Electric Vehicle Charging Stations in California

Group 19

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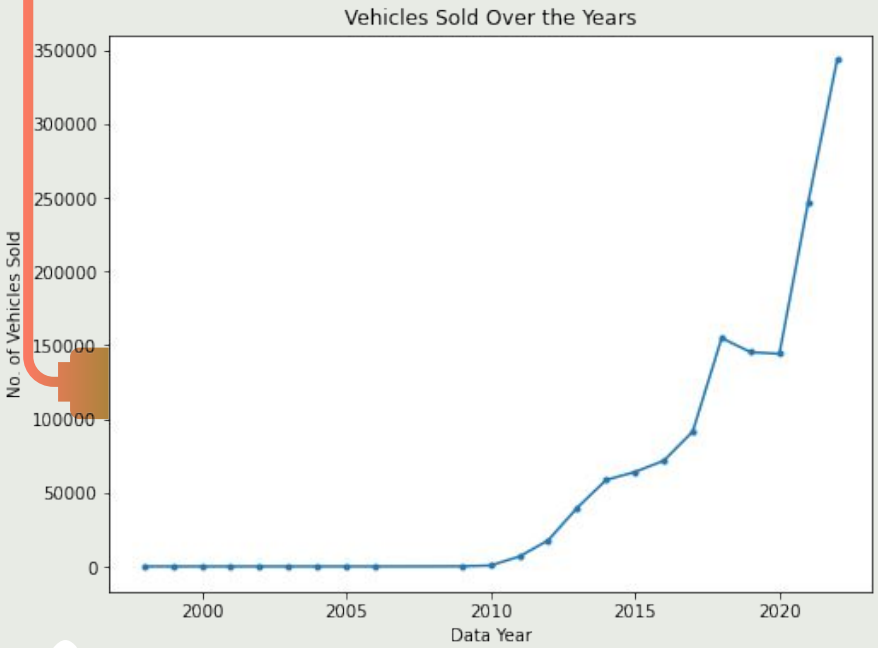
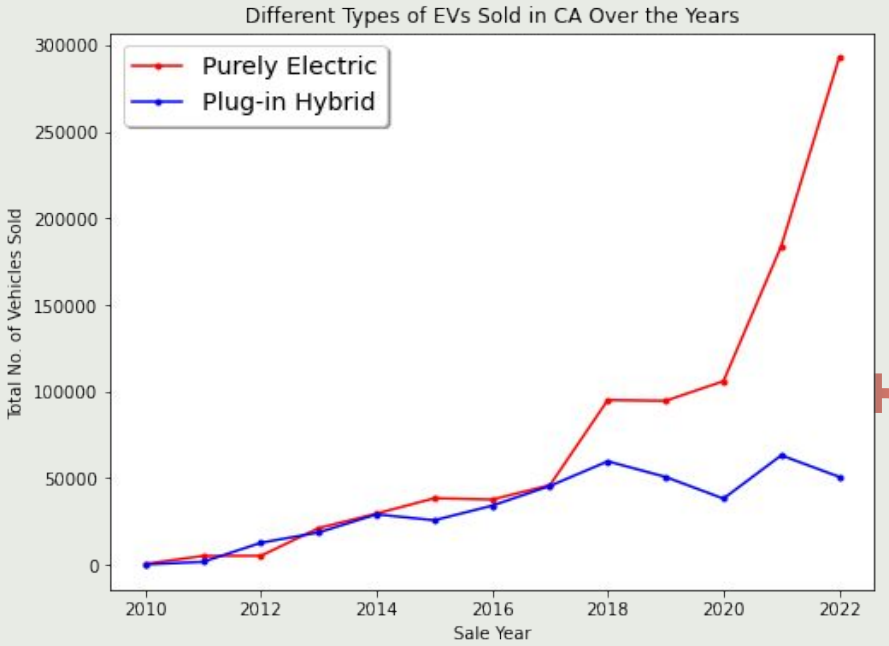
MOTIVATION

