

2024 Canadian Electric Vehicle Owner

Charging Experience Survey

Implementing Partners:



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2024 Canadian Electric Vehicle Owner Charging Experience Survey



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Mobility Futures Lab

Mobility Futures Lab is a leading sustainable transportation consulting firm that is at the forefront of innovation and research in the field of mobility. The firm's services are designed to help clients navigate the complex landscape of sustainable transportation, with a focus on proprietary software tools and data-driven solutions. Our approach is based on a deep understanding of the interconnections between transportation, energy, and the environment.

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List of Acronyms

AC – Alternating Current

BEV – Battery Electric Vehicle

CCS – Combined Charging System

DC – Direct Current

DCFC – Direct Current Fast Charger

EV – Electric Vehicles

EVSE – Electric Vehicle Supply Equipment

GHG – Greenhouse Gases

ICEV – Internal Combustion Engine Vehicle

ISED – Innovation, Science, and Economic Development Canada

IZEV – Incentives for Zero Emission Vehicles

km – Kilometers

kW – Kilowatts

kWh – Kilowatt Hour

MURB – Multi-Unit Residential Building

NACS – North American Charging Standard

NRCan – Natural Resources Canada

PHEV – Plug-in Hybrid Electric Vehicle

RFID – Radio Frequency Identification

TOU – Time of Use

V2G – Vehicle to Grid

ZEV – Zero-Emission Vehicle

ZEVIP – Zero-Emission Vehicle Infrastructure Program

Executive Summary



Canadian EV Market Trends

The outlook of the electric vehicle (EV) market in Canada is positive and trending in the right direction, fueled by a wide range of federal and provincial incentives for purchasing EVs and installing EV charging stations. EV sales in Canada in 2023 increased by 49% year-on-year and exceeded 180,000 for the first time. This increase in EV sales was complemented by the installation of new level 2 public EV charging stations at around 2,100 locations and Direct Current Fast Charging (DCFC) level 3 EV stations at around 330 locations across Canada in 2023. In terms of electric vehicle supply equipment (EVSE) charging ports, Canada had a total of 22,269 public level 2 ports at the end of 2023, reflecting a yearly increase of 36%. Similarly, there were 4,850 DCFC ports, reflecting a 29% year-on-year increase.

EV Owner Charging Experience Survey

The growing EV market has led to numerous stakeholders individually investing in the installation and operation of charging stations. Consequently, a decentralized public charging station ecosystem has emerged, comprising diverse networks managed separately by provincial and local governments, private charging station operators, electrical utilities, and vehicle manufacturers. Despite the industry rapidly maturing thanks to the adoption of several strategic partnerships, the charging experience of Canadian EV owners can vary significantly based on multiple factors, including access to home charging, driving behaviour, vehicle range, residential location, access to public charging networks, and socioeconomic status.

Natural Resources Canada (NRCan), under the Zero Emission Vehicle Awareness Initiative, and the University of Toronto's Positive Zero Transport Futures initiative funded Pollution Probe, in partnership with the Mobility Futures Lab to conduct EV owner charging experience yearly surveys for 2023 and 2024. This 2024 report presents the EV charging experience of 2,024 EV owners across the country and highlights their opinion on public

charging infrastructure. The results of this study identify gaps and weaknesses in the charging experience of EV owners, as well as strengths that can be leveraged to maximize the benefits of future deployments. This second yearly survey also aimed to identify any changes in Canadian EV owners' public charging experience compared to 2023.

Similar to last year's report, EV owners' interaction with public charging infrastructure was divided into four categories: charging behaviour, network coverage satisfaction, network service satisfaction and costs and payments. This year's survey included an additional section that investigates the impact of public charging and additional factors on EV owners' future purchase decision. Canadian EV owners appear to be overwhelmingly satisfied, with 86% stating they would definitely purchase another EV in the future—a sentiment consistent across provinces, charging access, and vehicle brands. Public charging plays a significant role in future EV purchasing decisions but for different reasons depending on the owner profile: it is critical for those without home charging (74% consider it a significant factor) and primarily supports long-distance travel for those with home charging (64%). Access to home charging also remains vital, with 88% of owners with home charging citing it as a major factor, compared to 43% of those without.

Survey Respondent Characteristics

- Responses were collected across 11 provinces. The highest number of responses were from Quebec (44%), Ontario (25%), and British Columbia (14%), with the remaining provinces representing 17% of responses.
- The majority of EV owners can be classified as higher income individuals residing in single-family homes with dedicated parking and owning at least one non-EV in addition to their EV.
- 79% of respondents were above the age of 45, and 52% had a household income of more than \$125,000 before tax which is much higher than the population median of \$84,000.
- Most EV owners (64% of respondents) owned at least one internal combustion engine vehicle in addition to their EV and 46% have owned an EV for less than 3 years.
- 85% of respondents reside in single-family houses with dedicated parking, while only 12% reside in Multi Unit Residential Buildings (MURBs).

EV Characteristics and Driving Behaviour

- The vast majority of EV owners can comfortably complete their daily commutes with a single full charge as 84% had an EV with a range greater than 300km and only 10% reported driving their EV for more than 100km daily.
- A sizeable portion of EV owners (34%) used their EVs for long-distance trips (200km one way) at least once per month, which would require interaction with public charging infrastructure.

EV Charging Behaviour

- **Home charging:** 99% of EV owners residing in single family homes with dedicated parking have access to home charging. This percentage drops to 75%, 78% and 72% for EV owners residing in single family homes without dedicated parking, low-rise apartments and high-rise apartments.
- **Public charging:** Only 10% of EV owners with access to home charging use public charging on a regular basis (i.e., daily or weekly) compared to 88% of EV owners without access to home charging. EV owners with access to home charging predominantly rely on fast charging when charging in public (during longer trips), whereas EV owners without access to home charging predominantly rely on level 2 public chargers (mainly for their daily charging needs). 84% of EV owners with access to home charging mostly use public charging stations for long trips, thus relying on fast charging stations commonly found along highways. On the other hand, only 38% of EV owners without access to home charging mentioned long-distance trips as a main reason for using public charging stations.

- **Workplace charging:** Out of the EV owners that commuted to work, 44% had access to a workplace charger. Around 51% of EV owners who do not have access to home charging and that commute to work, also do not have access to a workplace charger. This portion of the population would mostly have to rely on public charging stations to charge their EVs.

Network Coverage Satisfaction

- EV owners in Quebec were more satisfied with the coverage of public charging stations compared to the other provinces as 46% felt that the number of public charging stations of all types was adequate and 37% felt that the number of fast public charging stations was adequate. These numbers were lower for Ontario and British Columbia at 28% and 21% for charging stations of all types and 22% and 16% for fast charging stations respectively. EV owner satisfaction in the remaining provinces was worse, as 7% felt that there was an adequate number of public charging stations of all types, with a lower proportion for fast public charging stations (6%).
- 44% of EV owners across Canada indicated the need to often take indirect routes to access charging infrastructure, while 32% indicated the opposite.
- EV owners preferred level 2 public chargers at hotels/motels (64% of respondents), retail centers (52%), and common recreational destinations (51%), while level 3 charging stations were preferred at gas stations and highway rest stops (88%).

Network Service Satisfaction

IMPEDIMENTS AND WAIT TIME:

- 45% of EV owners across Canada reported issues with people staying plugged into charging stations after their vehicles were fully charged.
- 42% of EV owners noted gas-powered cars frequently occupying EV charging spots.
- While 29% of EV owners were dissatisfied with wait times at charging stations,

Tesla owners expressed much higher satisfaction (12% dissatisfied) compared to non-Tesla owners (35%).

RELIABILITY:

- EV owners in Quebec are more satisfied with the reliability of level 2 and level 3 public charging stations compared to other provinces, with only 15% of Quebec owners reporting issues versus 30% in other provinces. There were no significant differences in the satisfaction between level 2 and level 3 charging stations.
- Tesla owners are significantly less concerned about level 3 charging stations being out of service (12%) compared to non-Tesla owners (33%), with no difference for level 2 stations between the two groups.
- Power output at public charging stations is perceived as inconsistent by many EV owners, both in winter (42% of EV owners) and throughout the year (37%). Tesla owners report higher satisfaction with power consistency both in winter and year-round, likely due to the Tesla-specific charging network.

ACCESSIBILITY:

- EV owners across Canada were generally satisfied with winter access to public charging stations, with less than 16% expressing dissatisfaction.
- 46% of respondents found signage at public EV charging stations unclear, and 44% had difficulties with the length, weight, and position of charging cables.
- Tesla owners were more satisfied with the weight and length of charging cables (50% satisfied) compared to non-Tesla owners (30%).
- 50% of respondents in Ontario felt that public charging stations were located near useful amenities, compared to around 37% in other provinces.
- 62% of respondents never felt unsafe while charging in public. However, respondents that did express safety concerns indicate remote isolated locations (20%) and poor lighting at night (16%) as the main reasons for feeling unsafe.

Payments and Costs

PAYMENT:

- 71% of EV owners are members of at least two charging networks, highlighting the decentralized nature of Canada's charging ecosystem, with 33% unaware of roaming agreements between networks.
- Tesla owners primarily use the plug and charge payment method (69%), while non-Tesla owners have more diverse payment methods, with 37% using mobile apps, 16% using RFID cards, and 9% using physical credit/debit cards.
- 82% of Tesla owners prefer to pay using plug and charge, while non-Tesla owners' preferences are split between mobile apps and credit/debit cards.
- EV owners in Quebec are generally more satisfied with payment options (52% satisfied) than those in other provinces (29%).

COST:

- 47% of EV owners find public charging costs reasonable, with higher satisfaction in Quebec (60%) and British Columbia (40%), possibly due to lower electricity rates.
- 60% of EV owners express concern over inconsistent public charging pricing, with Quebec showing lower dissatisfaction (46%) compared to other provinces (72%).
- 70% of EV owners prefer billing per unit of energy (kWh) rather than per unit of time.
- 42% of respondents indicate willingness to pay more for faster charging. Willingness to pay for faster charging is less pronounced in Quebec (35% willing to pay more), among lower income EV owners (29% willing to pay more) and among EV owners without access to home charging (21% willing to pay more).
- A significant portion of respondents (49%) showed willingness to participate in time-of-use pricing which offers potential cost savings.

