Electric Vehicle Gap Analysis

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Xue Han
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David Kim

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Table of Contents

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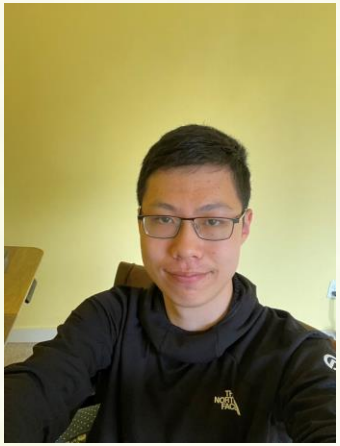
Team Easy Ev

Unnati Gaglani



Han Yang

Jessica Sang

Xue Han

David Kim

Background

- **1.5 million customers in WA**
- **Focus on safe, reliable, affordable energy service.**
- **6,000 square miles service area in west Washington**

Graham Marmion

Data Scientist
Focused on economic modeling and Transportation Electrification plan development.

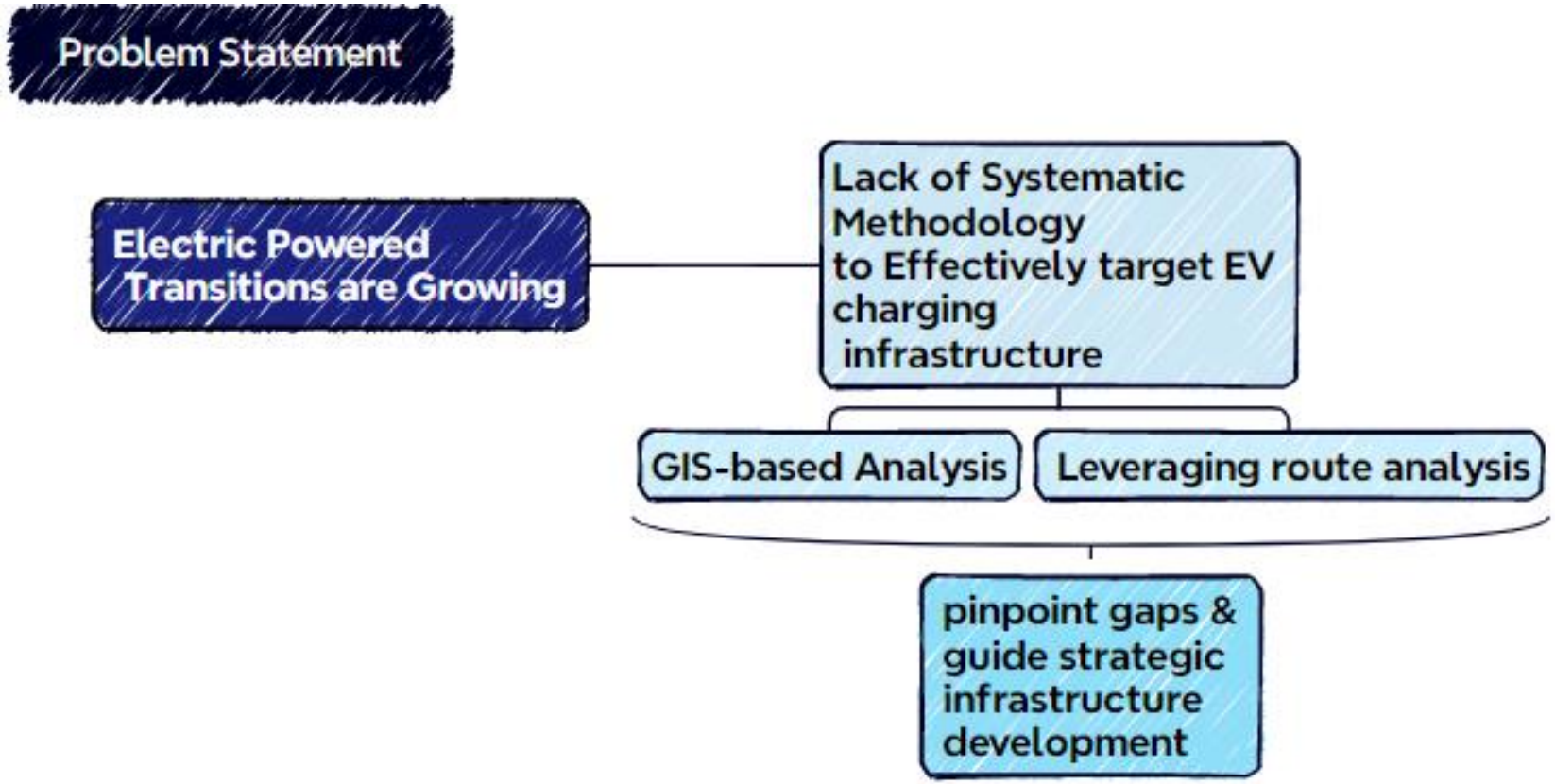
Dr. Divya Chaudhary

Assistant Teaching Professor
Cloud computing
Load scheduling
Machine learning
Systems and networking