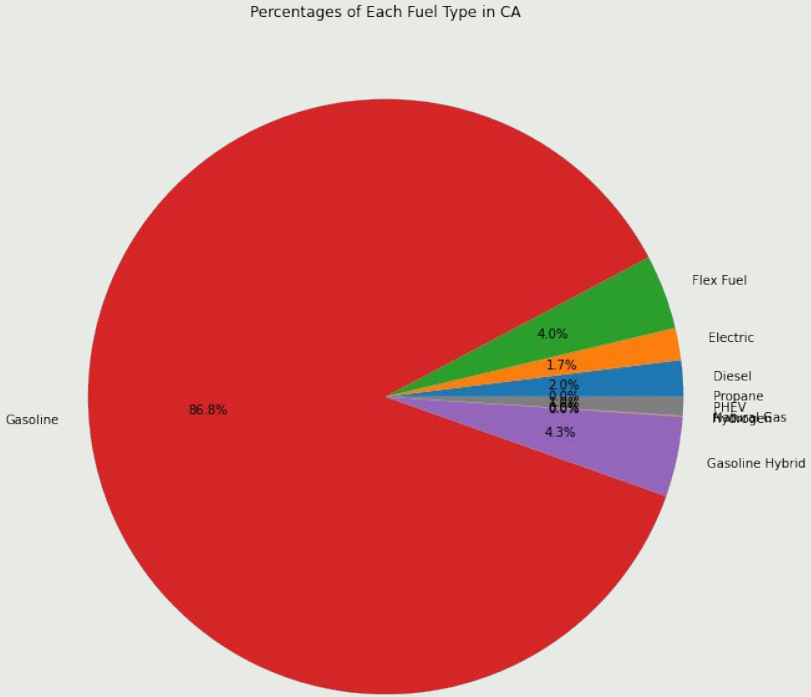


Electric Vehicles Sold Over the Years



Different Types of EVs Sold in CA Over the Years

MOTIVATION


Percentages of Each Fuel Type in CA
Gasoline
86.8%
Flex Fuel
4.0%
Electric
1.7%
Diesel
2.0%
Propane
PHEV
Gasoline Hybrid
4.3%

DATA SOURCE

Dataset 1: U.S. Department of Energy:

Alternative Fuels Data Center (https://afdc.energy.gov/stations/)

Dataset 2: California Energy Commission:

ZEV and Infrastructure Stats Data | California Energy Commission
(https://www.energy.ca.gov/filebrowser/download/5146)
(https://www.energy.ca.gov/filebrowser/download/4335)