Future EV purchase decision

- 86% of Canadian EV owners would definitely purchase another EV, with less than 1% saying they wouldn't, indicating high satisfaction among Canadian EV owners. These findings were consistent across provinces, among EV owners with and without access to home charging, and for both Tesla and non-Tesla owners.
- Public charging is a significant factor impacting future EV purchasing decision intentions, especially for EV owners without home charging (74% consider it as a significant factor), compared to those with access to home charging (64%). These findings highlight the importance of public charging for all EV owners, regardless of home charging access. For owners with home charging, its importance primarily arises from the need for charging during long-distance trips, as their regular reliance on public charging is limited.
- Access to home charging is also a critical consideration for future EV purchases, with 88% of EV owners with home charging indicating it as a major factor, compared to only 43% of those without home charging.
- Other key factors influencing future EV purchases include vehicle performance (67% of EV owners), cost (66%), government incentives (57%), and environmental concerns (52%).
- Among EV owners, 45% financed their vehicle, 47% paid in cash, and 8% chose to lease. Early adopters (owning an EV for more than 10 years) were more likely to pay in cash (57%) compared to recent adopters (less than 1 year) (47%). Additionally, a bigger proportion of recent adopters opted for leasing (18% vs. 8% for early adopters).

Recommendations

EXPAND CHARGING INFRASTRUCTURE AND IMPROVE ACCESSIBILITY

Prioritize the deployment of DC fast chargers along major travel routes to support long-distance travel and address range anxiety, while increasing Level 2 charger availability in urban areas for residents without home charging. Conduct studies to identify regions with a high density of homes without dedicated parking, providing insights for better public charging deployment. Incentivize EV owners in MURBs to install home charging infrastructure, and introduce retrofit programs to subsidize installations, particularly for Level 2 chargers.

ENHANCE CHARGING NETWORK RELIABILITY AND USER EXPERIENCE

Standardize payment methods across charging networks to reduce the need for multiple memberships and encourage the use of “plug and charge” systems. Ensure physical payment options like debit and credit cards are available, especially in areas with connectivity issues. Improve network reliability by collaborating with operators on regular maintenance and implementing real-time monitoring systems to minimize outages.

STANDARDIZE AND REGULATE CHARGING COSTS

Transition to energy-based billing (kWh) for fairer pricing, especially for slower charging vehicles. Promote transparent and consistent pricing across different public charging stations to address discrepancies between locations.



RAISE EV AWARENESS AND CONSUMER EDUCATION

Conduct surveys to identify knowledge gaps about EV charging and use the results to create targeted awareness campaigns. Provide clear information on charging options, payment methods, and costs, and collaborate with automakers and governments to ensure consistent messaging. Address pricing equity, ensuring public charging remains affordable and accessible to all EV owners, especially those without home charging access.

1 Background



Electrifying the transportation sector is a key component in the Canadian government's commitment to achieving net zero greenhouse gas (GHG) emissions by 2050.¹ As part of its decarbonization path, the federal government is committed to achieve 100% zero-emissions vehicles (ZEV) sales for all light-duty vehicles by 2035.² These regulations aim to ensure that 20% of new passenger vehicles available for sale in Canada starting from the 2026 model year are ZEVs, increasing to 60% by 2030 and 100% by 2035.³

Electric vehicle (EV) sales, including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), reached a record high in 2023, exceeding 180,000 vehicles sold for the first time.⁴ The rise in EV sales has been paralleled by substantial investments in charging infrastructure

from both the public and private sectors. Throughout 2023, there has been a notable surge in the number of EV charging stations at the national level. It is important to sustain EV sales growth through a simultaneous deployment of EV charging infrastructure. Insufficient public charging infrastructure has consistently been identified as one of the top three barriers to increased EV adoption, alongside purchase prices and vehicle range.⁵ Additionally, the presence of conveniently located public charging stations significantly influences consumer awareness and perception of the feasibility of EV usage.⁶

The growing EV market has led numerous stakeholders to independently invest in the installation and operation of charging stations. As a result, a decentralized public charging station ecosystem has emerged,

1 Canadian Institute for Climate Choices (2021). Canada's net zero future - Finding our way in the global transition. Retrieved from: https://climatechoices.ca/wp-content/uploads/2021/02/Canadas-Net-Zero-Future-Summary_FINAL.pdf

2 Transport Canada (2024). Canada's Zero-Emission vehicle sales targets. Retrieved from: <https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/canada-s-zero-emission-vehicle-sales-targets>

3 Battery electric (BEV), plug-in hybrid electric (PHEV), and fuel cell electric vehicles (FCEV) are all classed as ZEVs for the purposes of the regulation.

4 Statistics Canada. Table 20-10-0024-01 New motor vehicle registrations, quarterly. Retrieved from: <https://doi.org/10.25318/2010002401-eng>.

5 Newmotion (2020). EV Driver Survey Report. Retrieved from: https://assets.ctfassets.net/ulfvrpfliitxm/1Qid6yJBwkLoAoTSgr9kYt/9c11d5bdc97b994d1e8772e929e46f57/0729NM04_EV_driver_survey_report_2020_EN_FINAL.pdf

6 Sandia National Laboratories (2017). Impact of Public Electric Vehicle Charging Infrastructure. Retrieved from: <https://www.osti.gov/servlets/purl/1416695>

with networks managed separately by provincial and local governments, private charging station operators, electrical utilities, and vehicle manufacturers. While the industry is evolving and progressing toward maturity through strategic partnerships, EV owners across Canada continue to have differing opinions about their charging experiences, largely due to the varying coverage and service quality of public charging stations nationwide.

The charging experience of EV owners can vary for different segments of the population based on factors such as access to home charging, vehicle range, residential location and charging networks available, driving behaviour, and socioeconomic status of the EV owner. To comprehensively assess these charging experiences and identify strengths and limitations in Canada's EV charging infrastructure, continuous monitoring of various aspects of EV charging is essential.

In this context, Natural Resources Canada (NRCan), under the Zero Emission Vehicle Awareness Initiative, and the University of Toronto's Positive Zero Transport Futures initiative funded Pollution Probe, in partnership with the Mobility Futures Lab to conduct EV owner charging experience yearly surveys for 2023 and 2024. This 2024 report presents the EV charging experience of 2,024 EV owners across the country and highlights their opinion on public charging infrastructure. It is a continuation of the 2023 survey and includes 55 questions designed based on interviews with over 20 leading EV experts from both the public and private sectors, as well as an extensive review of the existing literature.⁷ Refinements to the 2023 survey reflect consultations with a Project Advisory Committee (PAC) and other stakeholders.

This study aims to identify weak points in the charging experience of EV owners, as well as strengths that can be leveraged to maximize the benefits of future infrastructure deployments. This study also aims to investigate whether there were any changes in the experience of EV owners in Canada compared to the previous year. This report categorizes the interaction of EV owners with charging infrastructure under four categories, namely: charging behaviour, network coverage satisfaction, network service satisfaction, and payment methods and costs. This year's survey includes an additional section that investigates the impact of public charging and additional factors on future EV purchase decisions of Canadian EV owners. A descriptive analysis of the survey results attributed to each category is presented in the body of the report and any significant differences between the 2023 and 2024 surveys are analyzed in detail.

The remainder of the report is structured as follows: **Section 2** provides a summary of the current EV market in Canada, including provincial and federal EV incentives, EV sales and number of charging stations. **Section 3** presents the characteristics of the survey respondents, including demographics, driving behaviour, and charging behaviour. **Sections 4, 5 and 6** summarize the satisfaction of EV owners in terms of network coverage, network service and network costs and payments respectively. **Section 7** presents the future purchase decision of EV owners and the factors that impact this decision. Finally, a list of recommendations is included in the report's **final section**.

⁷ Pollution Probe (2023). 2023 Canadian Electric Vehicle Owner Charging Experience Survey. Retrieved from: <https://www.pollutionprobe.org/2023-canadian-electric-vehicle-owner-charging-experience-report/>

2 Trends and Developments in the Canadian EV Market

To ensure a comprehensive understanding of the EV owner charging experience, it is essential to closely examine the recent market developments in terms of incentives, sales trends, and the installation of charging infrastructure.

2.1 Provincial and Federal incentives

EV sales growth has benefited from advancements in battery range and cost, as well as financial incentives for EV purchases and the installation of charging infrastructure. Federal rebate and incentive programs, such as the Incentives for Zero-Emission Vehicles (iZEV⁸) program and tax write-offs for businesses, help make EVs more financially accessible. The iZEV program offers incentives of up to \$5,000 for the purchase of BEVs and long-range PHEVs. Furthermore, the Zero Emission Vehicle Infrastructure Program (ZEVIP) introduced in 2019 aims to support the deployment of 84,500 EV chargers in public spaces, on-street locations, multi-unit residential buildings, and workplaces by 2029.⁹

In addition to federal incentives, several provinces have implemented their own incentive programs to encourage EV adoption and the installation of charging stations. These provincial incentives, summarized in Table 1, encompass various benefits for purchasing EVs, installing



public charging stations, and setting up home charging infrastructure. These provincial incentives were mostly the same compared to the previous year, with only Alberta discontinuing their public charging incentive program. Meanwhile, Quebec has announced a phased reduction of its Roulez Vert EV rebate program, with incentives set to decrease gradually starting in 2025 and ending entirely by 2027.¹⁰

⁸ Transport Canada (2023). Incentives for purchasing zero-emission vehicles. Retrieved from: <https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/light-duty-zero-emission-vehicles/incentives-purchasing-zero-emission-vehicles>.

⁹ Natural Resources Canada (2023). Zero Emission Vehicle Infrastructure Program. Retrieved from: <https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/zero-emission-vehicle-infrastructure-program/21876>.

¹⁰ Electric Autonomy Canada (2024). Quebec's move to end EV incentives ups scrutiny on Ottawa, other provinces. Retrieved from: <https://electricautonomy.ca/policy-regulations/ev-rebates-incentives-funding/2024-03-21/quebec-ev-sales-rebate/>

Table 1. Summary of Provincial EV Incentives.

Note: All provincial EV sales incentives and rebates can be stacked to the federal incentives

Province	Light-Duty Zero Emission Vehicle Purchase and Lease Programs	Public Charging Infrastructure Programs	Home and Workplace Charging Programs
Alberta	No Provincial Incentives	No Provincial Incentives	No Provincial Incentives
British Columbia	Rebates up to \$4,000 ¹¹	Rebates up to \$7,500 for level 2 chargers and \$130,000 for fast chargers ¹²	Multiple rebate options for installation of level 2 chargers in single homes and apartment/condo buildings and level 2 and 3 chargers in workplaces ¹¹
Manitoba	No Provincial Incentives	No Provincial Incentives	Loans up to \$3,000 per charger ¹³
New Brunswick	Rebates up to \$5,000 ¹⁴	No Provincial Incentives	Rebates up to \$750 for level 2 chargers ¹³
Newfoundland & Labrador	Rebates up to \$2,500 ¹⁵	No Provincial Incentives	No Provincial Incentives
Northwest Territories	Rebates up to \$2,500 ¹⁶	No Provincial Incentives	Rebates up to \$500 for level 2 chargers at home locations ¹⁶ and up to \$5,000 for level 2 chargers and \$75,000 for fast chargers in workplaces ¹⁷
Nova Scotia	Rebates up to \$3,000 ¹⁸	No Provincial Incentives	Rebates up to \$10,000 per apartment building ¹⁹
Nunavut	No Provincial Incentives	No Provincial Incentives	No Provincial Incentives
Ontario	No Provincial Incentives	Rebates up to \$7,500 per level 2 port and \$150,000 per level 3 port ²⁰	Loans for level 2 chargers (only for single homes in Toronto) ²¹
Prince Edward Island	Rebates up to \$5,000 ²²	No Provincial Incentives	Rebates up to \$750 for level 2 chargers ²¹
Quebec	Rebates up to \$7,000 ²³	No Provincial Incentives	Multiple rebate options for installation of level 2 chargers in single homes and apartment/condo buildings and level 2 and 3 chargers in workplaces ²²
Saskatchewan	No Provincial Incentives	No Provincial Incentives	No Provincial Incentives
Yukon	Rebates up to \$5,000 ²⁴	No Provincial Incentives	Rebates up to \$1,500 at residences and \$7,500 per charger at businesses ²⁵

11 CleanBC Go Electric (2023). Passenger Vehicle Rebates. Retrieved from: <https://goelectricbc.gov.bc.ca/personal-rebate-offers/passenger-vehicle-rebates/>.

