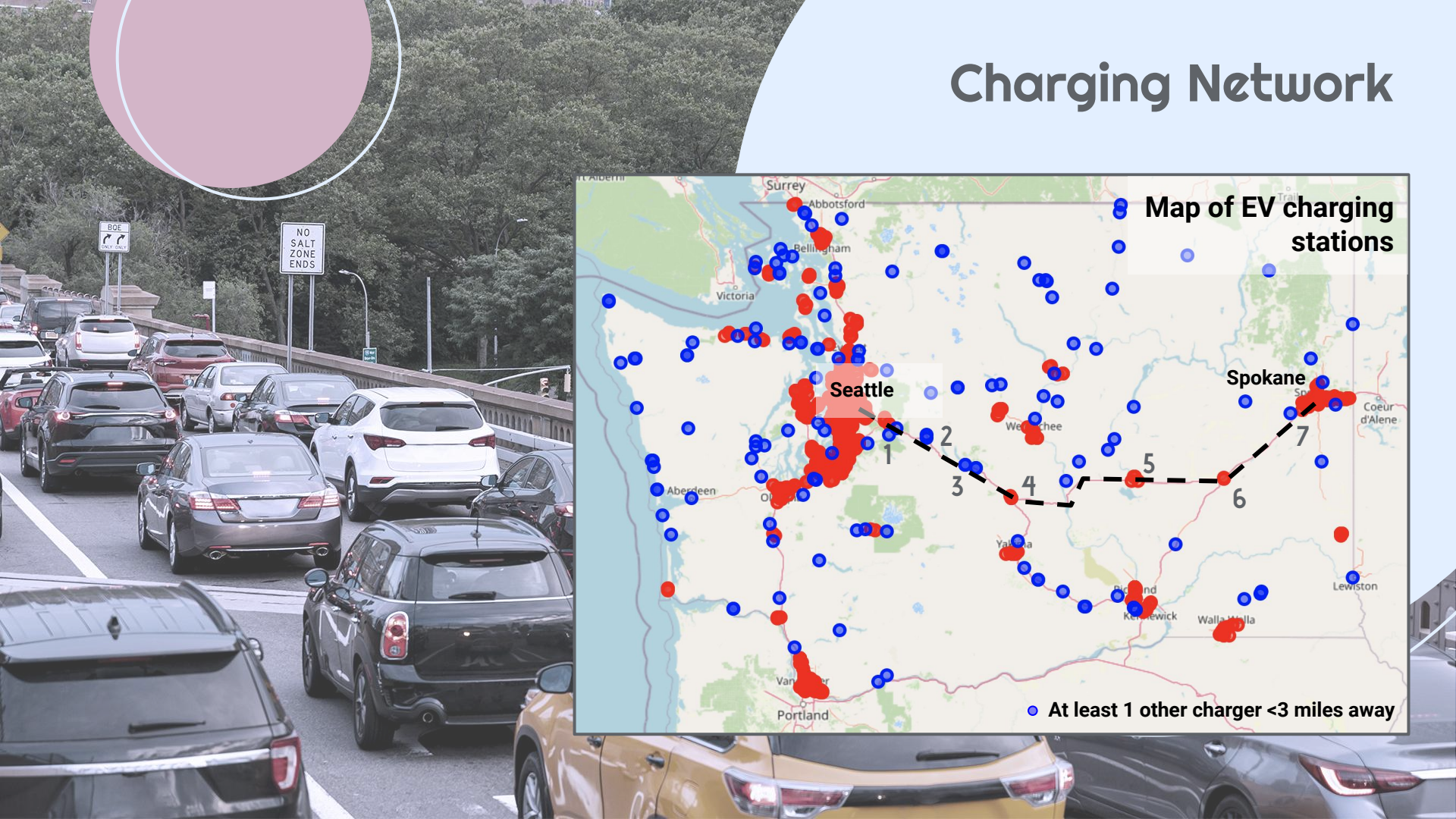
- Average charger density = 1.2 per 10k people
  - Compared to Norway with 35 per 10k people.
- Charger density is highest in low median income area