CALIFORNIA ENERGY COMMISSION

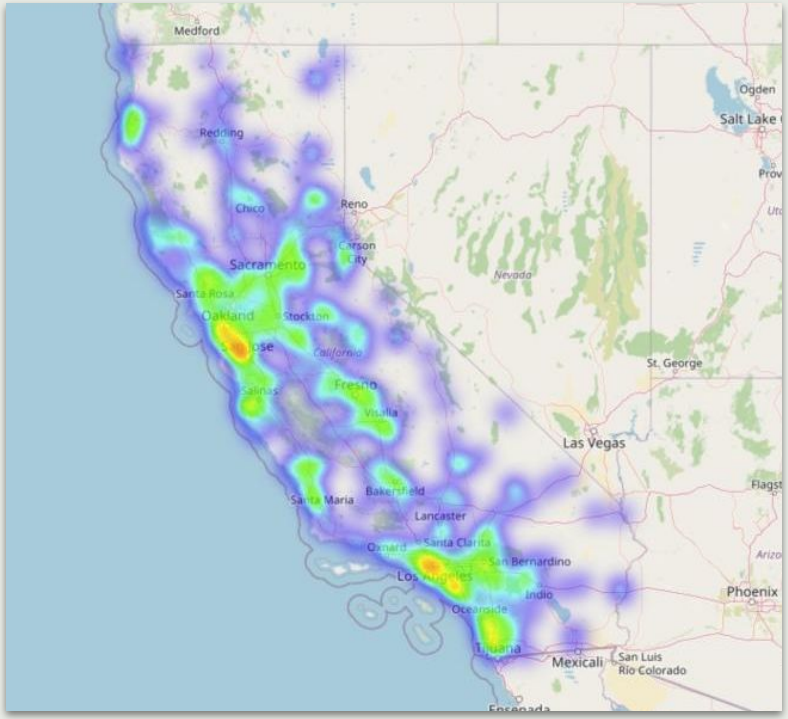
ENERGY.GOV

DATA CLEANING

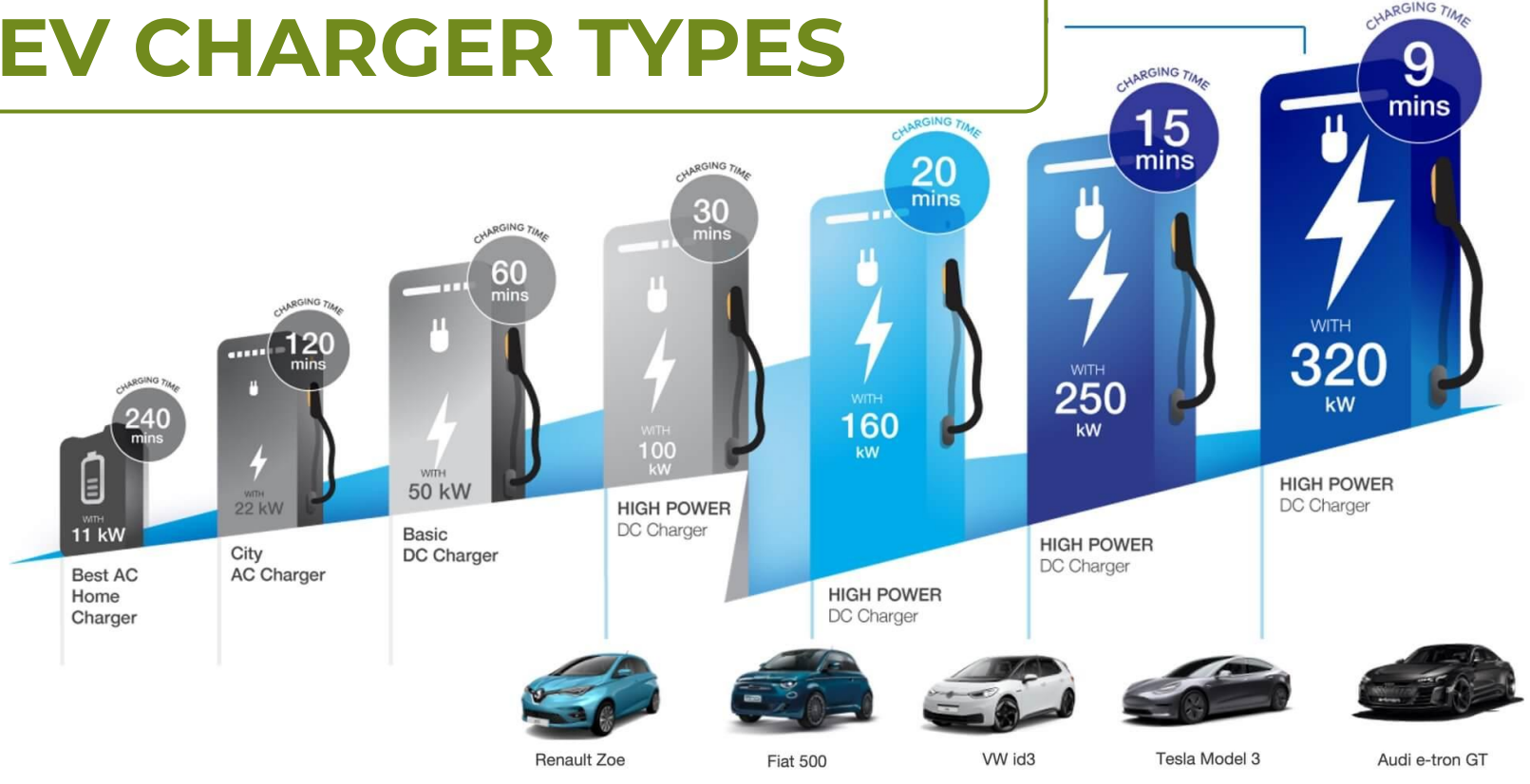
Charging Stations

- Location - Address, City, Zip, Latitude, Longitude
- Accessibility - Private/Public
- Usability - Charger types/amount Connector types

LOCATION

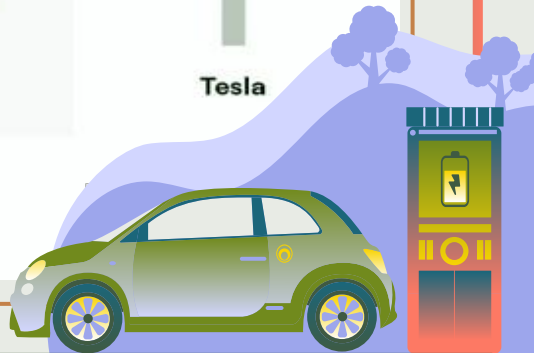

Medford
Redding
Chico
Reno
Carson City
Sacramento
Santa Rosa
Oakland
Stockton
San Jose
Fresno
Salinas
Visalia
Bakersfield
Santa Maria
Lancaster
Oxnard
Santa Clarita
San Bernardino
Los Angeles
Oceanside
Indio
Tijuana
Mexicali
San Luis Rio Colorado
Ensenada
Las Vegas
St. George
Ogden
Salt Lake
Phoenix
Nevada
California