12 CleanBC Go Electric (2023). Program guide for CleanBC Electric Charger Program. Retrieved from: https://pluginbc.ca/wp/wp-content/uploads/2023/03/ProgramGuide_GoElectricBC_Public_Charger_20230401v4.pdf.

13 Manitoba Hydro (2023). Home Energy Efficiency Loan. Retrieved from: https://www.hydro.mb.ca/your_home/residential_loan/.

14 New Brunswick Power (2023). Electric Vehicle Rebates. Retrieved from: <https://www.nbpower.com/en/products-services/electric-vehicles/plug-in-nb/electric-vehicle-rebates/>.

15 Newfoundland and Labrador Hydro (2023). Electric Vehicle Rebate Program. Retrieved from: <https://nlhydro.com/electric-vehicles/ev-rebate/>.

16 Arctic Energy Alliance (2023). Electric Vehicles. Retrieved from: <https://aea.nt.ca/program/electric-vehicles/>.

17 Government of the Northwest Territories (2022). Electric Vehicle Infrastructure Program. Retrieved from: <https://www.inf.gov.nt.ca/en/services/energy/electric-vehicle-infrastructure-program>

18 EV Assist Nova Scotia (2023). Electrify Nova Scotia Rebate Program. Retrieved from: <https://evassist.ca/rebates/>.

19 Efficiency Nova Scotia (2023). Electric vehicle charging station rebates for your apartment or condo building. Retrieved from: <https://www.efficiencyns.ca/evcharging/>



2.2 Provincial and National EV Sales Trends

EV sales in Canada witnessed a remarkable year-on-year growth of 49% in 2023. EV sales accounted for 11% of total vehicle sales in 2023 compared to 8% in 2022 (**Figure 1**). Breaking down the sales figures, BEVs comprised 76% of total EV sales in 2023, experiencing a substantial surge of 41% compared to 2022. PHEVs also saw a substantial growth of 80% in sales during the same period and accounted for 24% of EV sales.

This upward trend in EV sales was evident across all provinces in Canada that reported EV sales data, albeit to varying degrees. Quebec and British Columbia, which have the most generous EV sales and EV charging stations incentives, stood out with significantly higher EV market shares compared to the national average. Quebec achieved a remarkable 16% market share, while BC exceeded that at 20%. These figures align closely with the global EV market share of 18%.²⁶ Conversely, other provinces reported lower market shares, such as 7.5% in Ontario and Prince Edward Island, and around 5% in Manitoba, New Brunswick, and Saskatchewan. The three largest provinces of Ontario, Quebec and British Columbia alone accounted for 92% of all EV sales in Canada.

Despite the relatively lower market shares in Prince Edward Island, New Brunswick, Manitoba and Saskatchewan, it is encouraging to note that EV sales are moving in the right direction. These provinces witnessed substantial growth in 2023, building on the progress observed in 2022. Specifically, Prince Edward Island and New Brunswick experienced 128% and 100% year-on-year increases in EV sales respectively, while Manitoba, and Saskatchewan saw growth rates of around 52%.

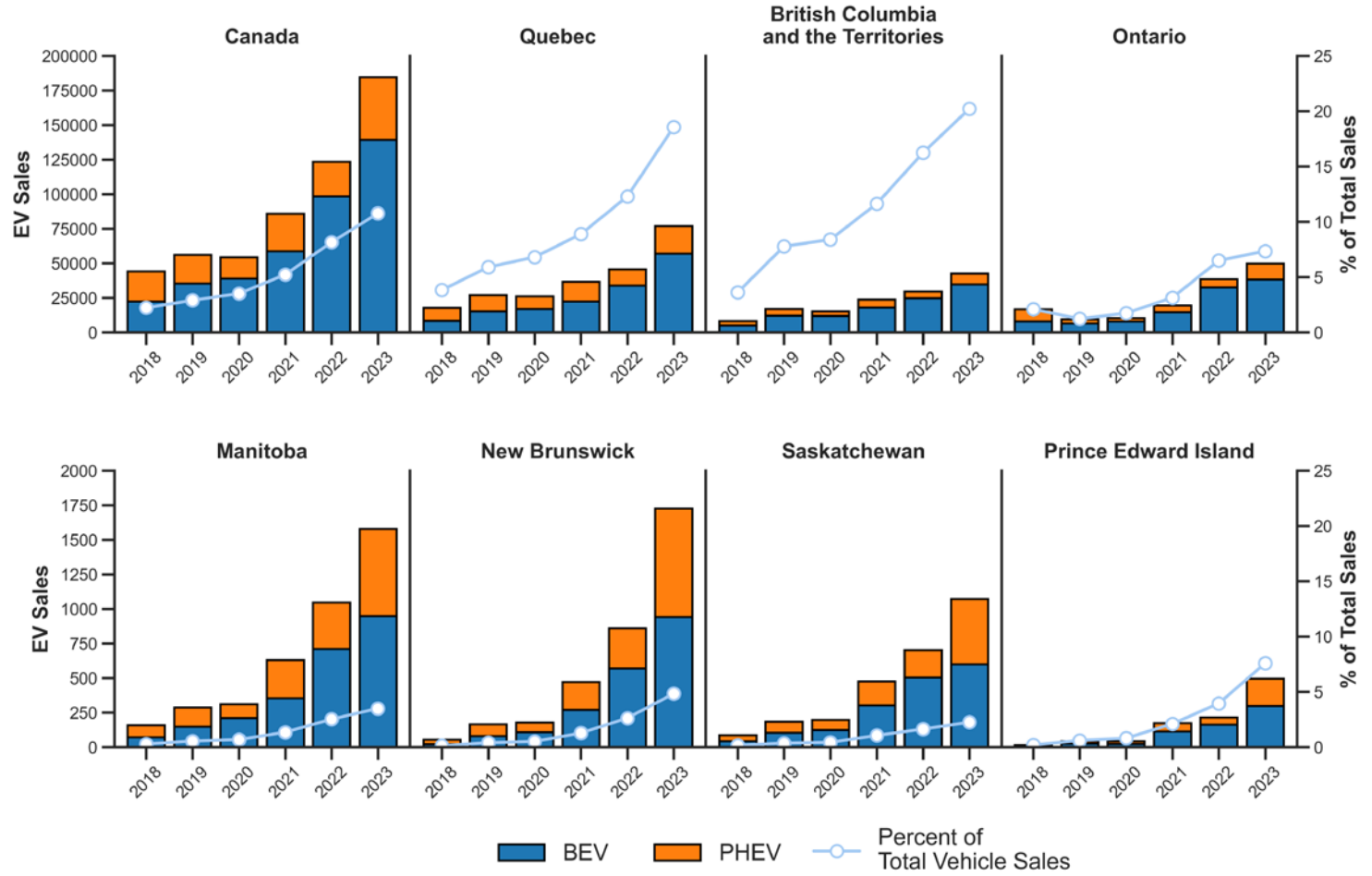
These increasing trends show the effectiveness of government incentives in encouraging EV uptake. Provinces with the most aggressive EV incentives, such as Quebec and British Columbia, saw the largest market shares for EVs and experienced solid sales growth in 2023, with increases of 68% and 44%, respectively. On another note, EV sales in Ontario slowed down in 2023 compared to 2022 and only increased by 28% compared to a 96% growth in the previous year.



- 20 Government of Ontario (2023). Electric Vehicle (EV) ChargeON Program. Retrieved from: <https://www.ontario.ca/page/ev-chargeon-program#section-1>
- 21 City of Toronto (2023). Home Energy Loan Program. Retrieved from: <https://www.toronto.ca/services-payments/water-environment/environmental-grants-incentives/home-energy-loan-program-help/>.
- 22 Prince Edward Island Environment Energy and Climate Change (2023). Electric Vehicle Incentive. Retrieved from: <https://www.princeedwardisland.ca/en/information/environment-energy-and-climate-action/electric-vehicle-incentive>.
- 23 Gouvernement du Quebec (2023). Financial Assistance for a New Electric Vehicle. Retrieved from: <https://www.quebec.ca/en/transports/electric-transportation/financial-assistance-electric-vehicle/new-vehicle>.
- 24 Yukon (2023). Apply for a rebate for a new zero-emission vehicle. Retrieved from: <https://yukon.ca/en/driving-and-transportation/apply-rebate-new-zero-emission-vehicle>.
- 25 Yukon (2023). Apply for a rebate for a level 2 electric vehicle charger. Retrieved from: <https://yukon.ca/en/driving-and-transportation/clean-energy-rebates/apply-rebate-level-2-electric-vehicle-charger-0>.
- 26 International Energy Agency (2024). Global EV Outlook 2024 – Catching up with climate ambitions. Retrieved from: <https://www.iea.org/reports/global-ev-outlook-2024>.

Figure 1. Yearly EV sales for different provinces. Bars and left axis show EV sales per year, whereas the white dots and the right axis show the percentage of EV sales from the total vehicle sales.

Note: EV sales were not available for the remaining provinces but are accounted for in the total EV sales for Canada.



2.3 Provincial and National EV Public Charging Trends

Charging stations in North America are categorized into three levels: level 1, level 2 and level 3 (also known as DC fast chargers, abbreviated as DCFC). **Table 2** provides an overview of the key features of each type of charging. Due to their low power and lengthy charging times, level 1 charging is inadequate for public charging and is rarely

used. There are currently only 136 public charging stations in Canada equipped with level 1 chargers. Consequently, this section primarily focuses on level 2 and level 3 DC charging stations and electric vehicle supply equipment (EVSE) ports. EVSE ports refer to the individual chargers capable of charging one vehicle at a time, while charging stations denote physical locations that can accommodate multiple EVSE ports.

