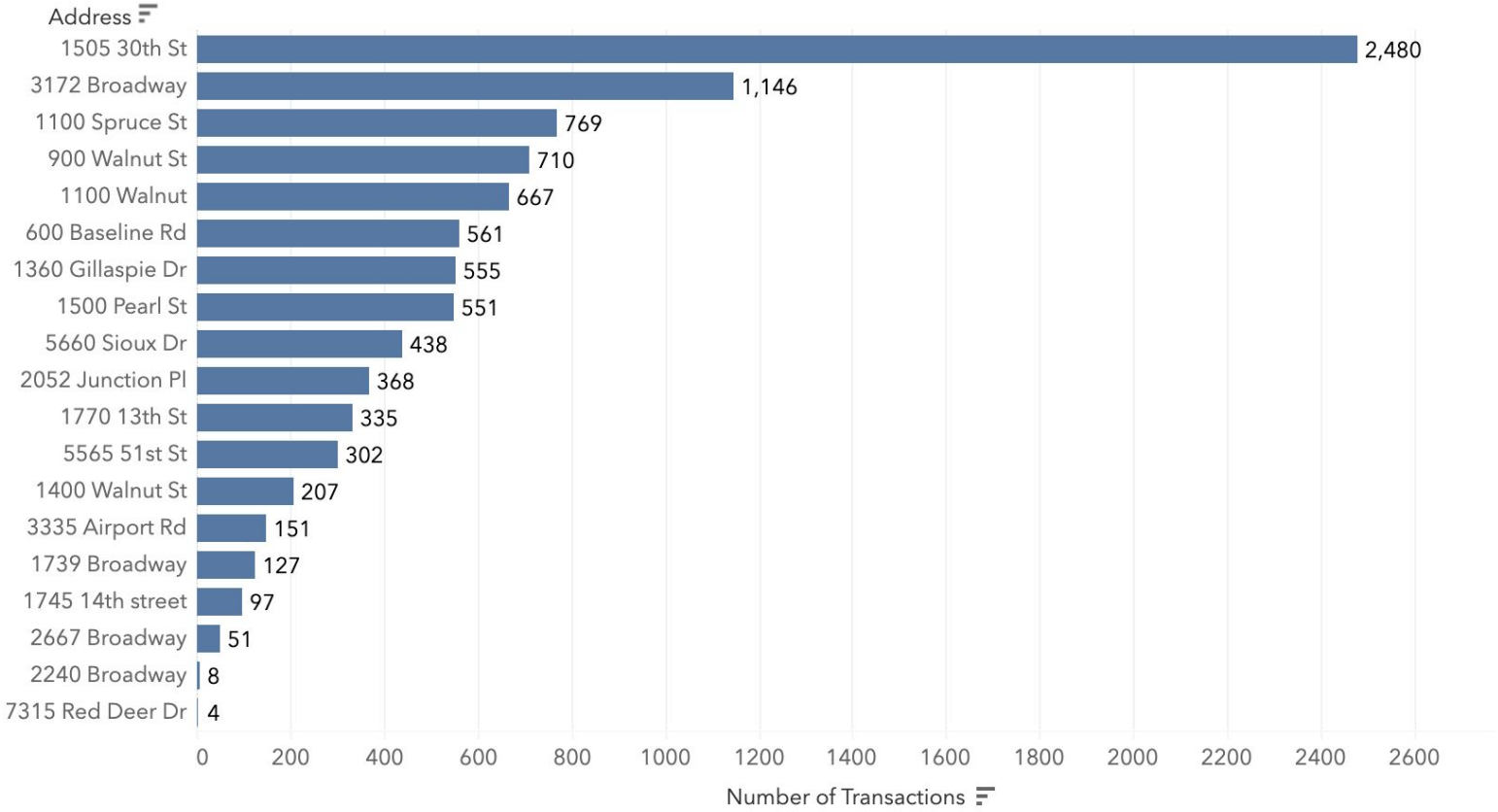
City of Boulder EV Charging Station Assessment

Using data science to evaluate and monitor
the health of City operated charging stations

Preliminary Analysis

- Combined City of Boulder's data on electric vehicle charging station energy consumption with info about the number of plugs and cost at each station
- Focused on 2021 data for a more recent picture
- Key metrics:
  - % failure per transaction
  - Number of transactions per station
  - Energy distributed per station