EV CHARGER TYPES

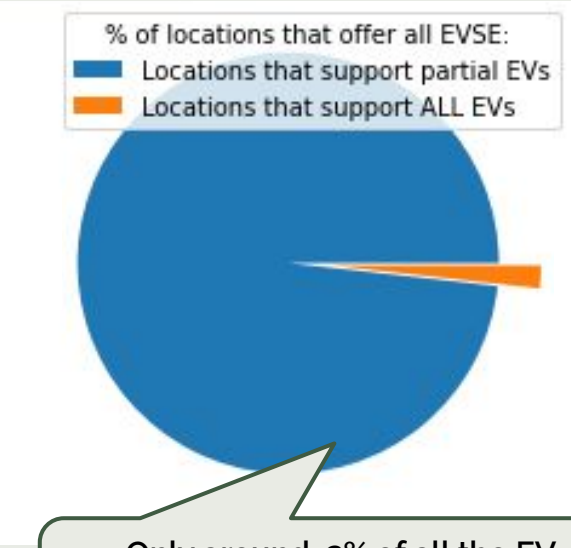


EV CHARGING CONNECTORS

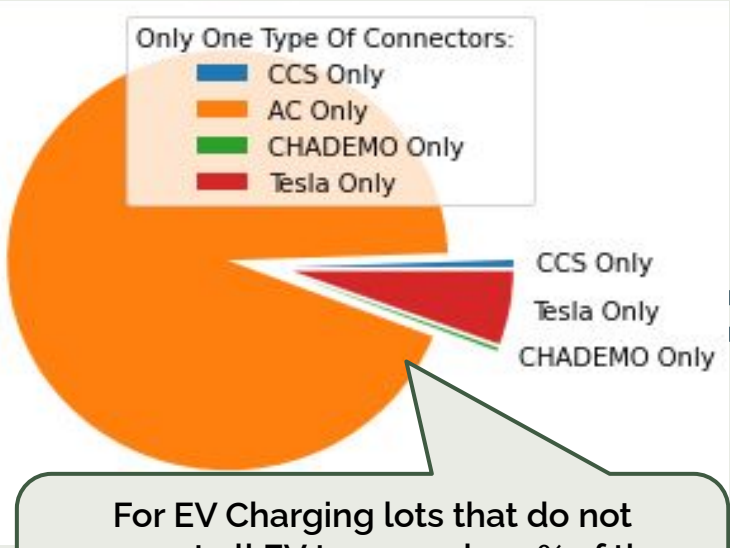
	N. America	Japan	EU *and the rest of markets*	China	All Markets *except EU*
AC					
	J1772 (Type 1)	**J1772** (Type 1)	**Mennekes** (Type 2)	**GB/T**	
DC					
	CCS1	**CHAdeMO**	**CCS2**	**GB/T**	**Tesla**