Table 2. Summary of Charging Station Types

	Level 1 AC	Level 2 AC	Level 3 DCFC
EVs supported	All PHEVs and BEVs	All PHEVs and BEVs	Most BEVs and some PHEVs
Requirements	120-volt AC (alternating current) standard electrical outlet	240-volt AC (alternating current) connection	480-volt DC (direct current) connection
Average BEV charging time	8 to 30 hours	4 to 10 hours	25 to 45 minutes (to 80% of full charge)
Power delivered	~1.6 kW	3.3 – 19.2 kW	50 – 450+ kW
Range added per hour (approximate)	5 – 8 km	30 – 40 km	240 – 400+ km
Hardware and installation costs	\$1,000 in new building \$2,000 during renovation	\$1,500 in new building \$5,000 during renovation	\$50,000 – \$180,000
Applications	Long-term parking (home, work, overnight, etc.)	Long- and short-term parking (home, work, retail, etc.)	Long-distance travel (highways) and retail

Source: Adapted from Framework for Municipal Zero Emission Vehicle Deployment²⁷

The number of EV charging stations has seen a significant increase in Canada, both at the national level and across all provinces and territories. According to Transport Canada, there were 9,524 public charging locations with level 2 charging as of the end of 2023, up by 29% from the previous year (equivalent to the installation of 2,136 new charging stations). Additionally, there were 1,758 public charging locations with DCFC

chargers, representing a 23% year-on-year increase (equivalent to the installation of 331 new charging stations). In terms of EVSE ports, Canada had a total of 22,269 public level 2 ports at the end of 2023, reflecting a yearly increase of 36% (a total of 5,906 level 2 ports installed in 2023). Similarly, there were 4,850 DCFC ports, reflecting a 29% year-on-year increase (a total of 1,098 DCFC ports installed in 2023) (**Figure 2**).²⁸

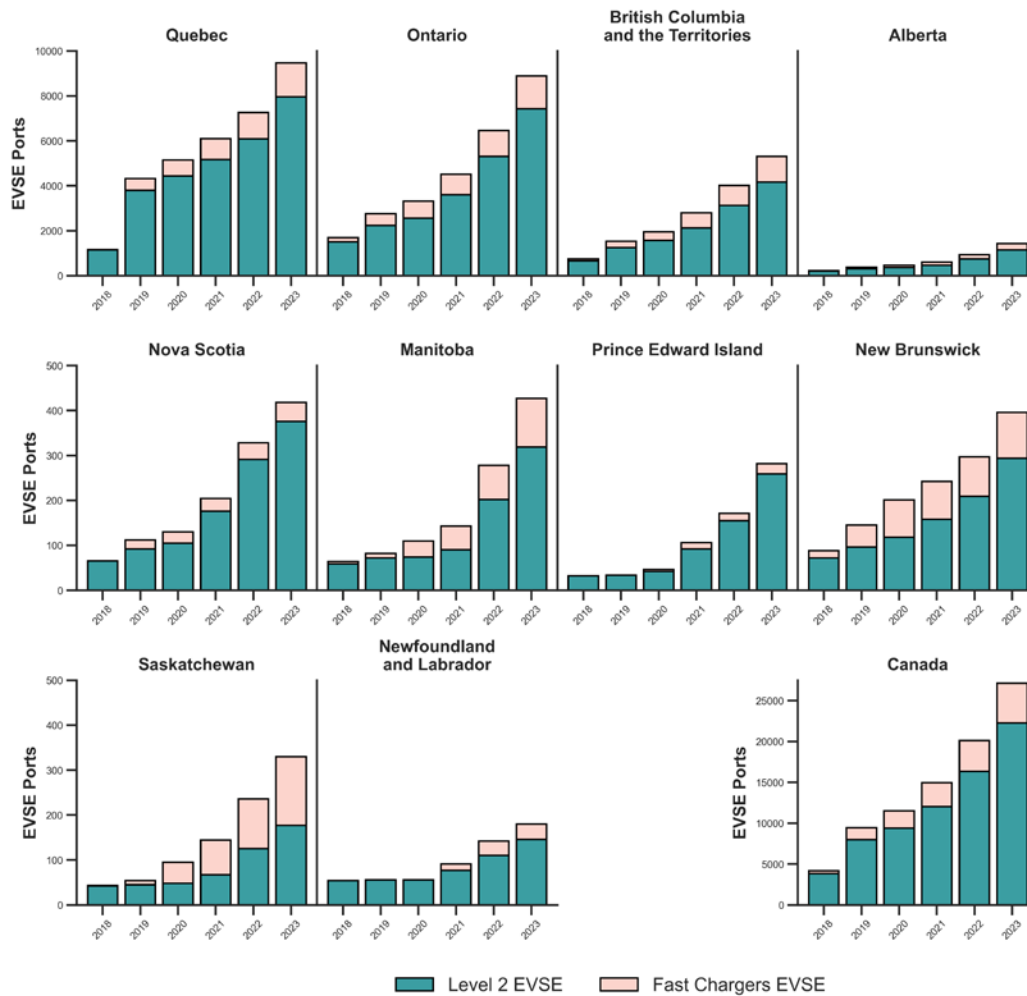
27 Pollution Probe and The Delphi Group. (2019). Framework for Municipal Zero Emission Vehicle Deployment. Retrieved from: <https://www.pollutionprobe.org/wp-content/uploads/Probe-Delphi-Municipal-ZEV-Framework-Report.pdf>

28 Transport Canada (2023). Zero-emission vehicle charging stations. Retrieved from: <https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/zero-emission-vehicle-charging-stations#/find/nearest?country=CA>.

Quebec, Ontario, and British Columbia account for a combined 88% and 85% of all level 2 and DCFC EVSE ports installed in 2023. However, when considering trends relative to 2022, Prince Edward Island, Manitoba and Alberta observed the largest increases in level 2 EVSE ports at 67%, 58% and 54%, respectively. Alberta and Manitoba also experienced the largest relative increase in DCFC EVSE ports at 55% and 42% respectively compared to 2022. Although the outlook for public EV charging stations in Canada appears

promising and trending in the right direction, the ratio of EVs on the road to EVSE ports is approximately 20, which is twice as high as the world average of 10.25. This ratio remained the same compared to 2022²⁹, indicating a consistent growth in the development of public charging infrastructure in proportion to EV sales.³⁰ While studies have found that high availability of charging stations does not necessarily lead to higher EV adoption, low availability was found to result in lower EV adoption rates.³¹

Figure 2. Total number of level 2 and DCFC EVSE ports in different provinces

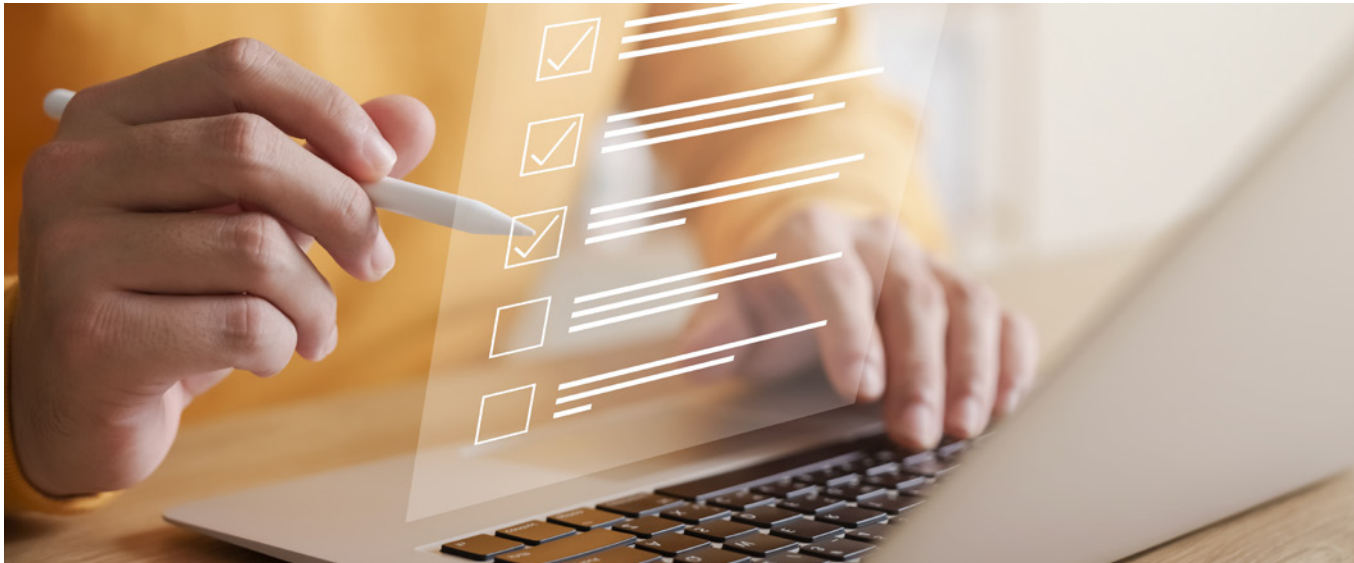


29 International Energy Agency (2023). Global EV Outlook 2023 - Catching up with climate ambitions. Retrieved from: <https://www.iea.org/reports/global-ev-outlook-2023>.

30 The project team acknowledges that this ratio will vary significantly from country to country based on urban planning policy and land-use, which dictates access to home charging. The importance of the metric in the Canadian context is still being evaluated.

31 Spöttle, M., Jörling, K., Schimmel, M. & Staats, M. (2018). Research for TRAN Committee - Charging infrastructure for electric road vehicles. Retrieved from: [https://www.europarl.europa.eu/RegData/etudes/STUD/2018/617470/IPOL_STU\(2018\)617470_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2018/617470/IPOL_STU(2018)617470_EN.pdf).

3 Survey Respondent Characteristics



3.1 Demographic Characteristics

The online survey was hosted on dedicated webpages in both English and French from April to August 2024. The survey received generous support from various stakeholders in the EV ecosystem, including vehicle manufacturer associations, non-profit and for-profit organizations, EV society groups and more. In particular, the efforts of Electric Mobility Canada are appreciated. A total of 2,024 responses were collected from across Canada, with the highest number of responses coming from Quebec, Ontario, and British Columbia, accounting for 44%, 25%, and 14% of the total responses, respectively (**Figure 3**). Compared to the 2023 charging experience survey, the 2024 charging experience survey received more responses from Quebec.

