March 25, 2024

Vancouver EV Charging Infrastructure Analysis

DSMM - Maple Mapping

PREPARED BY:

Auradee Castro (c0866821)

Bhumika Rajendra Babu (c0867081)

Lakshmi Kumari (c0867090)

Maricris Resma (c0872252)

TABLE OF CONTENTS

I. PROJECT OVERVIEW

The project objective is to showcase Vancouver's commitment to sustainability and carbon emission reduction. This involves highlighting efforts to reduce the carbon footprint by promoting sustainable transportation, such as expanding the public EV charging network across British Columbia and ensuring that all new vehicles are zero emissions by 2040[1]. Maple Mapping team has been assigned the task of creating interactive visualizations for Vancouver using the city's dataset of Electric Vehicle charging stations, available on its open data website. Additionally, the project aims to identify and incorporate any other relevant data sources that can enhance the existing dataset.

II. DATA PROCESSING

The project leveraged two primary data sources to create a robust and informative dataset on Vancouver's electric vehicle charging stations.

City of Vancouver Open Data Portal: Utilized Vancouver city's Open Data Portal, which provided a foundational set of 53 records detailing station addresses, geocoordinates, lot operators, and lot areas[2].

ChargeHub Web Scraping: To enrich the data and gain deeper insights, we web scraped additional information from ChargeHub[3]. This process yielded over 200 new records, significantly expanding the dataset. The additional information included:

- *Enhanced Location:* Added postal codes for EV charging stations.
- *Network & Compatibility:* Identified EV charging networks (ChargePoint, Flo etc.) and connector types (EV Plug, Tesla etc.) for filtering and ensuring compatibility.
- *Availability:* Included total number of charging ports per station.
- *Cost Transparency:* Provided details on charging fees (free or hourly).
- *Accessibility:* Clarified public vs. restricted access.
- *Operating Hours:* Established EV charging station's operation times.

---

[1] Information about Implementation of Electric Vehicles in Vancouver City: https://vancouver.ca/streets-transportation/electric-vehicles.aspx
[2] City of Vancouver Open Data Portal: Electric Vehicle Charging Stations: https://opendata.vancouver.ca/explore/dataset/electric-vehicle-charging-stations/information/
[3] Guide map of EV charging stations across Canada: https://chargehub.com/map/#/en/map

- *Activation Methods:* Outlined different methods to activate EV charging sessions (Network App, RFID etc.).

The combined dataset underwent a thorough cleaning process to remove duplicate entries and eliminate records for non-existent stations. ChargeHub data served as the primary source for this verification. In addition, features specific to city data (*lot operator* and *lot area*) were deemed unnecessary for stations sourced from ChargeHub and were therefore removed to maintain data consistency. Finally, leveraging postal codes, the team utilized Google Maps to enrich the dataset with comprehensive geospatial coordinates for all stations. This enhanced dataset provided a complete and informative picture of Vancouver's EV charging infrastructure, empowering users with valuable insights for informed decision-making. *Figure 1* illustrates the data preparation process for analysis: collection, cleaning and enrichment.
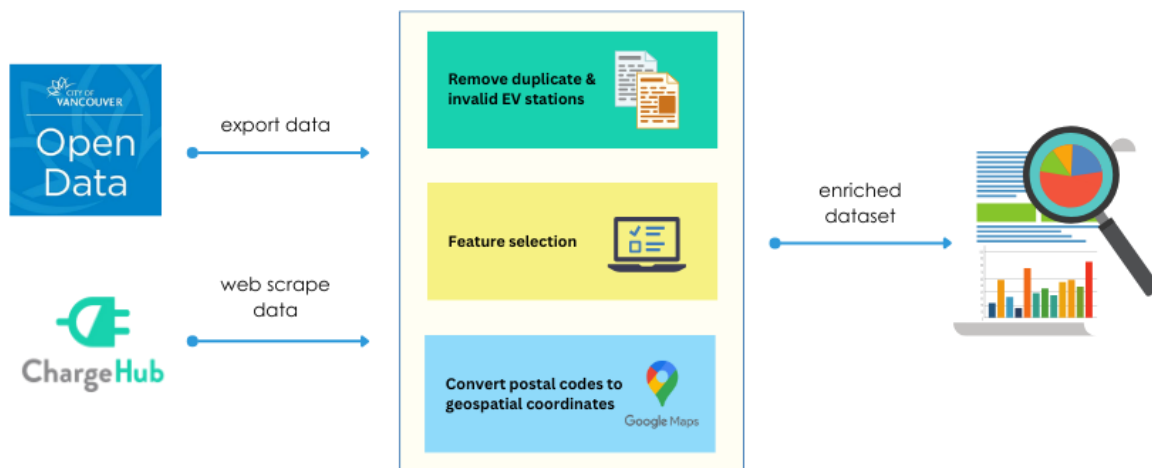