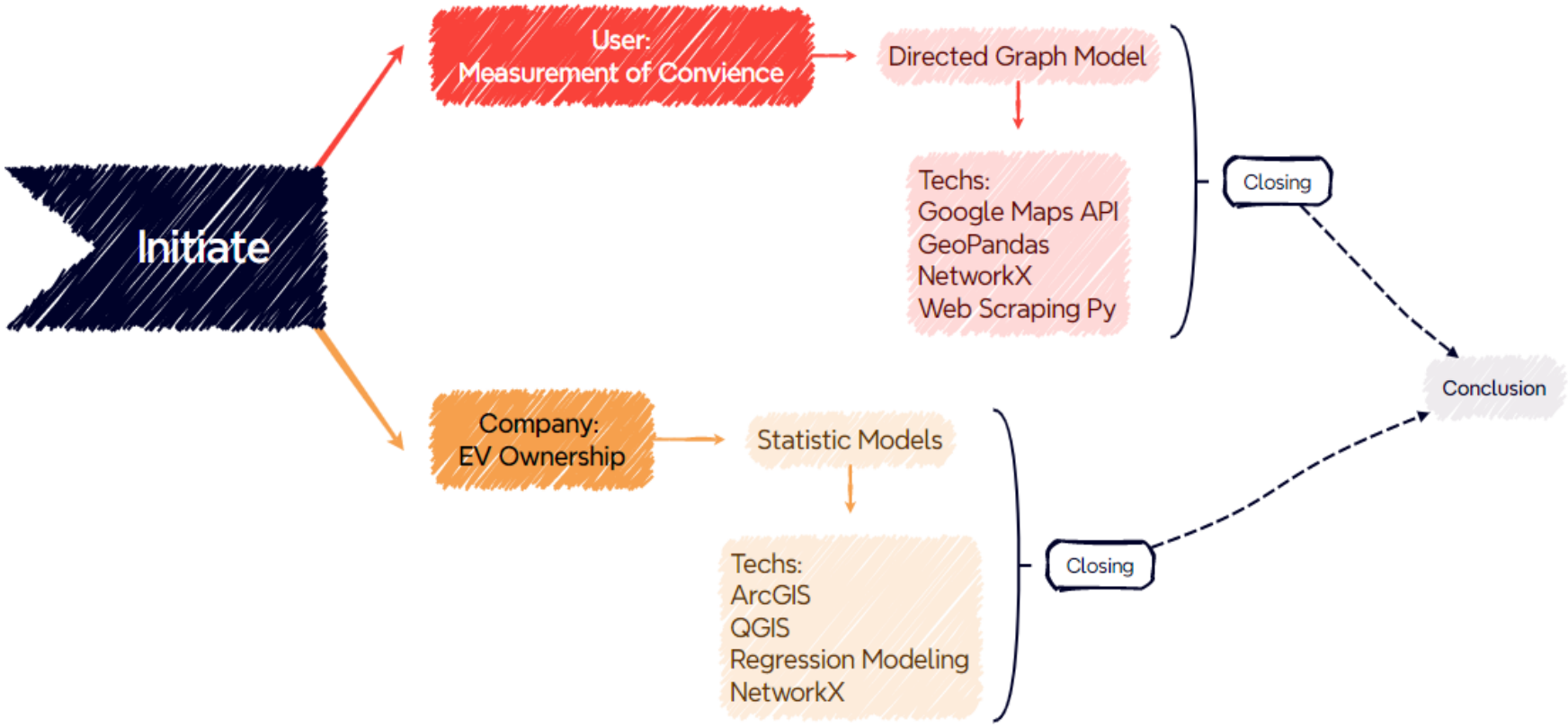
Austin Escalera, M. Ed.