Number of Transactions in 2021



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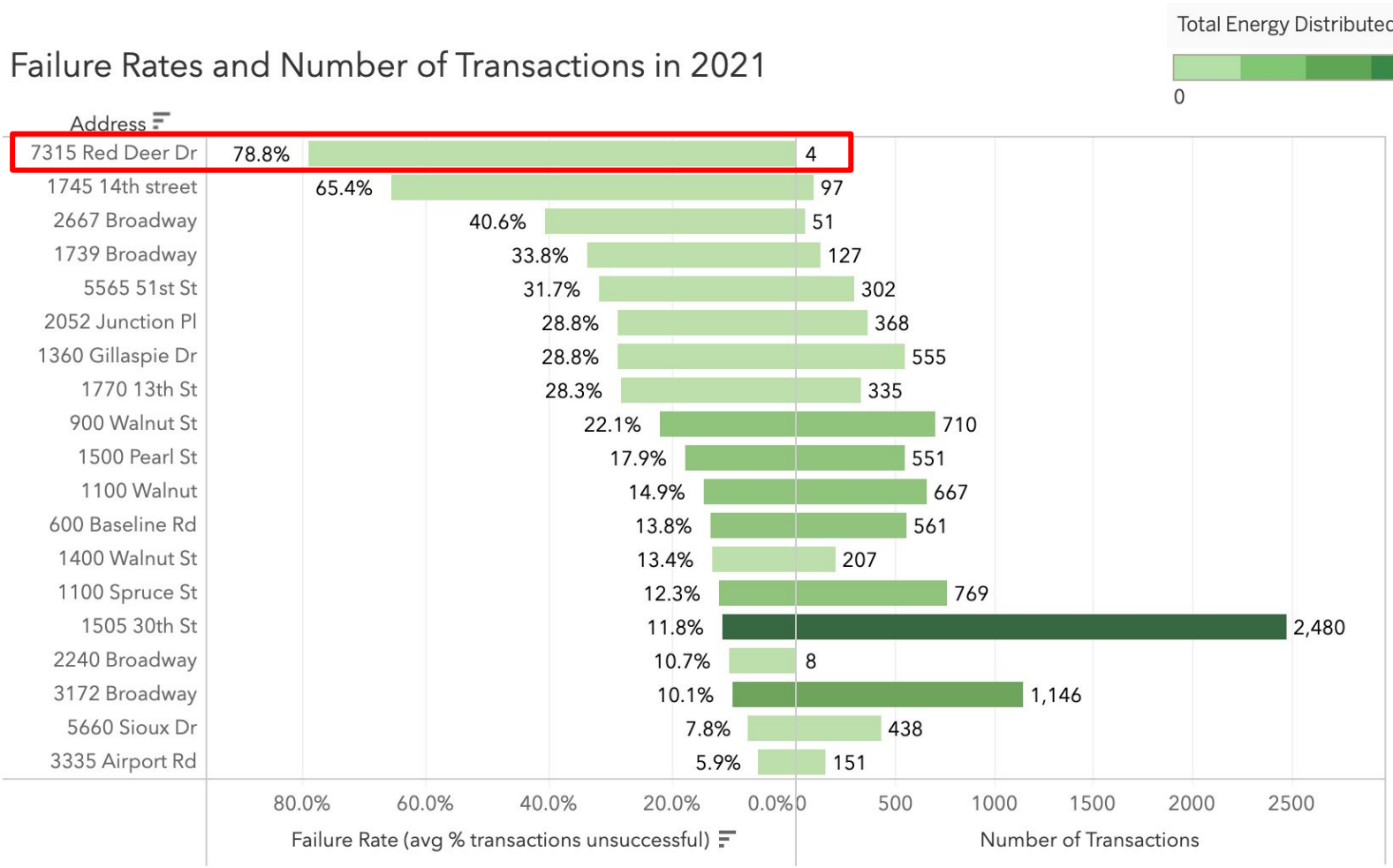