Figure 1 Data Pipeline: From Collection to Enrichment for Analysis

III. DATA ANALYSIS

Vancouver's dedication to sustainability and reducing emissions is evident in its expanding EV charging network. This analysis leverages Power BI to bring enriched data from the City's Open Data and ChargeHub to life through interactive visualizations as shown in *Figure 2*. With this comprehensive dataset, we unlock valuable insights for informed EV charging decisions. These compelling visuals not only highlight Vancouver's progress in sustainable transportation but also pinpoint areas for further development. Full analysis report can be viewed using this link.
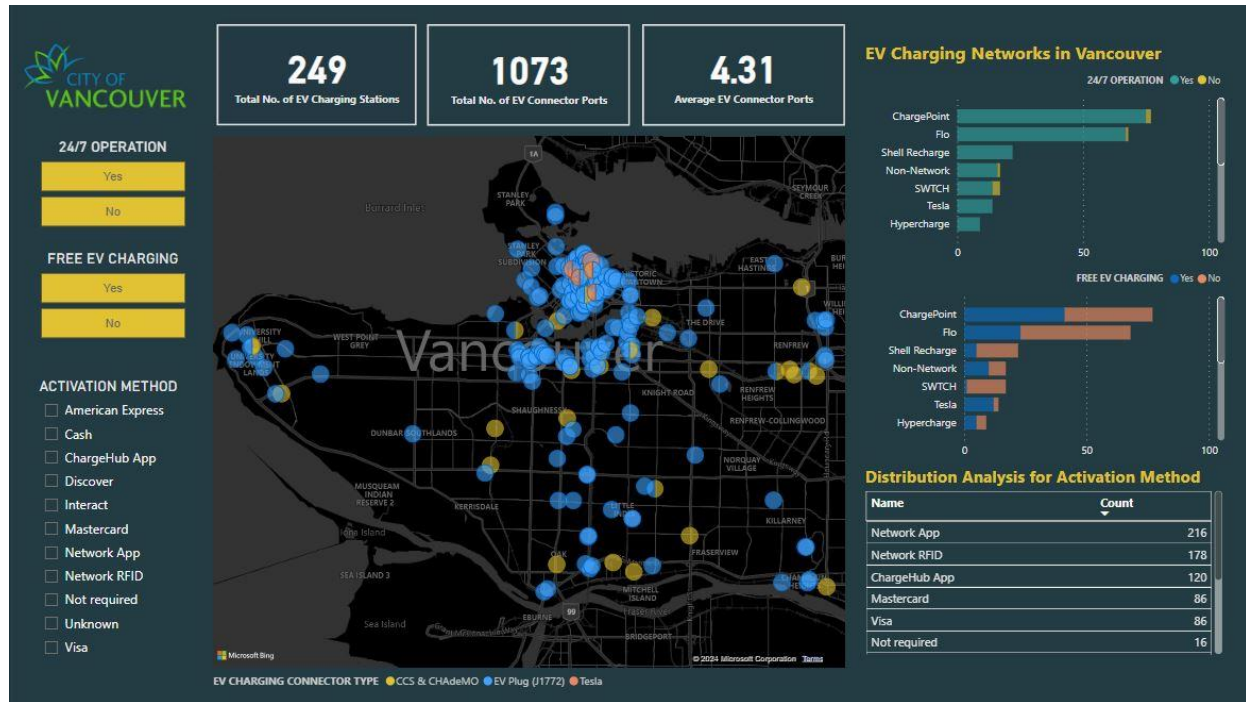
Figure 2 Vancouver's EV Charging Infrastructure Analysis using Power BI

Data Distribution Analysis

- **EV Charging Stations:** Out of the 260 EV charging stations in Vancouver, only 249 are included in this analysis. We excluded nine restricted stations typically found in schools, hotels, or government buildings, and two stations with unavailable details. This ensures our focus remains on publicly accessible charging options for a more comprehensive picture. *Figure 2* reveals a concentration of EV charging stations in Vancouver's northern region. Stations are more sparsely distributed in other areas of the city.