Location vs Connector types

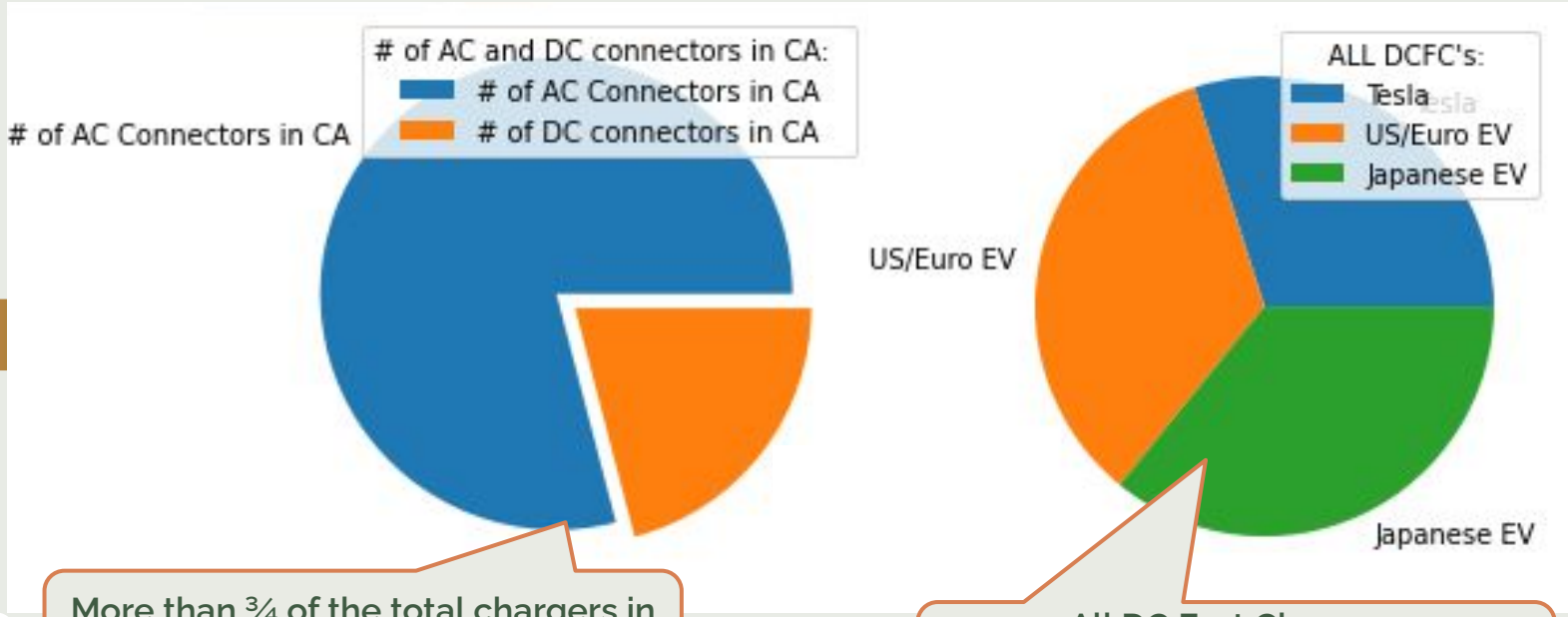


Only around 3% of all the EV Charging lots in CA support ALL EV types



For EV Charging lots that do not support all EV types, only 10% of the lots offer DCFC's, and 90% of the lots offer only AC chargers.