Graduate Student Services Coordinator,
Career Coach

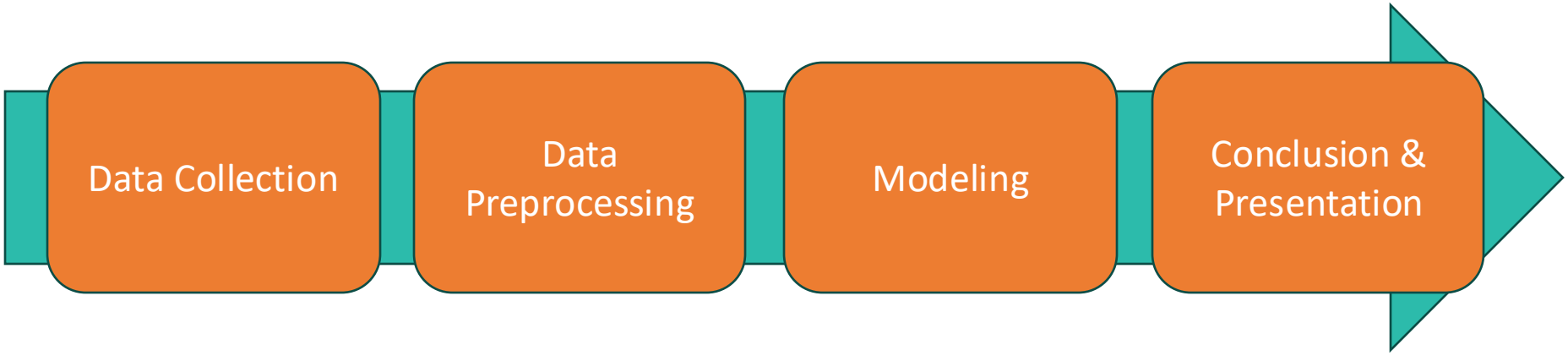
Problem Statement / Visualized Version



Strategy-Overview



Strategy- Agenda



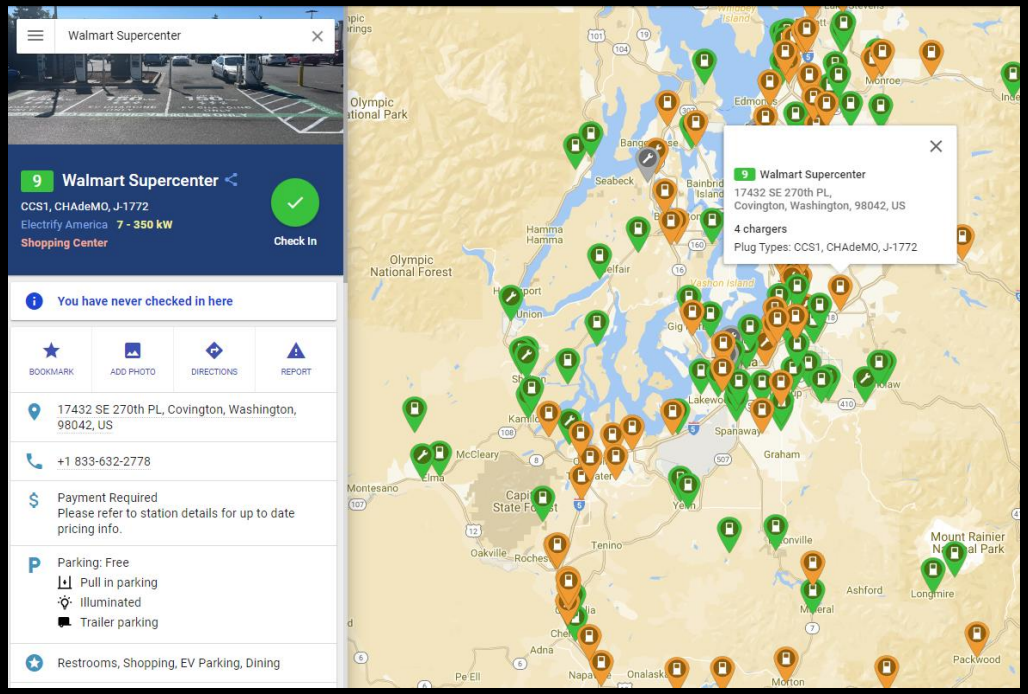
Data Overview – US Department of Energy

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Fuel Type Co	Station Nam	Street Addre	Intersection	City	State	ZIP	Plus4	Station Phon	Status Code	Expected Da	Groups With	Access Days	Cards Accep	BD Blends
2	ELEC	City of Lacey	420 College S	At 3rd Ave SE	Lacey	WA	98503		360-491-321	E		Public	24 hours daily		
3	ELEC	BELLEVUE BE	450 110th Ave NE		Bellevue	WA	98004		888-758-438	T	6/7/24	TEMPORARIL	24 hours daily		
4	ELEC	KING COUNT	1755 Highlands Dr NE		Issaquah	WA	98027		888-758-438	E		Public	24 hours daily		
5	ELEC	King County -	18655 NE Un	Off NE Union	Redmond	WA	98052			E		Private			
6	ELEC	UWB CASCA	18500 Campus Way NE		Bothell	WA	98011		888-758-438	E		Public	24 hours daily		
7	ELEC	CITY OF RED	15670 NE 85th St		Redmond	WA	98052		888-758-438	E		Public	24 hours daily		
8	ELEC	CITY OF RED	18080 NE 76th St		Redmond	WA	98052		888-758-438	E		Public	24 hours daily		
9	ELEC	WILLOWS LO	14580 NE 145th St		Woodinville	WA	98072		888-758-438	E		Public	24 hours daily		
10	ELEC	Rairdon's Nis	713 35th St NE		Auburn	WA	98002			E		Private	Service center only		
11	ELEC	Bellingham N	1516 Iowa St		Bellingham	WA	98229		360-733-730	E		Public - Call a	Dealership business hours		
12	ELEC	Advantage N	5101 Auto Center Blvd		Bremerton	WA	98312		360-373-630	E		Public - Call a	Dealership business hours		
13	ELEC	Olympia Nis	2220 Carriage Dr SW		Olympia	WA	98502		360-352-855	E		Public - Call a	Dealership business hours		
14	ELEC	Bill Korum's I	101 Valley Ave NW		Puyallup	WA	98371		253-848-450	E		Public - Call a	Dealership business hours		
15	ELEC	Younker Niss	3401 E Valley Rd		Renton	WA	98058			E		Public - Call a	Dealership business hours		
16	ELEC	KEY CENTER	601 108th Ave NE		Bellevue	WA	98004		888-758-438	E		Public	24 hours daily		
17	ELEC	KRC SKYLINE	10900 NE 4th St		Bellevue	WA	98004		888-758-438	E		Public	24 hours daily		

- Contains information about the address, *access days, longitude, latitude,* number of ports, etc. for EV charging stations nationwide
- Filtered to only include those in PSE service regions in WA state

Data Overview - PlugShare

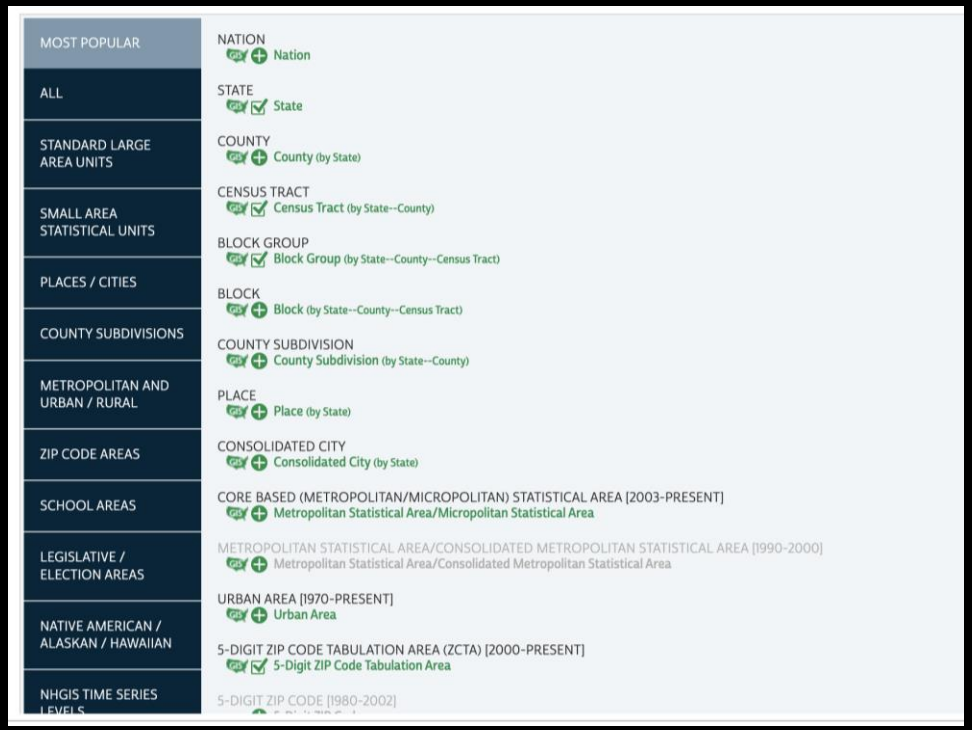
PlugShare.com provides a comprehensive map and database of electric vehicle charging stations, offering detailed information on locations, user reviews, and real-time availability.




```
area,name,address
aberdeen,Walmart Supercenter (350 checkins),"909 E Wishkah St, Aberdeen, Washington, 98520, US"
aberdeen,416 E Wishkah St Parking Lot (211 checkins),"416 E Wishkah St, Aberdeen, WA 98520, USA"
aberdeen,Five Star Chevrolet Buick Toyota (93 checkins),"300 S Boone Street, Aberdeen, WA 98520"
aberdeen,Quinault Beach Resort & Casino (83 checkins),"78 WA-115, Ocean Shores, WA 98569"
aberdeen,Lake Quinault Lodge (77 checkins),"345 S Shore Rd, Quinault, WA 98575"
aberdeen,Rainier Lanes Inc (66 checkins),"415 W Heron St, Aberdeen, WA 98520, USA"
bellingham,"Sehome Village (1,031 checkins)","222 36th St, Bellingham, WA 98225, USA"
bellingham,Bellingham Nissan (458 checkins),"1516 Iowa St, Bellingham, WA 98229"
```