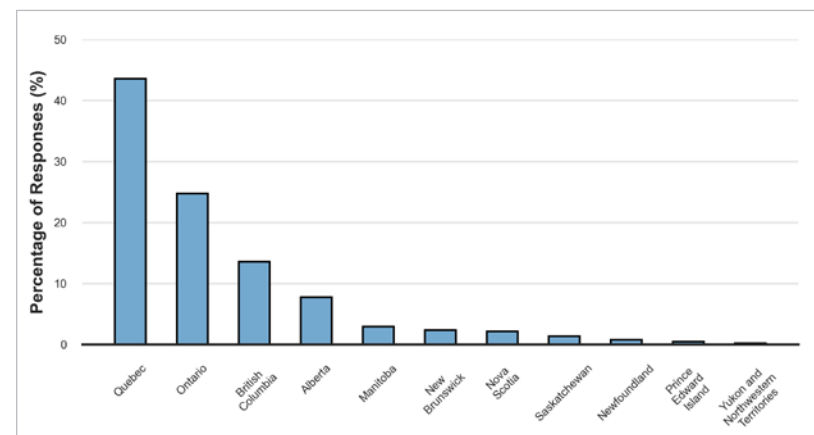


Figure 3. Responses per Province

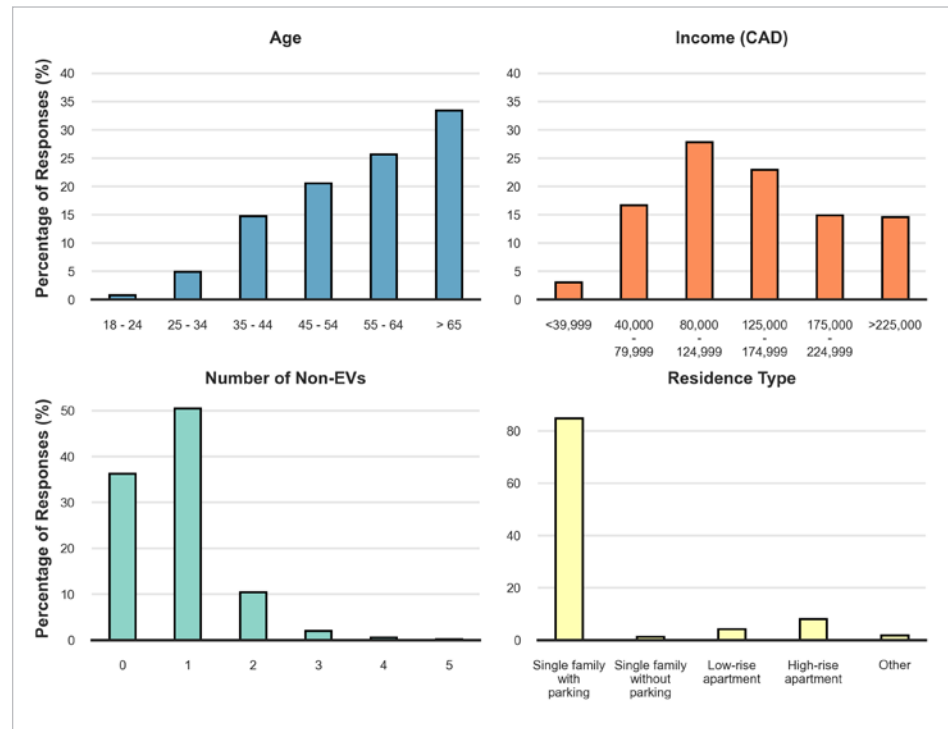
EV owners were asked about their age, income, number of non-EVs owned, and their residence type. These questions aimed to explore potential differences in charging experiences across different segments of the population.

About 79% of respondents were above the age of 45, and 52% had a household income of more than \$125,000 before tax (**Figure 4**). 29% of households in Canada have an income higher than \$125,000 based on the latest census data.³² These findings are consistent with earlier studies that demonstrate how individuals with higher incomes tend to be early adopters of EVs.³³ Furthermore, the initial higher cost of EVs can create obstacles for lower-income groups, despite the overall cost of ownership over the vehicle's lifetime being favorable for most EV models with access to home charging, particularly in provinces with the lowest electricity rates.³⁴

64% of respondents owned at least one internal combustion engine vehicle (ICEV) in addition to their EV. Owning a non-EV has previously been associated with reduced EV range anxiety, as the non-EVs are typically used for longer trips.³⁵ Additionally, 85% of EV owners were found to reside in single-family houses/townhouses with dedicated parking, while only 12% resided in multi-unit residential buildings (MURBs).³⁶ This is noteworthy considering that approximately 34% of all Canadians reside in MURBs.³⁷

These demographic results are similar to those found in other studies and show similar trends to those observed in the 2023 charging experience survey. They emphasize the need to consider different population groups when assessing experiences and concerns about public charging infrastructure.

Figure 4. Demographic characteristics of survey respondents



32 Statistics Canada (2023). Table 98-10-0055-01 Household total income group by household characteristics: Canada, provinces and territories, census metropolitan areas and census agglomerations with parts. Retrieved from: <https://doi.org/10.25318/9810005501-eng>.

32 Plug'N Drive (2017). Driving EV Uptake in the Greater Toronto and Hamilton Area. Retrieved from: <https://www.plugndrive.ca/wp-content/uploads/2017/07/EV-Survey-Report.pdf>.

34 Clean Energy Canada (2022). The true cost. Retrieved from: https://cleanenergycanada.org/wp-content/uploads/2022/03/Report_TheTrueCost.pdf.

35 Liao, F., Molin, E. & van Wee, B. (2017). Consumer preferences for electric vehicles: a literature review. *Transp Rev* 37, 252-275.

36 MURBs are defined in the survey as residents of condominiums/strata, and rental apartments in low-rise and high-rise buildings.

37 Statistics Canada (2021). Table 98-10-0040-01 Structural type of dwelling and household size: Canada, provinces and territories, census metropolitan areas and census agglomerations with parts. Retrieved from: <https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=9810004001>

3.2 EV Characteristics and Driving Behaviour

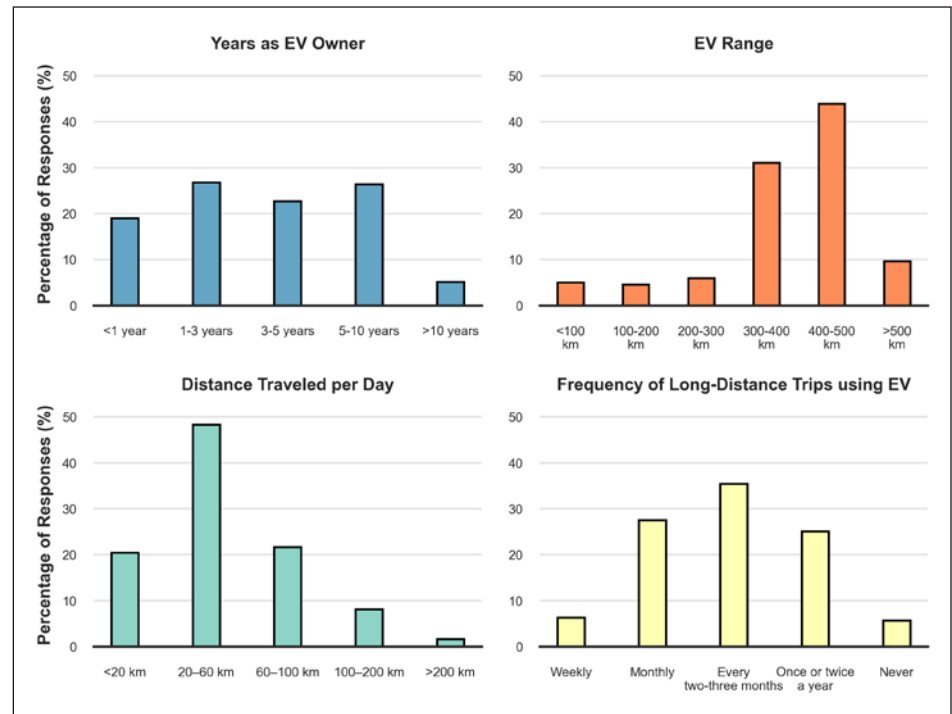
The satisfaction of EV owners with their charging experience depends on the characteristics of their EVs and their driving patterns. For instance, owners of EVs with shorter ranges who have long daily commutes might rely heavily on public charging stations, while those with longer EV ranges and shorter daily commutes may have less interaction with public charging infrastructure relying instead on home charging. In this context, survey respondents were asked about their EV type, EV range, length of daily commutes, and frequency of long trips (over 200 km one way) using their EVs.

Among the survey respondents, 95% identified as BEV users, while the remaining 5% owned PHEVs.³⁸ **Figure 5** presents information on the length of time survey respondents have owned their EVs, the range of their EVs, the average daily distance traveled using EVs, and the frequency of long-distance trips with their EVs. The results provide insights into the evolving landscape of EV adoption and usage patterns within the Canadian market.

31% of respondents have been EV owners for more than 5 years, classifying them as early adopters. Conversely, 46% of respondents have owned an EV for less than 3 years, representing the recent growth of the Canadian EV sector.

Vehicle range plays a significant role in shaping charging behaviour and consumer perceptions regarding public charging infrastructure. The survey revealed that 84% of respondents owned an EV with a range of at least 300km. Additionally, 69% of respondents reported driving an average of less than 60km per day, while only 10% traveled more than 100km on average. These findings suggest that the vast majority of EV owners can comfortably complete their daily commutes with a single full charge.

Figure 5. EV characteristics and driving behaviour



In addition, 34% of respondents reported undertaking long-distance trips of over 200km one way at least once per month using their EVs. Such journeys typically necessitate the use of public charging infrastructure. In contrast, only 6% of respondents stated that they never use their EVs for long-distance trips.

These findings underscore the diverse driving patterns among EV owners in Canada. The high percentage of EVs with ample range indicates that most owners can confidently rely on a single full charge for their daily travel needs. However, even though long-distance trips represent a smaller portion of total travel, the availability of charging for these occasional trips has been previously found to play a substantial role in driving EV adoption rates.³⁹

³⁸ BEVs are powered by a battery pack and rely entirely on access to a charging station or an electricity outlet to be recharged. PHEVs have smaller battery packs that are coupled with an internal combustion engine (ICE) that is activated whenever the battery is depleted.

³⁹ Hausteijn, S., Jensen, A. F. & Cherchi, E. (2021). Battery electric vehicle adoption in Denmark and Sweden: Recent changes, related factors and policy implications. Energy Policy 149, 112096.