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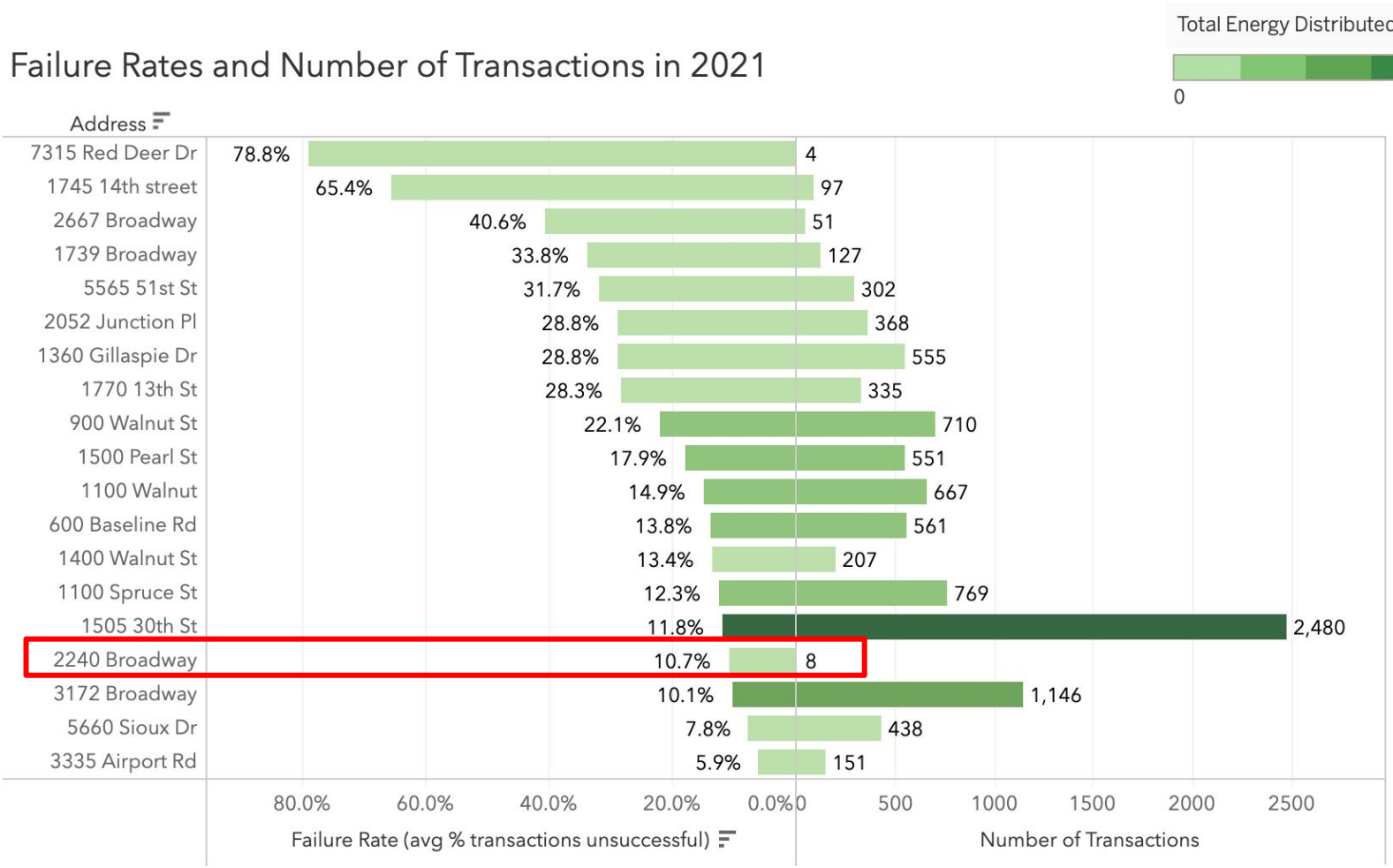


https://public.tableau.com/views/EVStationTornadoChart/Tornado?:language=en-US&publish=yes&:display_count=n&:origin=viz_share_link