Data Overview - NHGIS

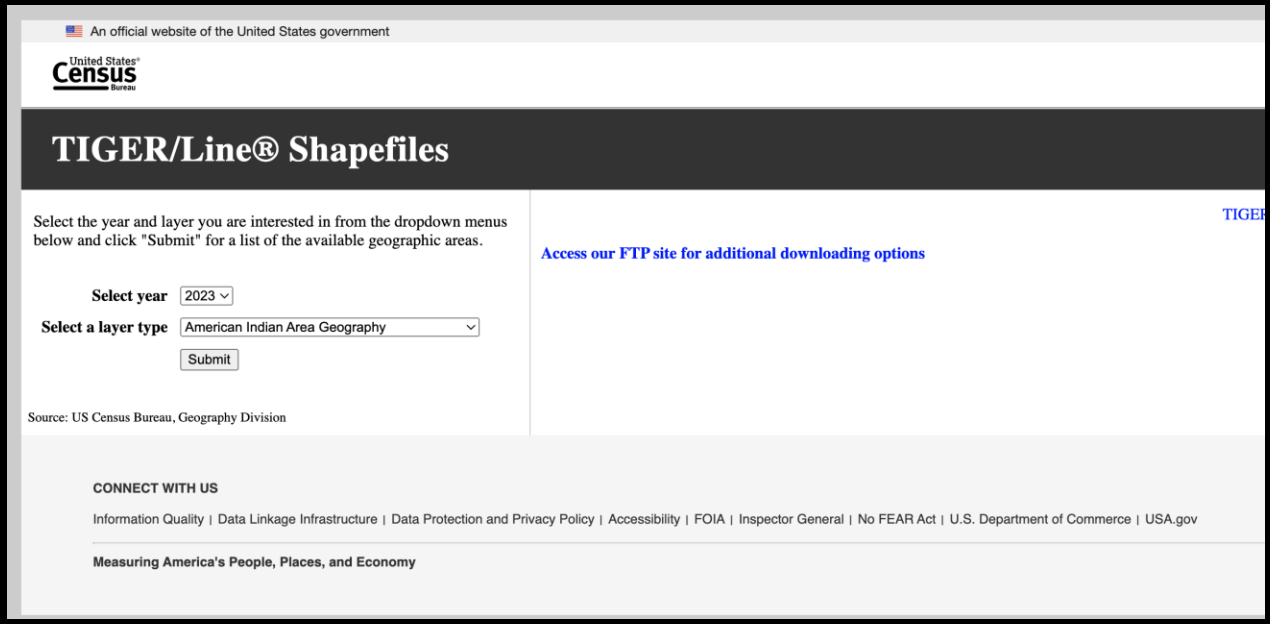
NHGIS provides extensive demographic data. By applying filters, we can access information like total population counts, population density, and the number of households, along with insights into population trends using 2010 data.



	GISJOIN	YEAR	STUSAB	REGIONA	DIVISIONA	STATE	STATEA	COUNTY	COUNTYA	TRACTA	BLKGRPA	H7V001	GEOID10
2	G53002909701001	2010	WA	4	9	Washington	53	Island County	29	970100	1	1102	5.303E+11
3	G53002909701002	2010	WA	4	9	Washington	53	Island County	29	970100	2	1502	5.303E+11
4	G53002909702001	2010	WA	4	9	Washington	53	Island County	29	970200	1	1633	5.303E+11
5	G53002909703001	2010	WA	4	9	Washington	53	Island County	29	970300	1	791	5.303E+11
6	G53002909703002	2010	WA	4	9	Washington	53	Island County	29	970300	2	1203	5.303E+11
7	G53002909703003	2010	WA	4	9	Washington	53	Island County	29	970300	3	1044	5.303E+11
8	G53002909703004	2010	WA	4	9	Washington	53	Island County	29	970300	4	1951	5.303E+11
9	G53002909704001	2010	WA	4	9	Washington	53	Island County	29	970400	1	951	5.303E+11
10	G53002909704002	2010	WA	4	9	Washington	53	Island County	29	970400	2	2256	5.303E+11