3.3 EV Charging Behaviour

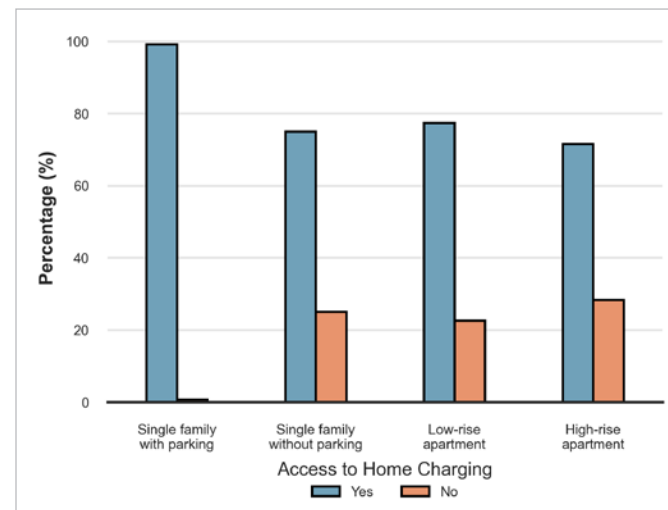
Charging of EVs typically takes place at four main locations: (1) at-home (typically overnight), (2) at the workplace, (3) at other publicly available locations and (4) on travel corridors for long-distance trips.⁴⁰ The charging locations and patterns of EV owners were explored by asking them about their access to home charging, the type of available home charger, their access to workplace charging, their frequency of use of public charging and public fast charging, the charging compatibility of their EVs and whether they had to complete any home upgrades to install a home charger.

3.3.1 HOME CHARGING

While charging at home is the most common and convenient charging location, this option is not available at all residences, especially in MURBs where parking spaces may be more limited and installing charging infrastructure can involve a lengthier process. This pushes these portions of the population to rely on other locations to charge.

Figure 6 shows the access to home charging for different residence types. Almost all EV owners residing in single family homes with dedicated parking had access to home charging (99%). On the other hand, 75%, 78% and 72% of respondents residing in single family homes without dedicated parking, low-rise apartments and high-rise apartments have access to charging at home, which makes them more reliant on public charging infrastructure. The percentages of residents that have access to home charging in MURBs is significantly higher than in the previous 2023 survey (58% vs 78% in low-rise apartments and 65% vs 72% in high-rise apartments).

Figure 6. Access to home charging per residence type



Out of all the EV owners that have access to home charging, 84% had a level 2 charger, whereas 15% relied on level 1 charging. 39% of EV owners that use a level 2 home charger had to complete retrofits and upgrades to their home in order to install their charger, whereas 59% did not have to complete any upgrades and the remaining 2% already had a level 2 charger installed when they moved into their residence. These findings highlight that a significant portion of EV owners have to incur home upgrade costs to install a home charger, adding an additional barrier to the already high upfront costs of purchasing an EV and installing a home charger.

40 Hardman, S. et al. (2018). A review of consumer preferences of and interactions with electric vehicle charging infrastructure. *Transp Res D Transp Environ* 62, 508–523.

3.3.2 PUBLIC CHARGING

57% of respondents rarely use public charging stations or do not use them at all, with only 13% using them regularly (i.e., daily or weekly). The remaining 30% use public chargers around once per month. These responses can be broken down by access to home charging (**Figure 7**). Only 10% of EV owners with access to home charging use public charging on a regular basis (i.e., daily or weekly) compared to 88% of EV owners without access to home charging. 59% of EV owners with access to home charging rarely or never use public charging, compared to only 5% for EV owners without access to home charging.

Similarly, the majority of EV owners with access to home charging (67%) relied on public charging for a small portion of their charging needs (<10% of total charging needs), with only 10% relying on public charging for more than 50% of their charging needs (**Figure 8**). This pattern was the same when asking respondents about their proportion of charging using fast charging. This indicates that the interaction of EV owners who have access to home charging with public charging stations is predominantly with fast charging stations.

This trend was different for EV owners who do not have access to home charging. The majority of these EV owners (89%) mentioned that public charging accounted for more than 75% of their charging needs. On the other hand, fast charging stations were used to a lesser extent, with only 20% of EV owners without access to home charging mentioning that fast charging accounts for more than 75% of their charging needs.

These findings indicate that the interaction with public charging is very different between EV owners with and without access to home charging. EV owners with access to home charging mostly use fast chargers when charging at a public station, whereas EV owners without access to home charging predominantly rely on level 2 public chargers.

These patterns can be explained by the reason for why EV owners use public charging (**Figure 9**). EV owners with access to home charging mostly use public charging stations for long trips (84% of

Figure 7. Frequency of public charging for EV owners with access to home charging (figure on the left) and without access to home charging (figure on the right)

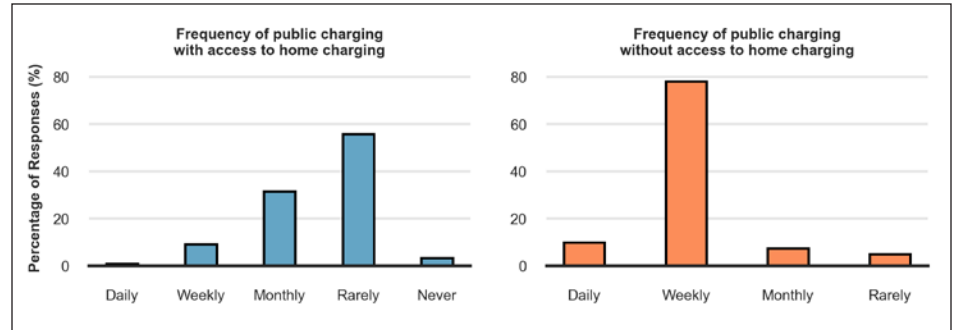
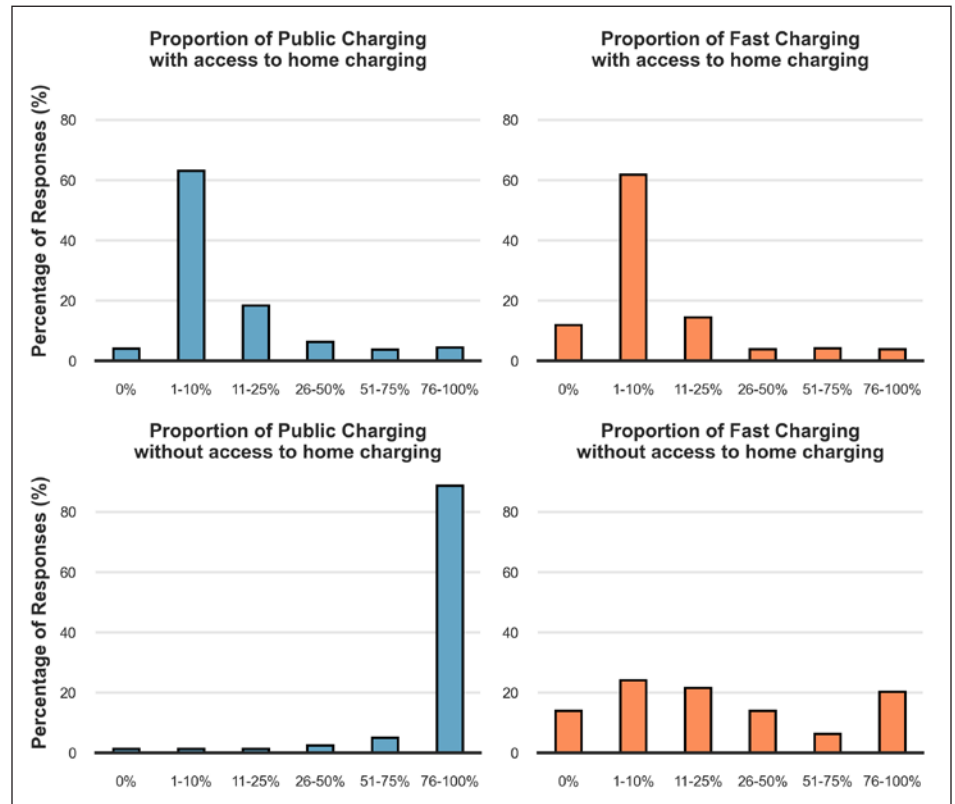


Figure 8. Proportion of public charging and public fast charging



responses), thus relying on fast charging stations commonly found along highways. On the other hand, only 38% of EV owners without access to home charging used public charging stations for long distance trips, with other important reasons being lack of access to home charging (85% of respondents), faster charging speeds (21%) and convenience (15%).

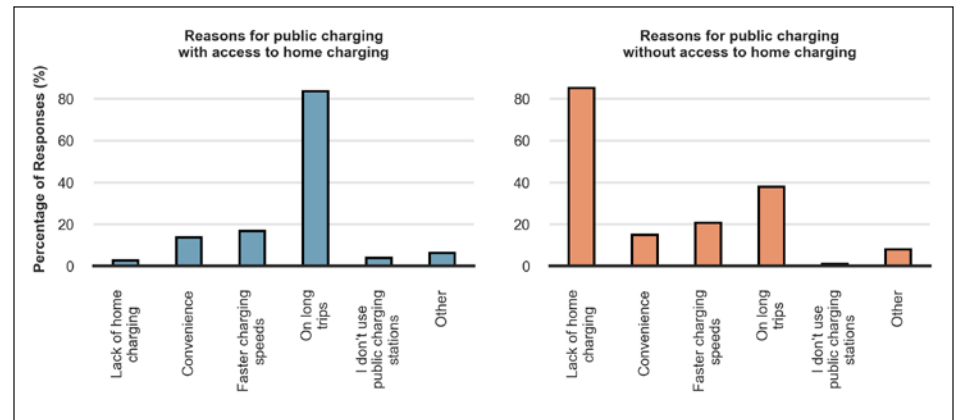
In addition to home and public charging, we asked EV owners whether they had access to an EV charger at their workplace. The results show that out of the EV owners that commuted to work, 44% had access to a workplace charger. Additionally, around 51% of EV owners who do not have access to home charging and that commute to work, also do not have access to a workplace charger. This portion of the population would mostly have to rely on public charging stations excluding workplace charging stations to charge their EVs.

PUBLIC DC FAST CHARGING CONNECTORS

EVs use different types of connectors/plugs for DC fast charging—Combo Charging System (CCS), CHAdeMO, and the North American Charging Standard (NACS, formerly Tesla’s Supercharger). Compatibility with fast charging stations depends on the vehicle’s plug type. Up until early 2023, the CCS connector was the most popular plug equipped on vehicles by European and North American vehicle manufacturers, while the CHAdeMO was the favoured option for Japanese and Korean manufacturers. However, in 2023, the NACS connector, previously exclusive to Tesla vehicles, has been adopted by other manufacturers and is now gaining significant support in North America. Vehicles equipped with NACS will still be able to use the existing predominant public CCS charging infrastructure that has not been retrofitted with an adapter.⁴¹

Major automotive manufacturers including Ford, General Motors, Mercedes-Benz, Volvo, and others, have committed to adopting the Tesla NACS plug in future EV models and will gain access to Tesla’s existing NACS public charging network. Existing CCS vehicles will also be able to access the Tesla NACS public charging network with an adapter. For example, GM has launched pre-orders for adapters that allow vehicles with a CCS plug to use the Tesla NACS network by the end of 2024.⁴² As of the time of this survey, the only vehicles built with a NACS plug are Tesla

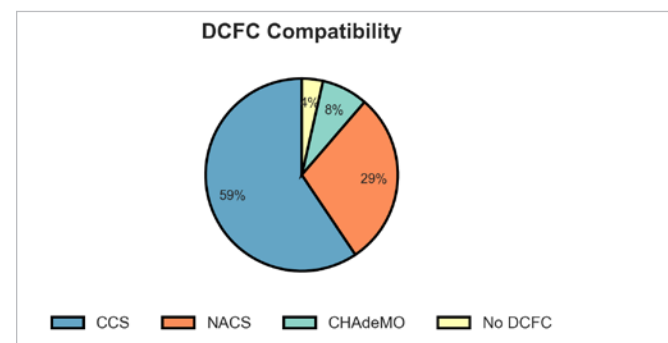
Figure 9. Reasons for public charging



vehicles, as new models from other manufacturers have yet to be launched with NACS.