- **EV Charging Connector Types:** Focusing on the most common options, four main connector types power electric vehicles: J1772 (EV Plug), Tesla, CCS, and CHAdeMO.
  - *EV Plug (J1772):* Universal AC charging standard in North America (Level 1 & 2), most common for public stations (except Tesla).
  - *Tesla:* Proprietary system, for Tesla vehicles only, offers fast charging with Tesla Superchargers.
  - *CCS:* Standardized AC & DC charging gaining popularity, works for many EVs with a single plug.

- CHAdeMO: DC fast charging standard, primarily used by Japanese automakers (less common than CCS).

- **EV Charging Connector Ports:** Vancouver's electric vehicle charging stations exhibit variability in the number of connector ports per station. The average station boasts 4.31 ports, resulting in a citywide total of 1,073 ports. Notably, the ChargePoint network station located at 658 Homer Street offers the most extensive availability, featuring 70 connector ports.

- **EV Charging Networks**: As illustrated in *Figure 3*, Vancouver's EV charging network landscape comprises 14 distinct operators. ChargePoint and Flo emerge as the leading networks, each boasting over 60 stations. Notably, the distribution exhibits a concentration in Vancouver's northern region. Conversely, non-networked stations, primarily standalone EV Plug chargers installed by property owners, are more prevalent in the city's northern and western areas.
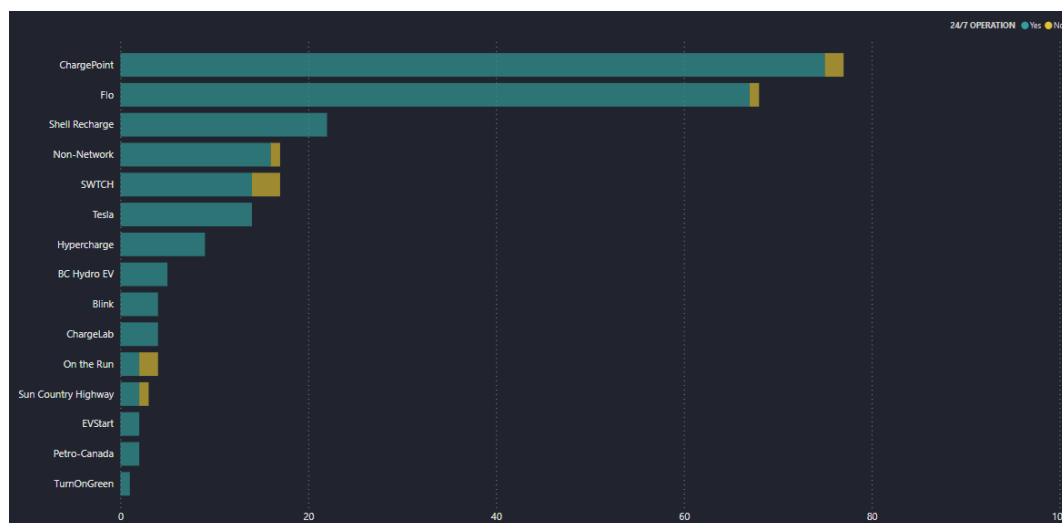