Data Overview – US Census

US Census for demographic and geographical data

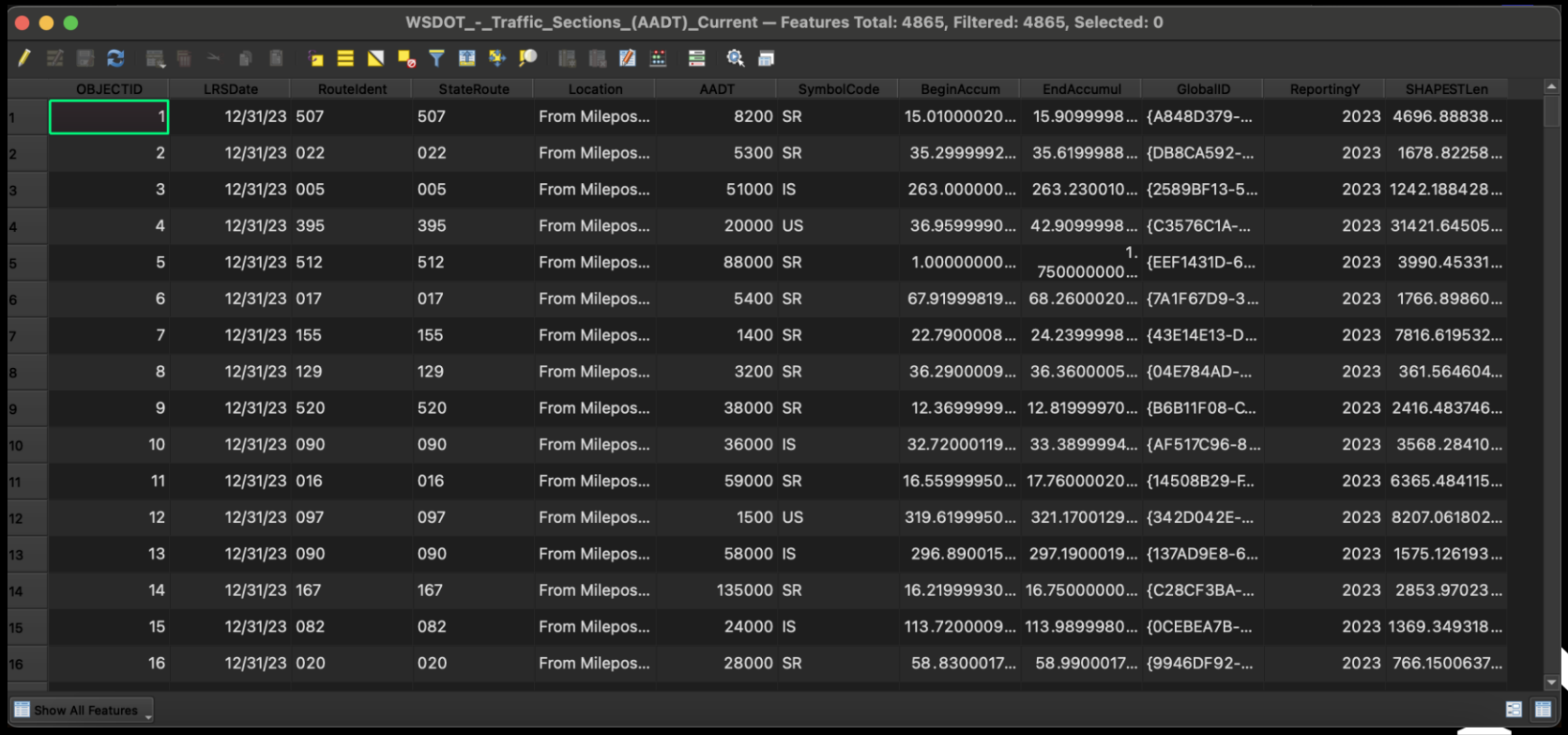


block groups — Features Total: 2855, Filtered: 2855, Selected: 0

	STATEFP	COUNTYFP	TRACTCE	BLKGRPCE	GEOID	GEOIDFQ	NAMELSAD	MTFCC	FUNCSTAT	ALAND	AWATER	INTPTLAT
1	53	029	970100	1	530299701001	1500000US5...	Block Group 1	G5030	S	8297782	2918067	+48.377985
2	53	029	970100	2	530299701002	1500000US5...	Block Group 2	G5030	S	18219638	5115041	+48.390916
3	53	029	970200	1	530299702001	1500000US5...	Block Group 1	G5030	S	18048387	3705620	+48.339947
4	53	029	970300	1	530299703001	1500000US5...	Block Group 1	G5030	S	4516006	0	+48.324248
5	53	029	970300	2	530299703002	1500000US5...	Block Group 2	G5030	S	11721984	6749561	+48.344438
6	53	029	970300	3	530299703003	1500000US5...	Block Group 3	G5030	S	11054579	413526	+48.329038
7	53	029	970300	4	530299703004	1500000US5...	Block Group 4	G5030	S	19574720	7368308	+48.308997

Data Overview – Average Annual Daily Traffic

AADT, or Average Annual Daily Traffic, is a measure of the average number of vehicles that pass a specific point on a road each day over the course of a year.



	OBJECTID	LRSDate	RouteIdent	StateRoute	Location	AADT	SymbolCode	BeginAccum	EndAccumul	GlobalID	ReportingY	SHAPESTLen
1	1	12/31/23	507	507	From Milepos...	8200	SR	15.01000020...	15.9099998...	{A848D379-...	2023	4696.88838...
2	2	12/31/23	022	022	From Milepos...	5300	SR	35.2999992...	35.6199988...	{DB8CA592-...	2023	1678.82258...
3	3	12/31/23	005	005	From Milepos...	51000	IS	263.000000...	263.230010...	{2589BF13-5...	2023	1242.188428...
4	4	12/31/23	395	395	From Milepos...	20000	US	36.9599990...	42.9099998...	{C3576C1A-...	2023	31421.64505...
5	5	12/31/23	512	512	From Milepos...	88000	SR	1.00000000...	1.750000000...	{EEF1431D-6...	2023	3990.45331...
6	6	12/31/23	017	017	From Milepos...	5400	SR	67.91999819...	68.2600020...	{7A1F67D9-3...	2023	1766.89860...
7	7	12/31/23	155	155	From Milepos...	1400	SR	22.7900008...	24.2399998...	{43E14E13-D...	2023	7816.619532...
8	8	12/31/23	129	129	From Milepos...	3200	SR	36.2900009...	36.3600005...	{04E784AD-...	2023	361.564604...
9	9	12/31/23	520	520	From Milepos...	38000	SR	12.3699999...	12.81999970...	{B6B11F08-C...	2023	2416.483746...
10	10	12/31/23	090	090	From Milepos...	36000	IS	32.72000119...	33.3899994...	{AF517C96-8...	2023	3568.28410...
11	11	12/31/23	016	016	From Milepos...	59000	SR	16.55999950...	17.76000020...	{14508B29-F...	2023	6365.484115...
12	12	12/31/23	097	097	From Milepos...	1500	US	319.6199950...	321.1700129...	{342D042E-...	2023	8207.061802...
13	13	12/31/23	090	090	From Milepos...	58000	IS	296.890015...	297.1900019...	{137AD9E8-6...	2023	1575.126193...
14	14	12/31/23	167	167	From Milepos...	135000	SR	16.21999930...	16.75000000...	{C28CF3BA-...	2023	2853.97023...
15	15	12/31/23	082	082	From Milepos...	24000	IS	113.7200009...	113.9899980...	{0CEBEA7B-...	2023	1369.349318...
16	16	12/31/23	020	020	From Milepos...	28000	SR	58.8300017...	58.9900017...	{9946DF92-...	2023	766.1500637...

Solutions

Potential solutions:

- Prioritize new charging stations in high-density urban areas to meet immediate demand.
- Focus on high-traffic areas with low existing station density, emphasizing underserved regions with high Average Annual Daily Traffic (AADT).