The availability of different connector types adds complexity to the EV charging experience and can make charging stations less accessible. However, the recent convergence of multiple EV manufacturers towards the NACS may help alleviate this issue. The survey results indicated that 29% of respondents had EVs that were compatible with NACS (all consisting of Tesla vehicles when the 2024 survey was conducted), while 59% and 8% had EVs that were compatible with CCS and CHAdeMO respectively (Figure 10).

Figure 10. DCFC Compatibility



41 Yakub, M. (2023). Seven major automakers in joint venture to launch 30,000-charger network across North America. Retrieved from: <https://electricautonomy.ca/2023/07/28/seven-automakers-30000-chargers-north-america/>.

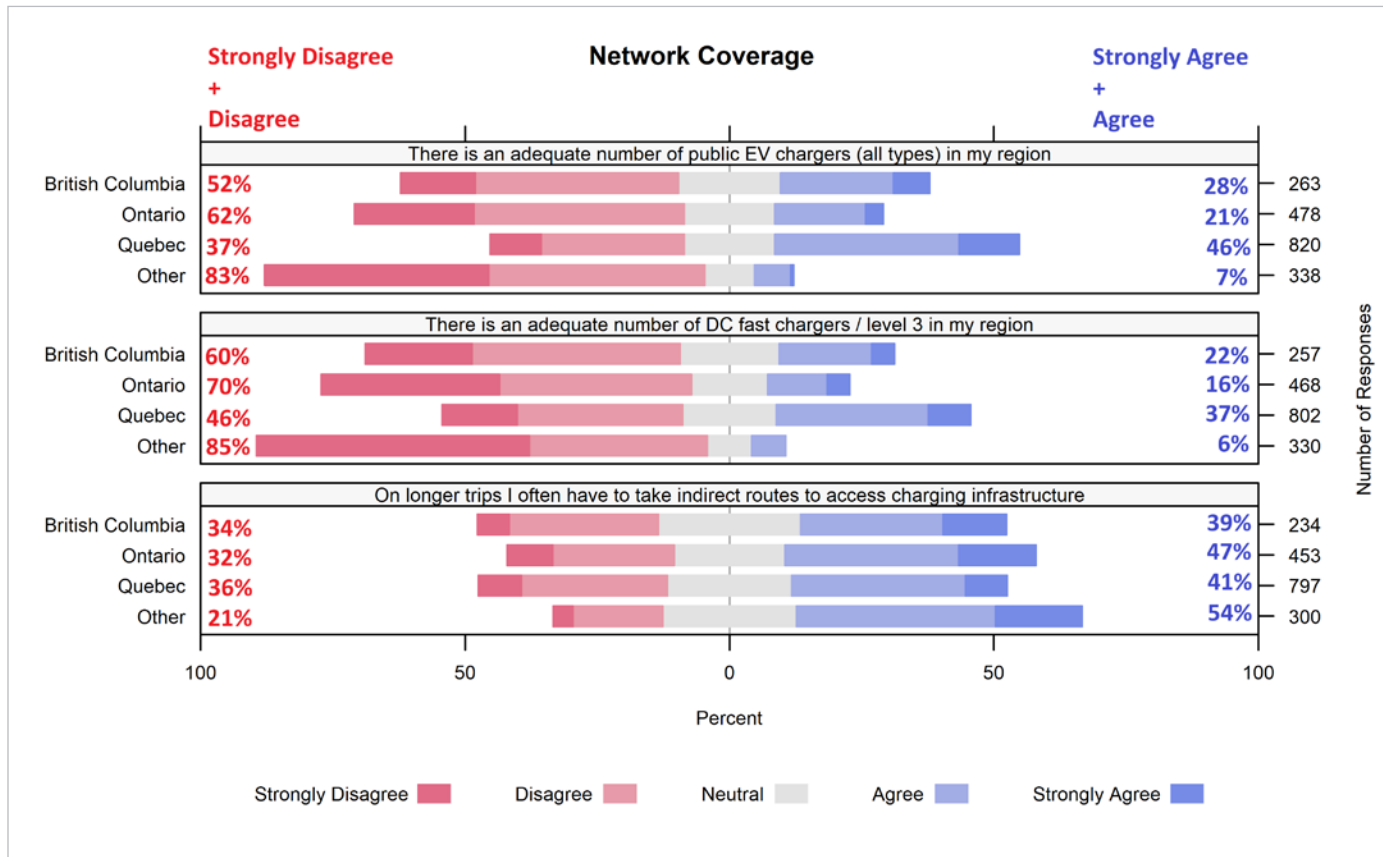
42 Electric Autonomy Canada (2024). Tesla charging stations now open to GM EVs, though NACS adapters not available until later this year. Retrieved from: <https://electricautonomy.ca/charging/public-charging/2024-09-18/tesla-gm-supercharger-canada-nacs/>

4 Network Coverage Satisfaction

Figure 11 presents the Likert scale responses to statements related to charging infrastructure coverage broken down by province. British Columbia, Quebec and Ontario were considered separately, whereas the remaining provinces were clustered together due to their lower EV uptake, less mature public charging infrastructure network and smaller number of survey responses.

EV owners across all provinces were generally dissatisfied with the number of public charging stations and fast charging stations. EV owners in Quebec reported slightly higher satisfaction with the coverage of public charging stations compared to those in other provinces. Specifically, 46% of Quebec residents felt that the number of public charging stations was adequate, while 37% felt the same about

Figure 11. Network coverage satisfaction Likert plot. Percentages on the left refer to the proportion of disagree and strongly disagree responses whereas percentages on the right refer to the proportions of agree and strongly agree responses.



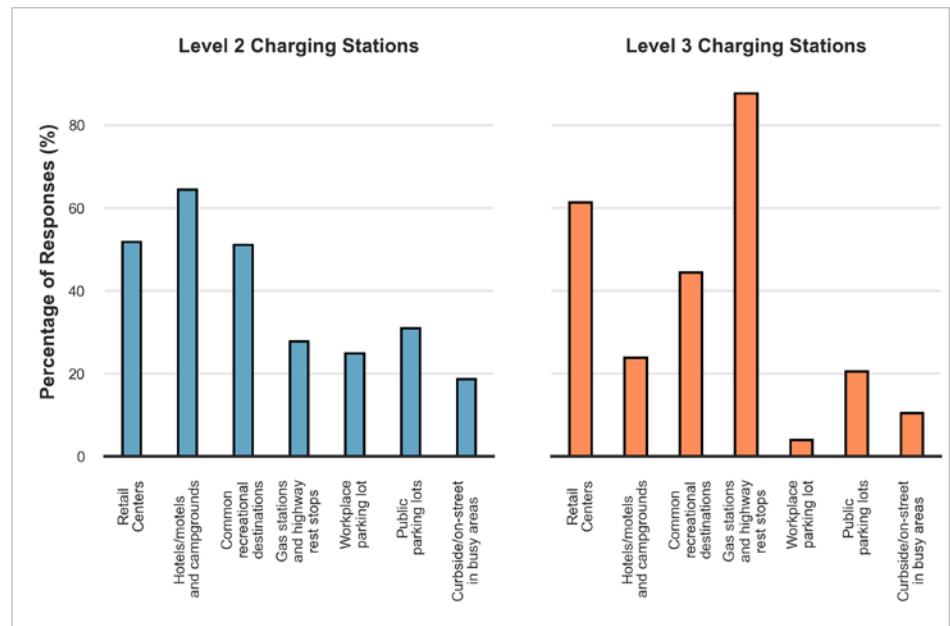
fast charging stations. In contrast, only 21% of EV owners in Ontario and 28% in British Columbia felt that the number of public charging stations was adequate, and only 16% in Ontario and 22% in British Columbia felt the same about fast charging stations. EV owner satisfaction in the remaining provinces was worse as only around 7% felt that there was an adequate number of public charging stations and fast charging stations.

Regarding coverage on long distance trips, 44% of EV owners across Canada indicated the need to often take indirect routes to access charging infrastructure, while 32% indicated the opposite. The “other provinces” had the lowest level of satisfaction compared to Quebec, British Columbia and Ontario, with 54% of respondents expressing dissatisfaction with coverage on long distance trips. Overall, our results show that EV owners generally express dissatisfaction with the number of public charging stations in their respective regions. However, they demonstrate slightly higher satisfaction with the availability of charging infrastructure along longer routes, suggesting superior distribution of charging stations along highway corridors compared to population clusters. Overall, public charging infrastructure coverage will benefit from recent significant investment commitments from automakers to expand the North American charging network.⁴³

A recent study estimated that by 2040, Canada will require around 679,000 level 2 and DCFC public chargers, with 9 in 10 expected to be level 2 chargers and the remainder being fast chargers.⁴⁴ While the number of public charging stations has significantly increased in recent years with the support of federal government funding,⁴⁵ strategic placement of these charging stations is crucial to maximize their utility and improve satisfaction among EV owners.

The majority of survey respondents identified hotels/motels and campgrounds (64%), retail centers (52%), and common recreational destinations (51%) as their preferred locations for level 2 chargers. These are locations where EV owners typically park for extended periods. On the other hand, gas stations and highway rest stops (88%) were identified as preferred locations for level 3 DC fast charging, in addition to retail centers (61%) and common recreational destinations (44%) (Figure 12).

Figure 12. Preferred locations of level 2 and level 3 charging stations



43 Yakub, M. (2023). Seven major automakers in joint venture to launch 30,000-charger network across North America. Retrieved from: <https://electricautonomy.ca/2023/07/28/seven-automakers-30000-chargers-north-america/>.

44 Electric Mobility Canada (2024). Canada needs 679,000 public charging ports by 2040 to support Canadian EVs: report. Retrieved from: <https://electricautonomy.ca/charging/2024-08-28/dunsky-icct-report-ev-charging-canada/>

45 Natural Resources Canada (2023). Zero Emission Vehicle Infrastructure Program. Retrieved from: <https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/zero-emission-vehicle-infrastructure-program/21876>.