Explore further in Tableau dashboard

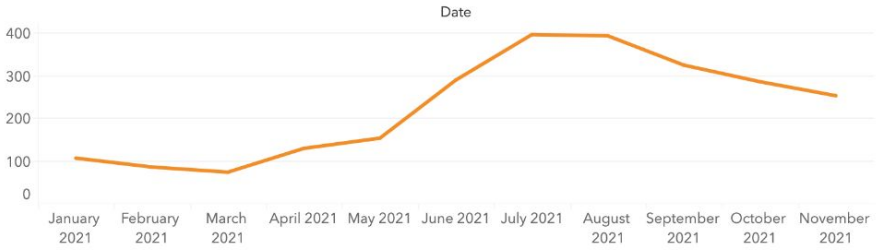
City of Boulder EV Station Assessment

Choose Station Address

1505 30th St

Free
TRUE
FALSE

Transactions per Month



Percent Unsuccessful

11.8%

Percent Occupied Monthly

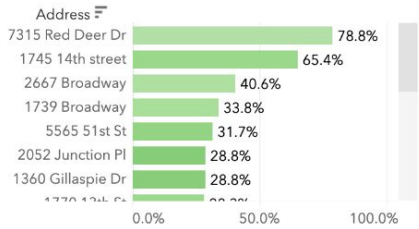
16.8%

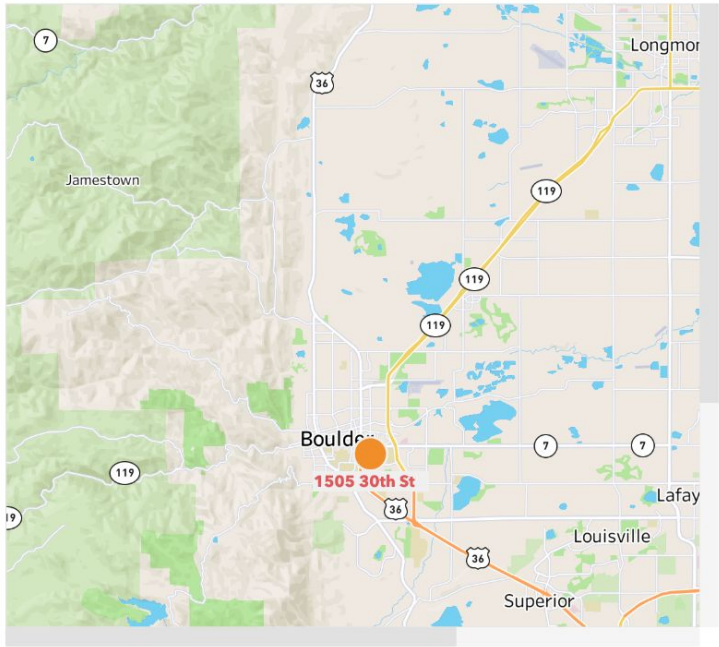
GHG Savings (kg CO2)

12,937

Total transactions by hour of the day

Average Percent Unsuccessful





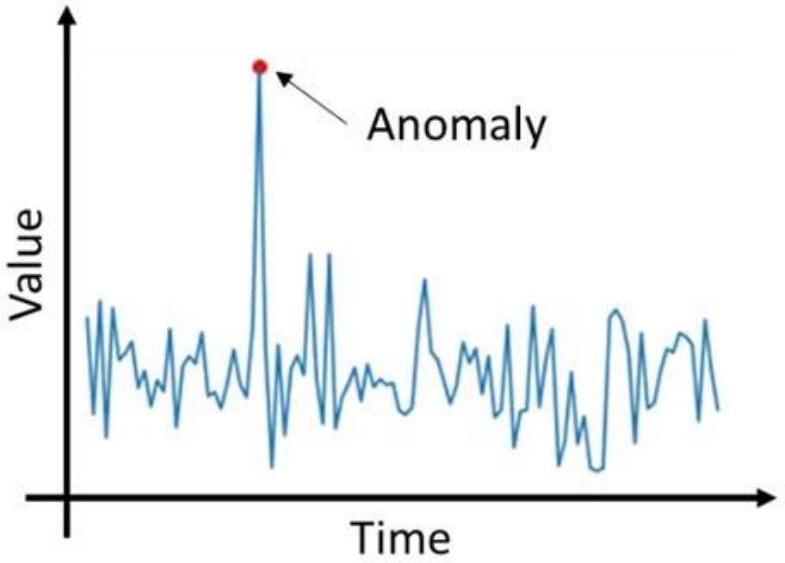
Total Charge Distributed in 2021 (kWh)

Impact Hypothesis

Automated detection of plug failures and reporting malfunctions can improve maintenance response time, shortening outages and increasing public use and satisfaction

Proposed Solution Path

- Establish real-time system of anomaly detection to identify malfunctioning chargers, as well as stations whose data reporting system may be failing
- Communicate functioning/malfunctioning stations to consumers via simple app or dashboard



Measures of Success

- Early detection of deviations in failure rates or usage (target time goal may be limited by frequency of transactions at a given station)
- Decreased average failure rates per station
- Technical measures
    - Recall: What proportion of true anomalies was identified?
    - Precision: What proportion of identified anomalies are true anomalies?