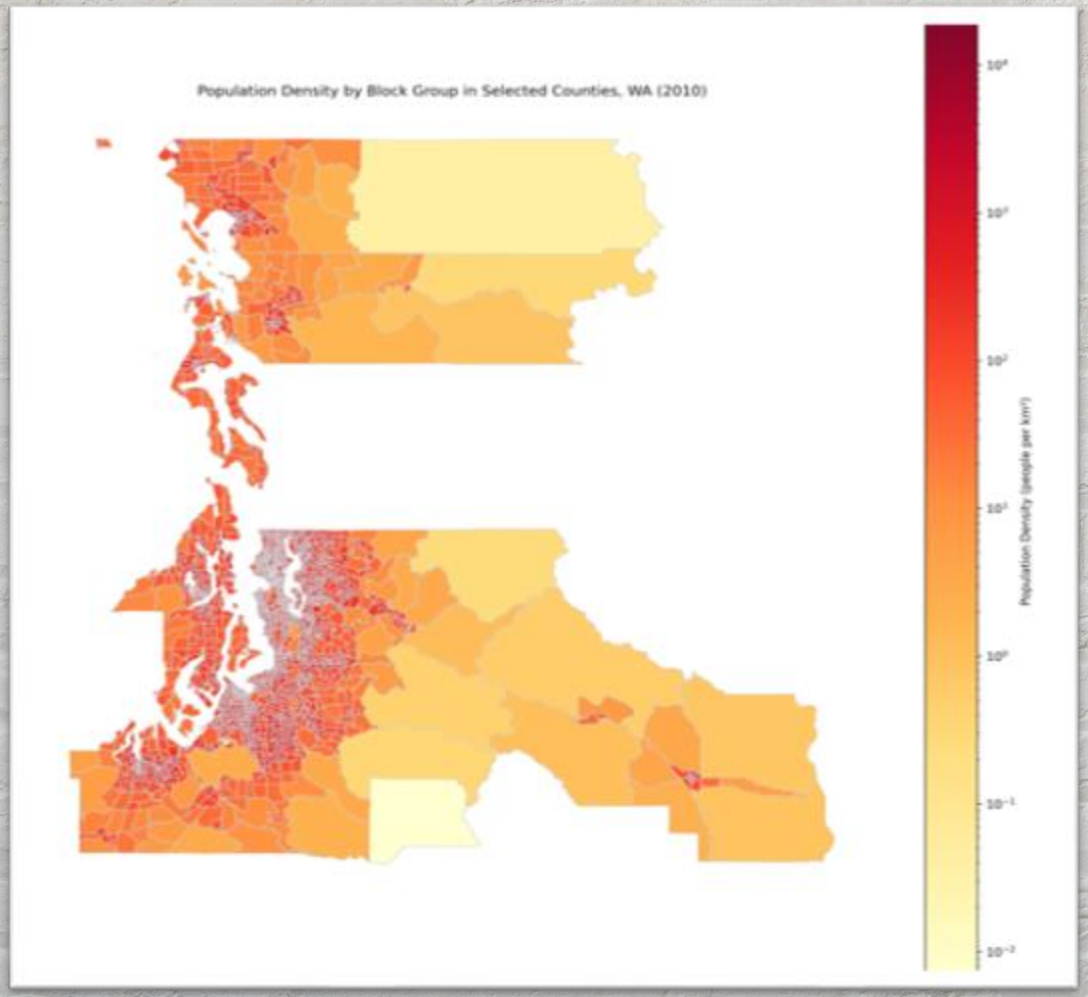
Solutions

Reason for choosing the option to address the problem

- Immediate high demand justifies rapid deployment.
- Aligns infrastructure with high user demand, enhancing convenience and boosting EV adoption.

Solutions

Data and insights: Population Density Map



Highlights areas of high population density, indicating regions with immediate demand for charging infrastructure.

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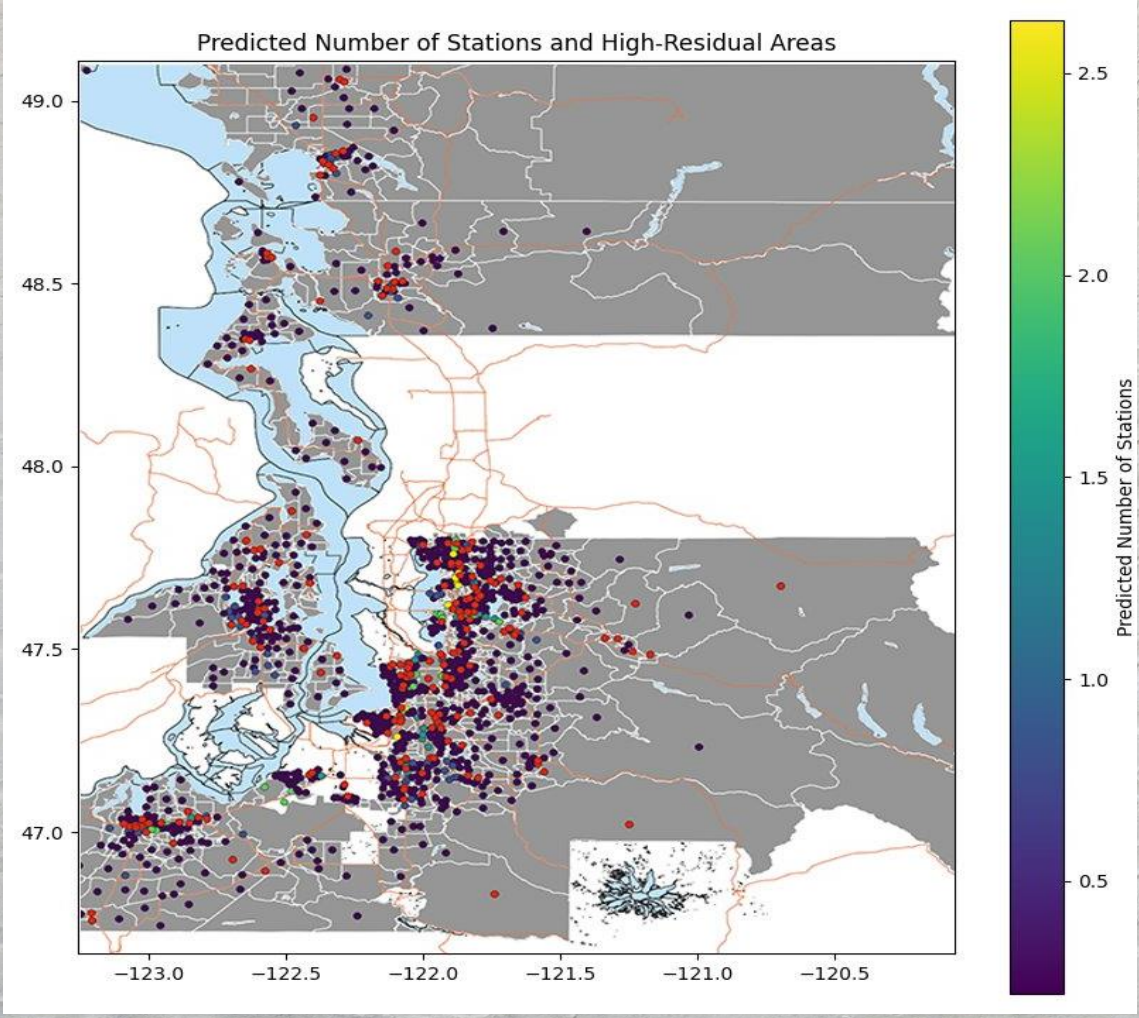
Solutions

Data and insights: Predicted Station Needs



Predicted station locations and areas with the highest unmet demand, guiding infrastructure placement.