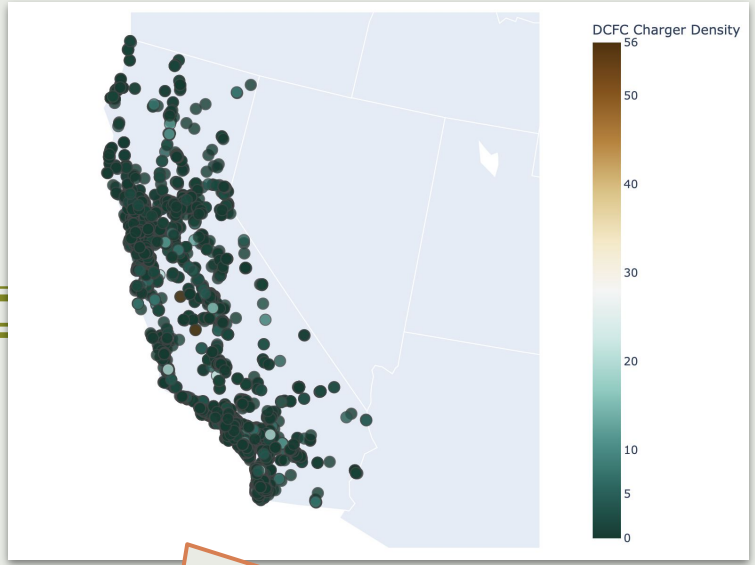
EV Charger Connectors



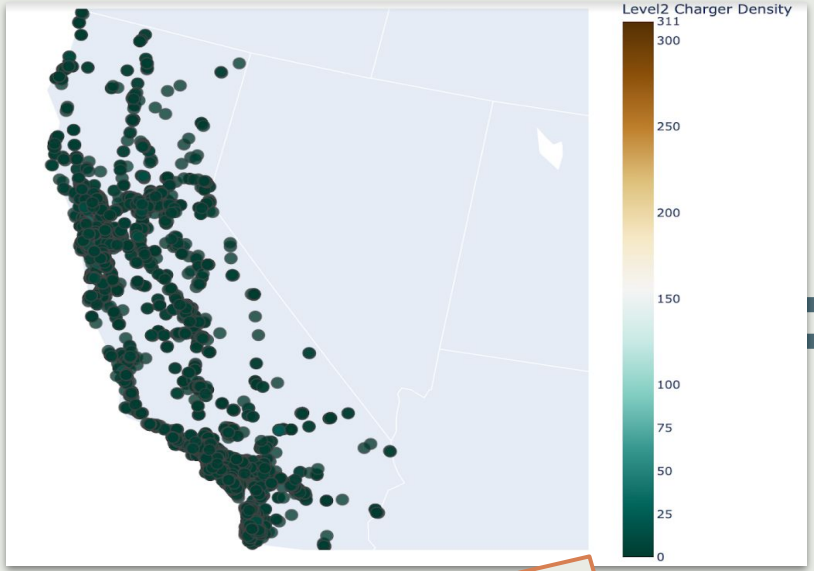
More than ¾ of the total chargers in CA are Level 2 AC chargers.

All DC Fast Chargers Distributed pretty evenly

EV Charging Station Density AC vs DC

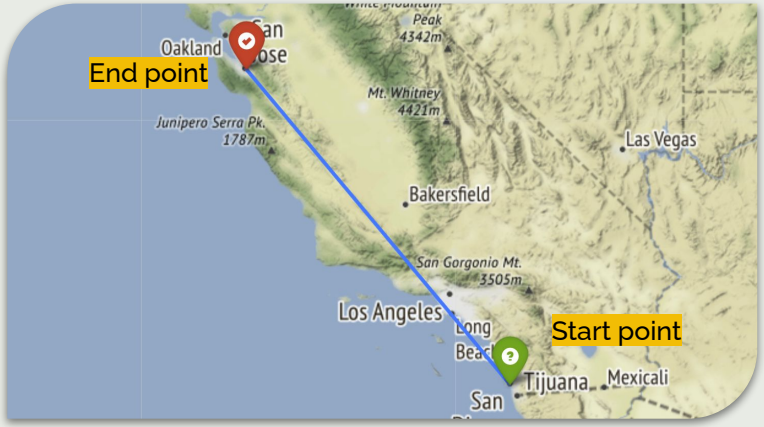


DCFC Charger Density



Level 2 AC Charger Density

ROUTE PLANNER - Tasks



Task 1

Given start and end cities, provide driving route and DC fast charging stations along the route

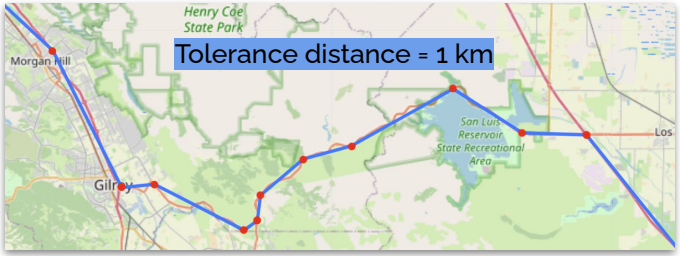
Task 2

Recommend charging stations and provide information for the trip

Presuppose:
1. Only use DC fast charge
2. Every charge takes 1 h
3. EV has 200 miles range