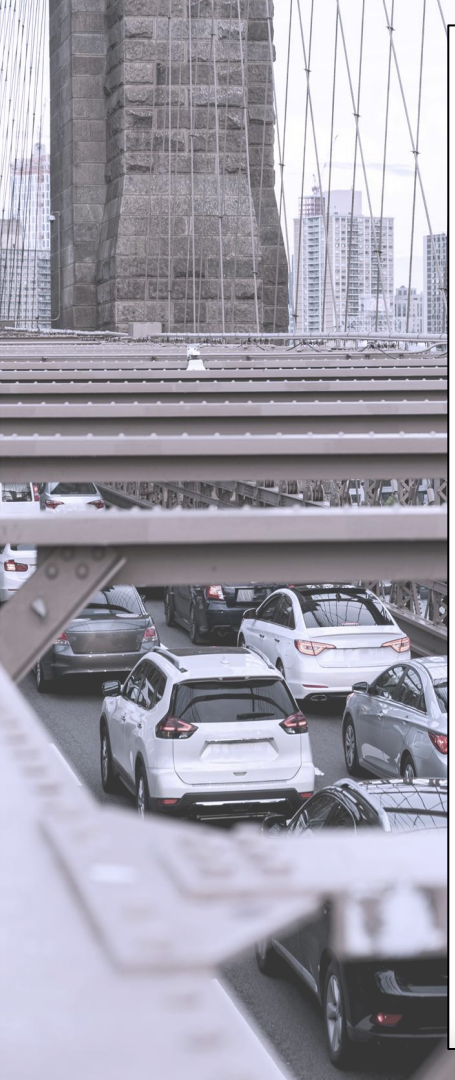


Charger density by median income



Charging Network





Supporting Clean Cars 2030

Electric vehicle plugged into charger

Are you considering building a charging station at your business?

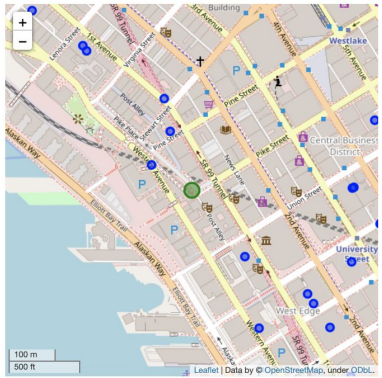
Enter your business address and we will provide information on other stations around it.

Please input your business address:

86 Pike Pl, Seattle, WA 98101

Check now!

There are more than 3 charging stations within a 0.2 mile radius.



Business Opportunity:

Attract more customers and increase dwell time

https://evstreamlit.herokuapp.com/

Recommendations

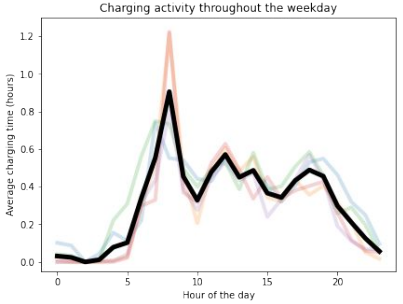
- Provide incentives relative to income (currently state tax exemptions)
- Legislate charging station requirements for housing developments
- Encourage businesses to install charging stations (incentives)

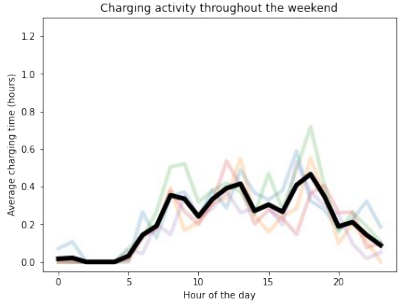
Questions?

Charging Cycles

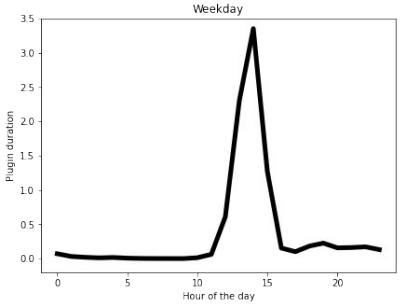
- From 3 datasets on charging cycles:
  - Usage of publicly accessible charging stations peak in the morning, at lunchtime, and at dinnertime, for both weekdays and weekends. The morning peak is stronger on weekdays
  - Charging at work peaks in the morning only on weekdays
  - Charging at home occurs in the evening (3 behavior clusters)
- Usage can be projected into the future

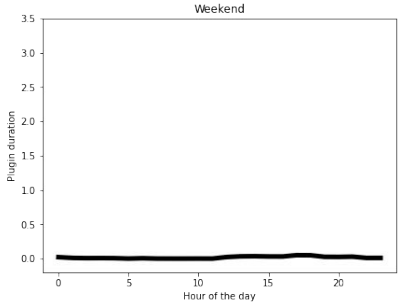
PUBLIC BUSINESSES





WORKPLACE





HOME