Red Points: Areas where actual installations are below predictions, indicating potential priorities for future infrastructure development.

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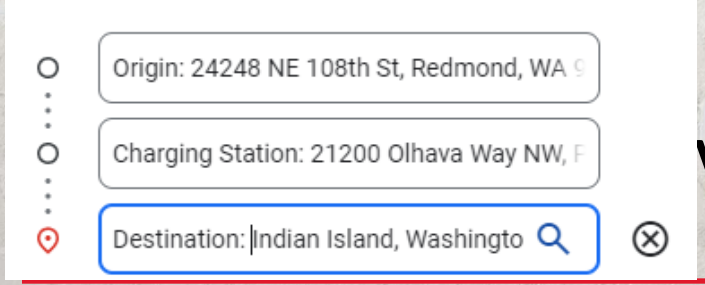
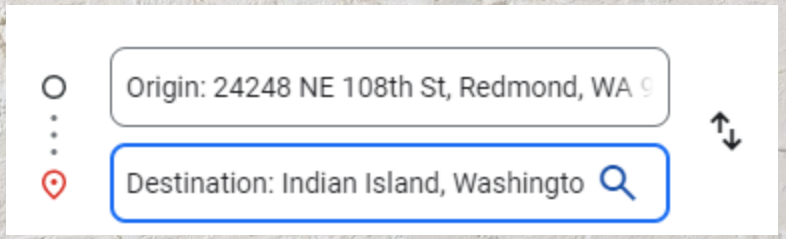
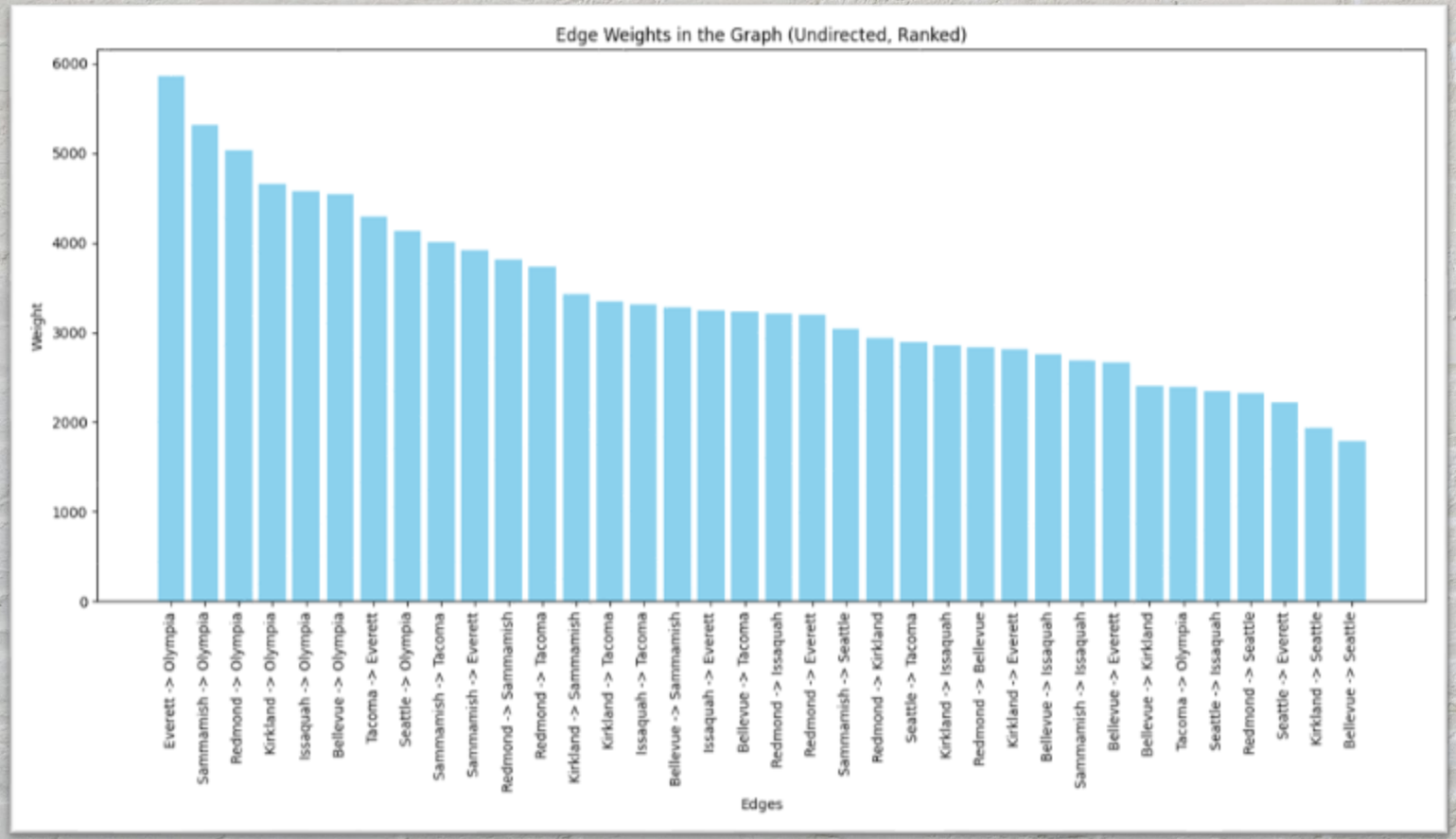