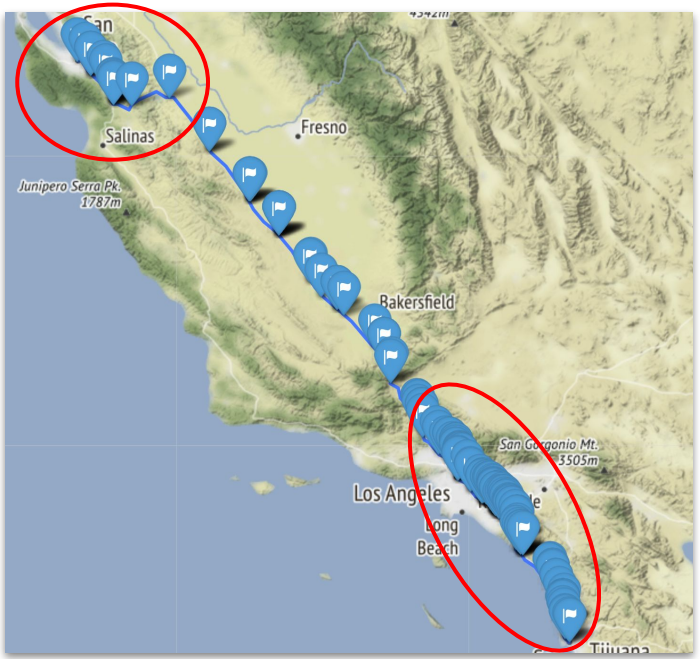
ROUTE PLANNER - Methodology

1. Call MapRequest API to get route from start to finish, use polylines to simulate the route



2. Call NREL.GOV API to get stations along the polylines, compared with the cleaned dataset of DCFC stations

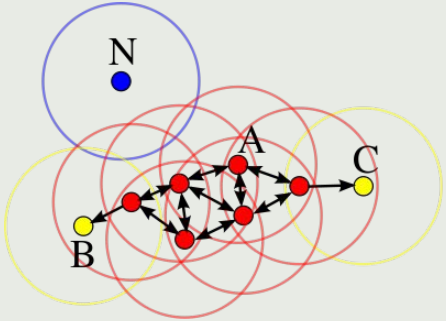
PROBLEM: Stations too crowded



ROUTE PLANNER - Methodology

Density-based spatial clustering of applications with noise (DBSCAN)

distance = 10 km
min_samples = 1

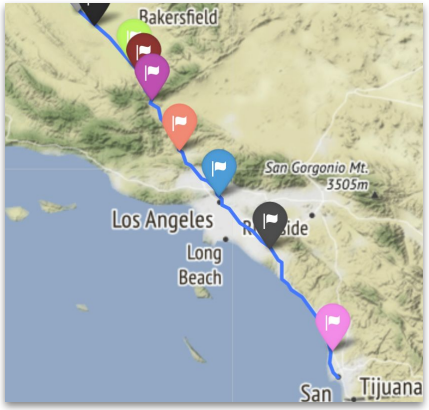


Red: core points
Yellow: boundary points
Blue: Outliers

Original stations

After DBSCAN

Keep center-most station

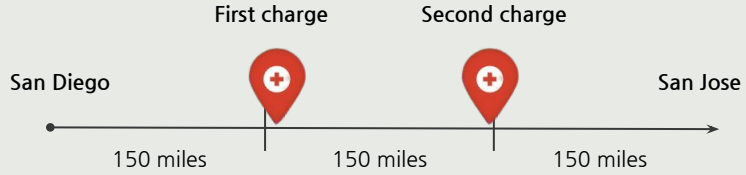


ROUTE PLANNER - Methodology

Finding the recommended stations

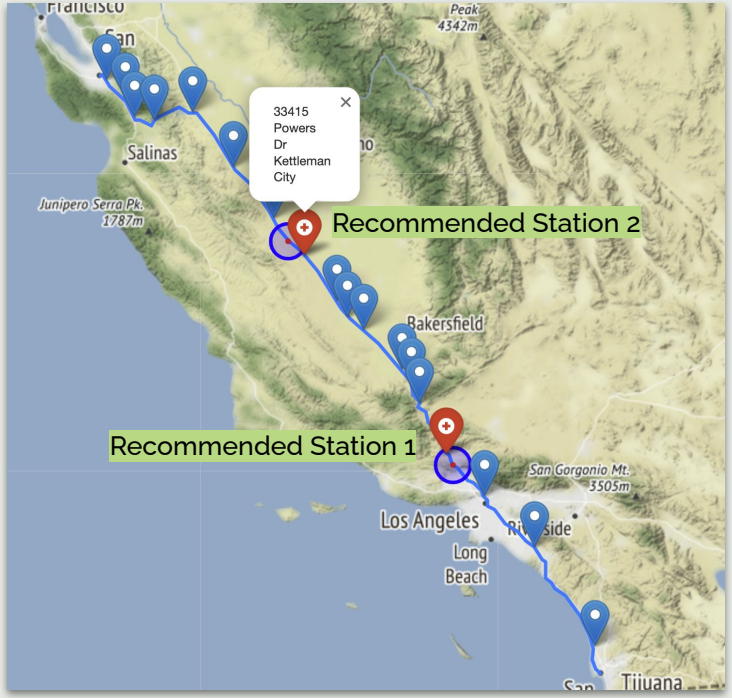
Segment = distance / num of charges
100 miles < Segment <= 200 miles
Search for the closest station to the endpoints