Risks & Assumptions

- Efficient data streaming coming from stations
- Identified malfunctions in stations can be corrected
- Having functioning stations
- Consumers will use resulting info to inform decisions

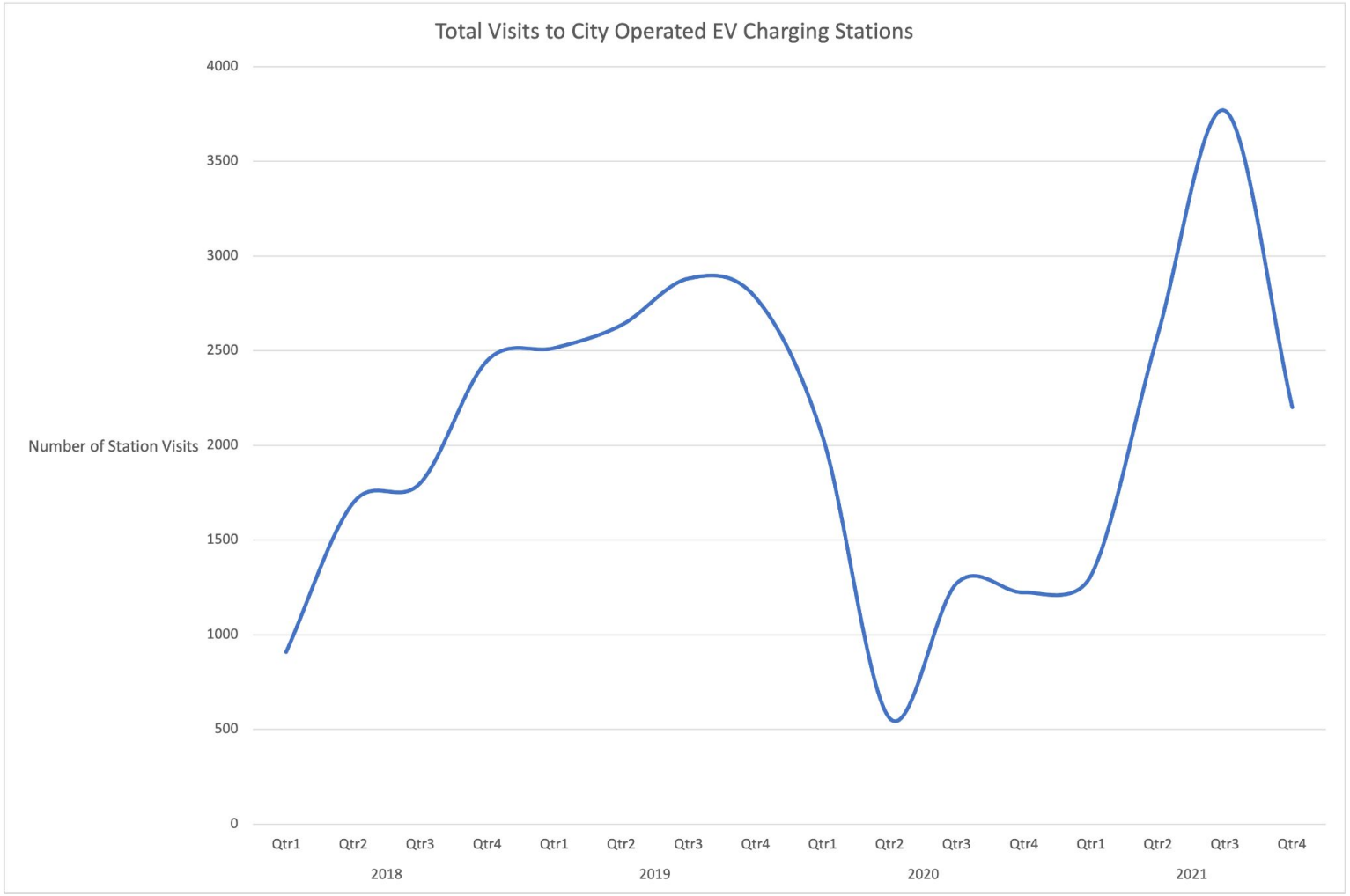
Thank you!

Appendix

Data Fields (fields used in final visualizations in bold)

Location
Lat
Long
Station Name
Address
City
State
Zip Code
Start Date Time
Plug-in Hour
Start Time Zone
End Date Time
End Time Zone
Total Duration (Days)
Total Duration Mins

Charging Time (days)
Charging Time (mins)
Energy (kWh)
GHG Saving (kg)
Gasoline Savings (gallons)
Port Type
Number of Ports
Free
Unsuccessful Charge Time (mins)
Percent Unsuccessful by Transaction
Month
Year
Day of Week (1 = Sunday)
Date
Monthly Station Total (mins)
Percent Monthly Use
Num Daily Transactions


Total Visits to City Operated EV Charging Stations
Number of Station Visits
4000
3500
3000
2500
2000
1500
1000
500
0
Qtr1
Qtr2
Qtr3
Qtr4
2018
2019
2020
2021