VS



Data and insights: Deviation Time Analysis



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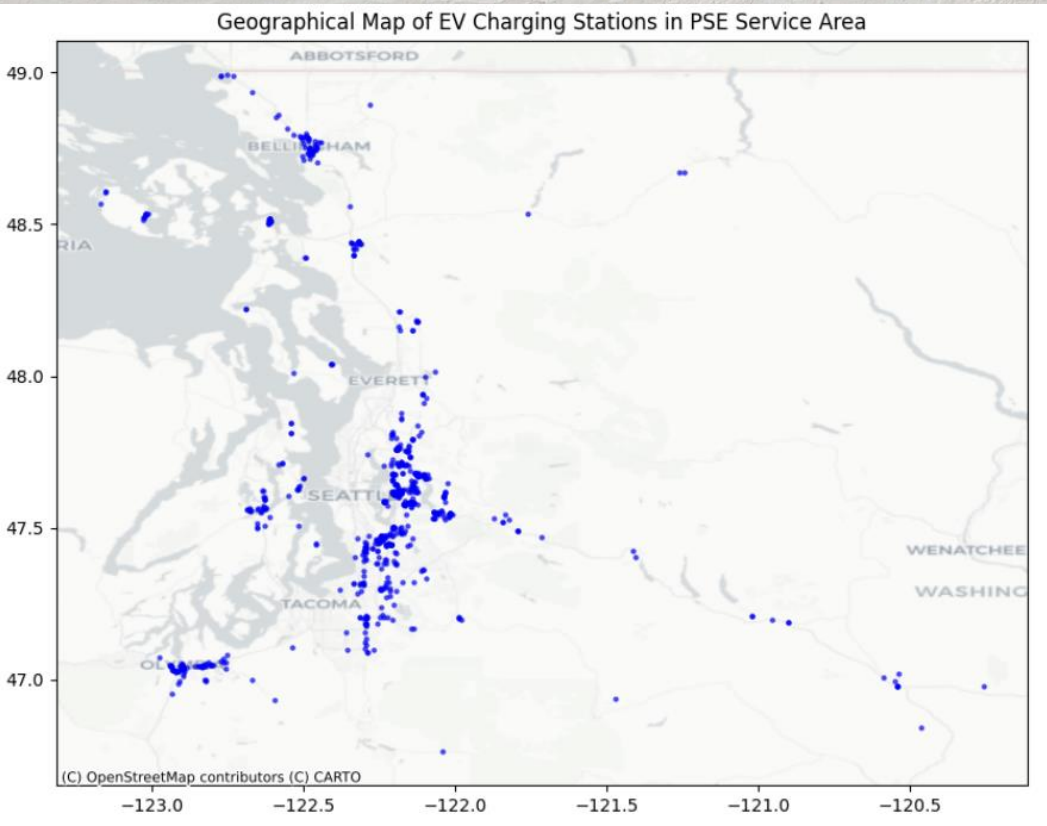
Solutions

Data and insights: PSE EV Locations



Current EV charging locations in the PSE service regions.

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Next Steps


Home/private chargers
Common routes and destinations
Competitor

Conclusions

- **Urban Areas:** High-density urban regions show effective EV charging coverage, correlating with high AADT levels.

- **Rural & Suburban Areas:** Significant infrastructure gaps exist in rural and emerging suburban areas with lower traffic volumes.

- **Key Routes:** Identified critical routes where additional EV stations could reduce travel time and support EV adoption.

- **Strategic Focus & Application:** Targeted infrastructure enhancement in underserved areas should guide future planning to ensure a balanced and accessible charging network, supporting broader EV adoption.

Reflections

What Worked:

- Effective GIS spatial analysis
- Accurate identification of infrastructure gaps

Challenges:

- Difficulties in integrating varied data sources
- Challenges in accurate future growth predictions

Improvements for Future Projects:

- **Data Integration:** Employ advanced techniques for smoother analysis.
- **Stakeholder Engagement:** Involve stakeholders earlier for better insights and support.

Key Learnings:

- Enhanced skills in spatial data analysis and visualization.
- Gained experience in managing complex, data-intensive projects.
- Recognized the importance of early and effective stakeholder communication.

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Thank You!

---- *Team Easy EV*

Experience Expo 2024

Team Easy EV & Puget Sound Energy
Where to Put Electric Vehicle Charging?

Northeastern University

Introduction

Electric Vehicle Gap Analysis includes identifying lack of infrastructure of EV chargers where it is high needed in Puget Sound Energy (PSE)'s service area.

Goal & Problem Statement

The project should identify the areas in PSE's electric service area with inadequate access to charging infrastructure. The ideal deliverable would be a geodatabase containing the data and conclusion regarding the gaps' in EV infrastructure as well as a summary slide deck giving an overview of the methodology and outputs.

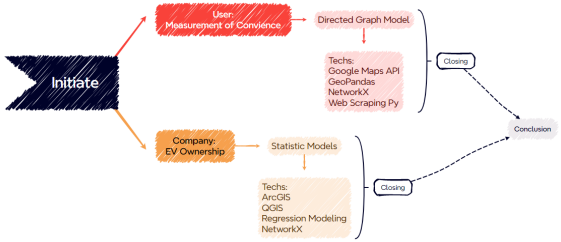
Data Overview

PSE PUGET SOUND ENERGY

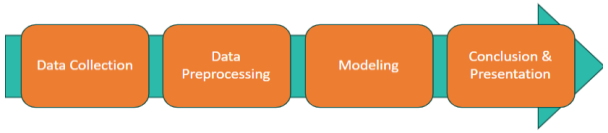
WSDOT

United States® Census Bureau

IPUMS NHGIS



Methodology

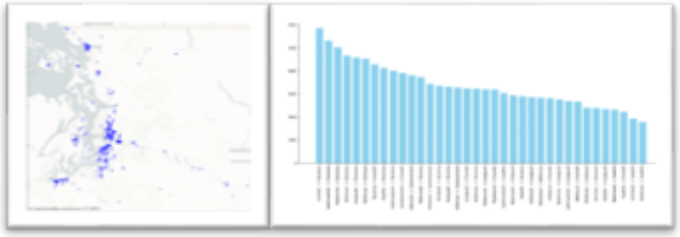


Techs: Cool Things We Did

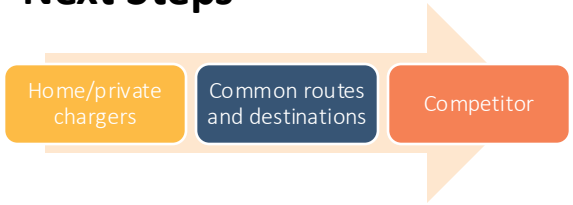
- Web Scraping For Data Integration
- Python Panda for Data Cleaning
- Google Geo API
- Directed Graph Modeling
- ArcGIS, QGIS Layer Construction
- Geo Spatial Regression Model

Solutions

Prioritize new charging stations in high-density urban areas to meet immediate demand. Focus on high-traffic areas with low existing station density, emphasizing underserved regions with high AADT.



Next Steps



Conclusion

- **Urban Areas:** High traffic urban regions have good EV charging coverage.
- **Rural & Suburban Areas:** Significant gaps in charging infrastructure.
- **Key Routes:** Critical routes identified for additional stations to reduce travel time.
- **Strategic Focus:** Focus on underserved areas to ensure a balanced, accessible charging network.

References

US Census: https://www.census.gov/
NHGIS: https://www.nhgis.org/
PlugShare: https://www.plugshare.com/
US Department of Energy: https://www.energy.gov/