Figure 3 Electronic Vehicle Charging Networks in Vancouver

EV Charging Insights: Availability, Cost and Activation Methods

- **Operational Availability:** The analysis revealed that a significant majority of Vancouver's EV charging stations operate on a 24/7 basis, significantly enhancing accessibility for electric vehicle owners. However, it is important to note that a small subset of approximately 10 stations across the city maintains limited operating hours as shown in ***Error! Reference source not found.***. These stations typically open between 5:00 AM and 8:00 AM and close between 10:00 PM and midnight. For users planning to utilize these specific stations, consulting individual station information or signage is recommended to confirm operational hours and avoid potential inconvenience.
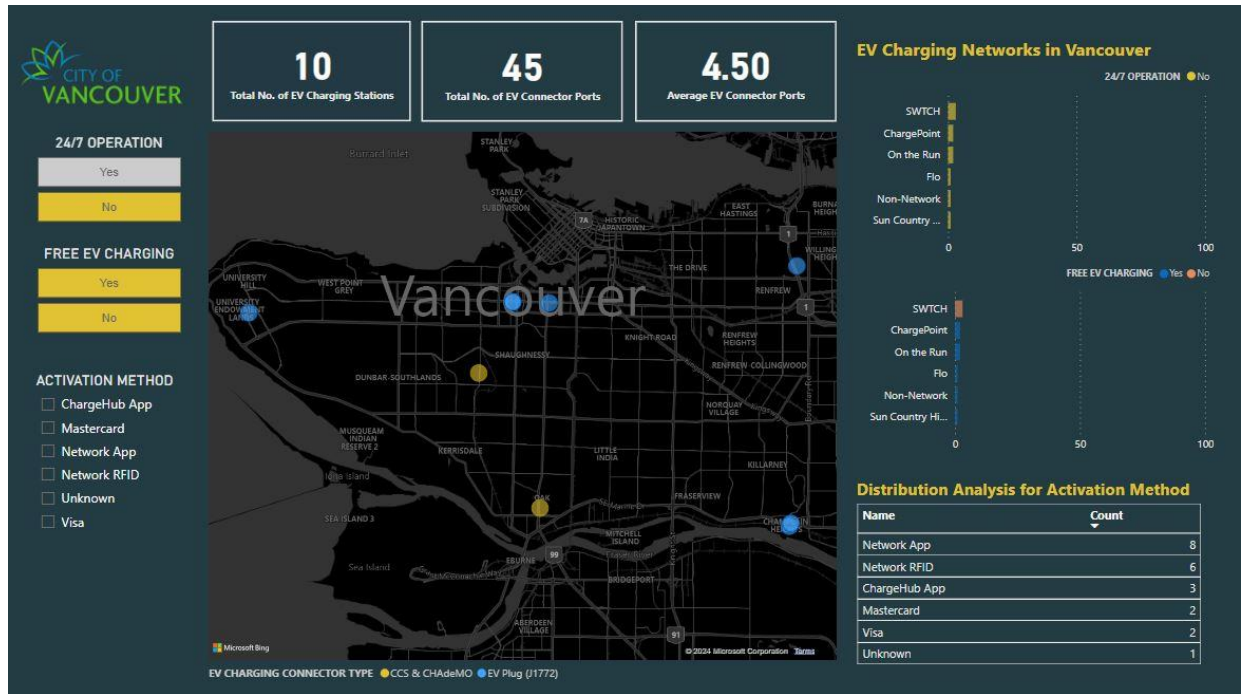
Figure 4 EV Charging Station Availability with Operating Hours

- **EV Charging Cost:** While 111 stations across Vancouver offer complimentary EV charging, it is essential to consider potential parking fees associated with these locations. Therefore, the perception of "free" charging may require further clarification regarding any applicable parking costs. On the other hand, 138 stations implement a fee structure for EV charging. *Table 1* details the specific pricing schemes for these paid stations.

Table 1 Average Price per EV Charging Connector

Connector Type	Average Price per Hour
EV Plus (J1772)	$1 to $2
CCS & CHAdeMO	$10 to $30
Tesla	Free

- **Activation Methods:** While major credit cards like Mastercard and Visa are accepted at some stations, most public EV chargers in Vancouver require activation through a dedicated network application, network-specific RFID card, or the ChargeHub app as seen in *Table 2*. This activation process is typically linked to the specific charging network operator. On the other hand, Tesla

Supercharger stations function differently, as they do not require any separate activation method for Tesla vehicles to begin charging.

Table 2 Distribution of EV Charging Stations by Activation Method

Activation Method	Number of Stations
Network Application	216
Network RFID	178
ChargeHub App	120
Mastercard	86
Visa	86
No activation required	16
American Express	10
Interact	10
Unknown	6
Cash	2
Discover	2

IV. RECOMMENDATIONS

While Vancouver's efforts to promote electric vehicles (EVs) are commendable, our analysis reveals a gap between existing public charging infrastructure and potential demand. Although private charging options likely exist in residences and commercial buildings, our data (sourced from ChargeHub) primarily focuses on public stations, highlighting their current limitations in number and geographic distribution. Public stations are concentrated in Vancouver's northern region, with limited availability elsewhere. This scarcity can lead to higher charging costs due to reduced competition.

To bridge this gap and incentivize wider EV adoption, a two-pronged approach is recommended:

- **Strategic Expansion and Competition:** Government subsidies could be targeted to expand charging networks in underserved areas, promoting a more balanced geographic distribution. This increased competition could potentially lower charging costs for users.

- **Enhanced Capacity per Station:** Encouraging stations to increase their average number of connector ports (currently 4.31 per station) would significantly enhance overall charging capacity and accommodate a growing EV population.

By implementing these measures, Vancouver can solidify its commitment to sustainable transportation and empower residents to make a seamless transition to electric vehicles.