Example:



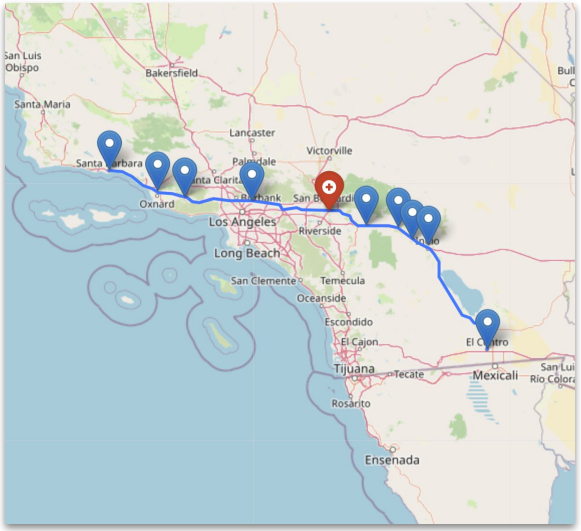
Segment = 450 / 3 = 150 miles
Charge twice

Estimated time = driving time + charging time



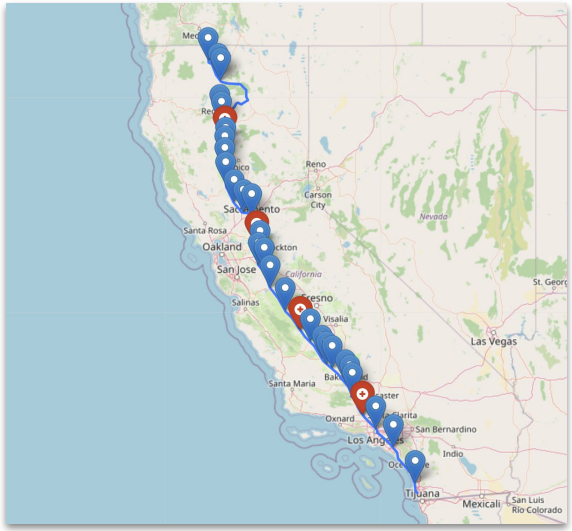
ROUTE PLANNER - Results

Santa Barbara - El Centro



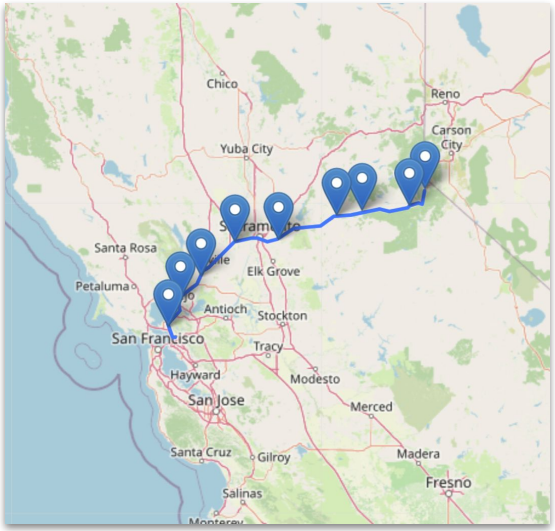
Distance: 308.0659 miles
Estimated time: 5:49:18

San Diego - Yreka



Distance: 814.6338 miles
Estimated time: 16:21:41

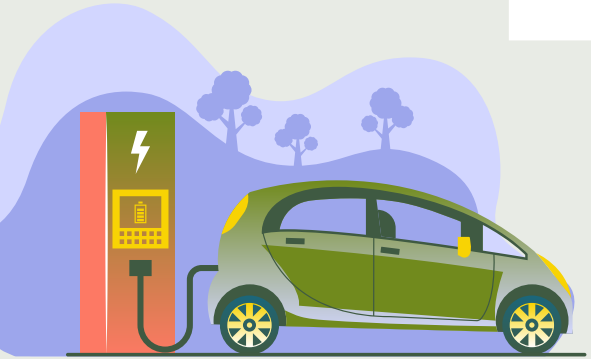
Berkeley - South Lake Tahoe



Distance: 176.2277 miles
Estimated time: 3:01:37


Thanks for watching

THANKS!



Do you have any questions?
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