5 Network Service Satisfaction

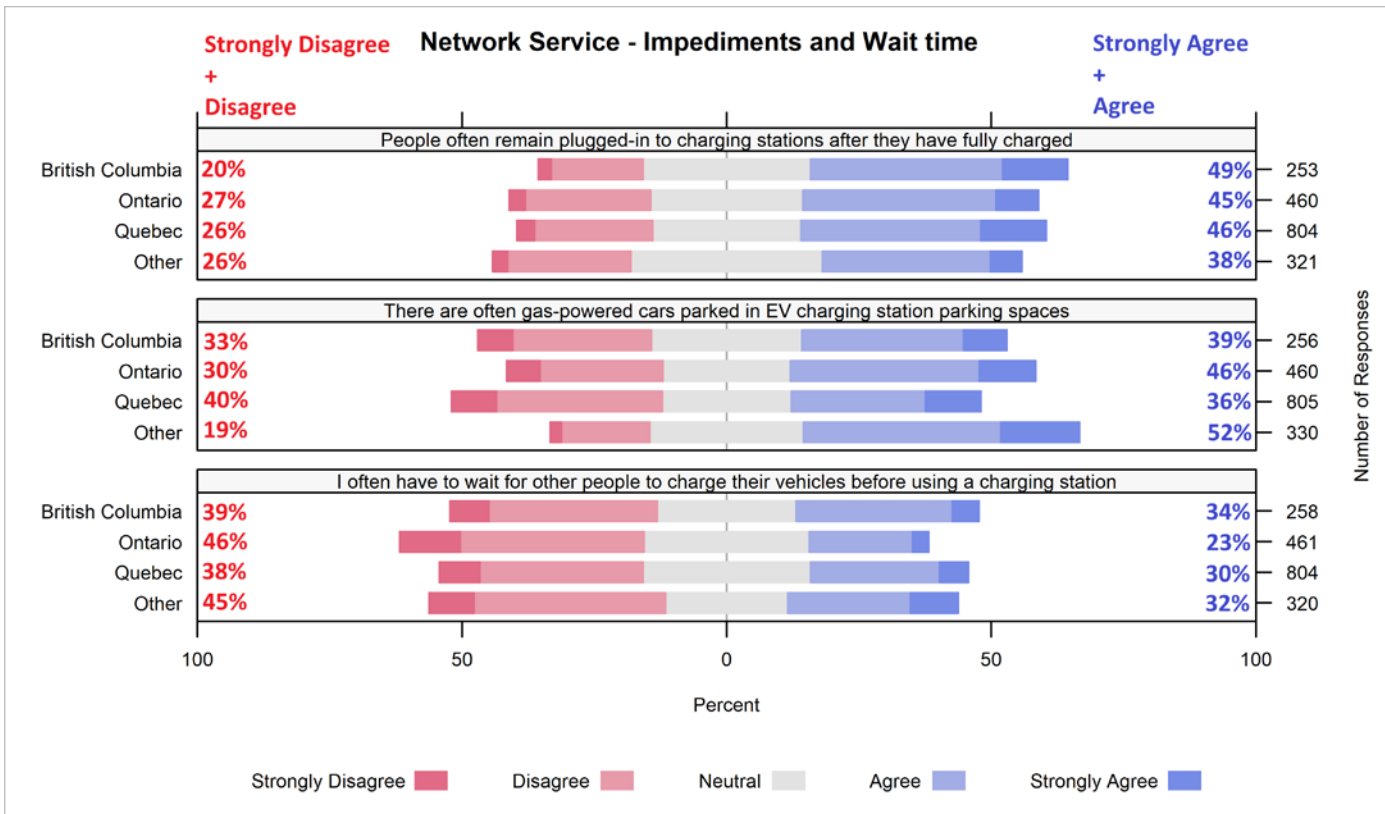
Network service satisfaction refers to the level of approval experienced by users of public charging stations with the services provided. It was broken down into three categories, namely (1) impediments, (2) reliability and (3) accessibility.

5.1 Impediments

Figure 13 illustrates the Likert scale responses to statements related to impediments at public charging stations broken down by province. Overall, 45% of EV owners across all provinces reported instances of people remaining plugged in

to charging stations after they have fully charged. Additionally, 42% of EV owners felt that gas-powered cars often occupy parking spaces designated for EV charging stations. This issue was more pronounced in the remaining provinces, with 52% of respondents agreeing with the statement. EV owners across Canada were mostly satisfied with the wait times at charging stations (29% dissatisfied). However, wait time satisfaction varied significantly between Tesla owners and non-Tesla owners as only 12% of Tesla owners were dissatisfied with the wait times to access a station compared to 35% for non-Tesla owners.

Figure 13. Network service – Impediments Likert chart. Percentages on the left refer to the proportion of disagree and strongly disagree responses whereas percentages on the right refer to the proportions of agree and strongly agree responses.



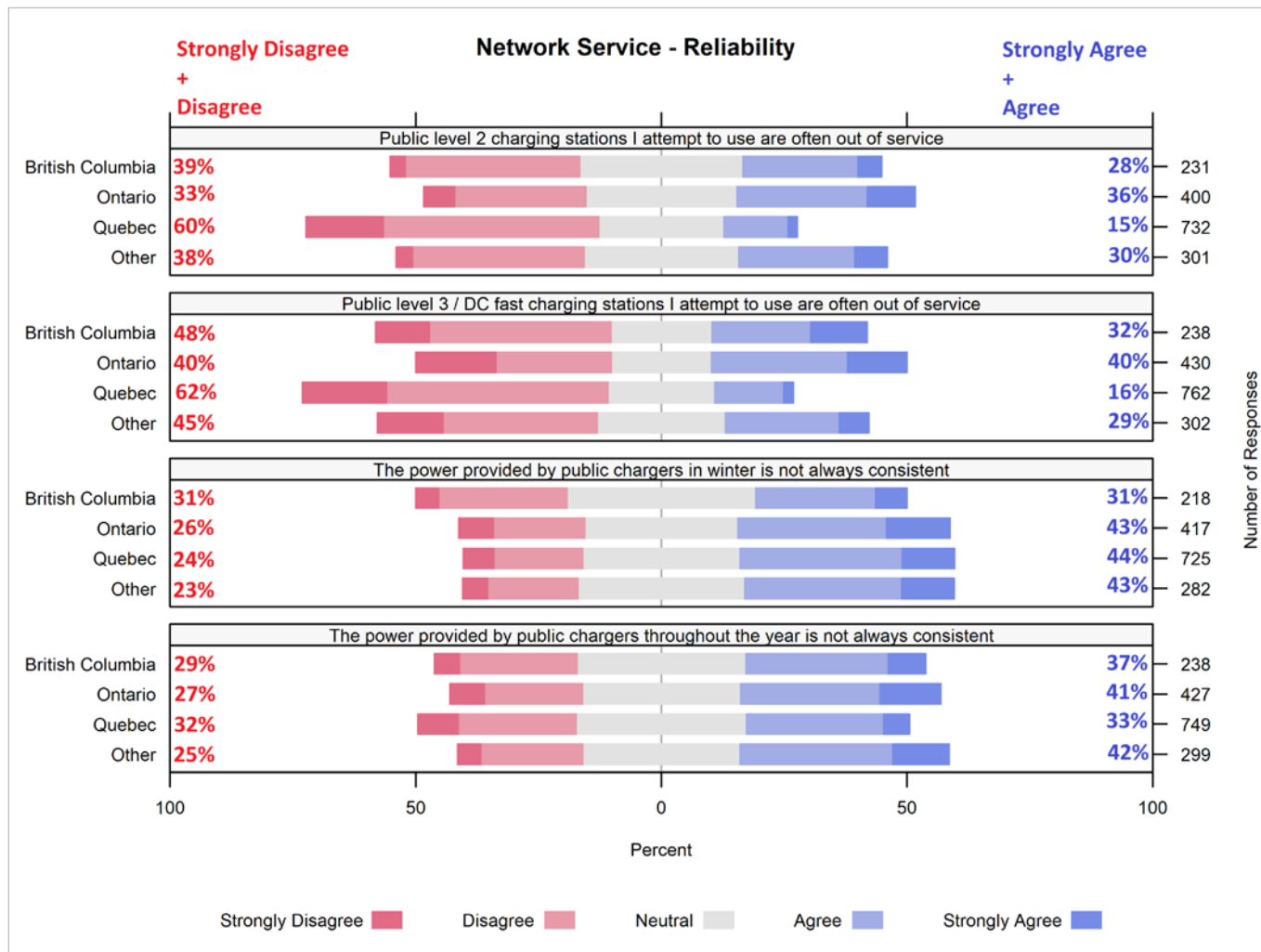
5.2 Reliability

Figure 14 presents the Likert scale responses to statements related to charging infrastructure reliability broken down by province. EV owners in Quebec were generally more satisfied with the reliability of level 2 public charging infrastructure, as only 15% complained about stations being out of service compared to around 30% in the remaining provinces. These results were similar for level 3 public charging stations. In other words, public charging stations in Quebec are perceived to be more reliable than in other provinces regardless of the type of charging station (level 2 or level 3). However, a large difference was observed

between Tesla owners and non-Tesla owners regarding the reliability of level 3 charging stations, as only 12% of Tesla owners were concerned about level 3 charging stations being out of service compared to 33% for owners of other EVs. No difference was observed for level 2 public charging stations between Tesla and non-Tesla owners.

Additionally, around 42% of EV owners felt that the power provided at public charging stations was inconsistent during the winter season, and 37% felt it was inconsistent throughout the year. These findings were generally consistent across provinces, with the exception of British Columbia, where fewer EV owners reported inconsistent

Figure 14. Network service – Reliability Likert chart. Percentages on the left refer to the proportion of disagree and strongly disagree responses whereas percentages on the right refer to the proportions of agree and strongly agree responses.



power at public charging stations in winter. This difference is likely due to the region's less extreme seasonal temperature changes. Overall, our results suggest that while EV owners feel that the power provided at charging stations is sometimes inconsistent, they do not view lower winter temperatures as a major factor affecting the power output of public charging stations, compared to other factors that may influence the power their vehicles receive throughout the year.

The power output received by a vehicle at a charging station depends on several factors, including the maximum power capacity the vehicle can accept (which varies by model), and any power curtailment imposed by the site host, which may depend on their business model and the number of vehicles charging simultaneously. Notably, we observed significant differences between Tesla and non-Tesla owners: approximately 42% of Tesla owners felt that power output was consistent both in winter and year-round, compared to only 22% of non-Tesla owners. This discrepancy can be attributed to Tesla vehicles' use of the NACS Tesla charging network, which ensures more uniform power delivery, as all Tesla vehicles are part of the same network and use consistent vehicle models.



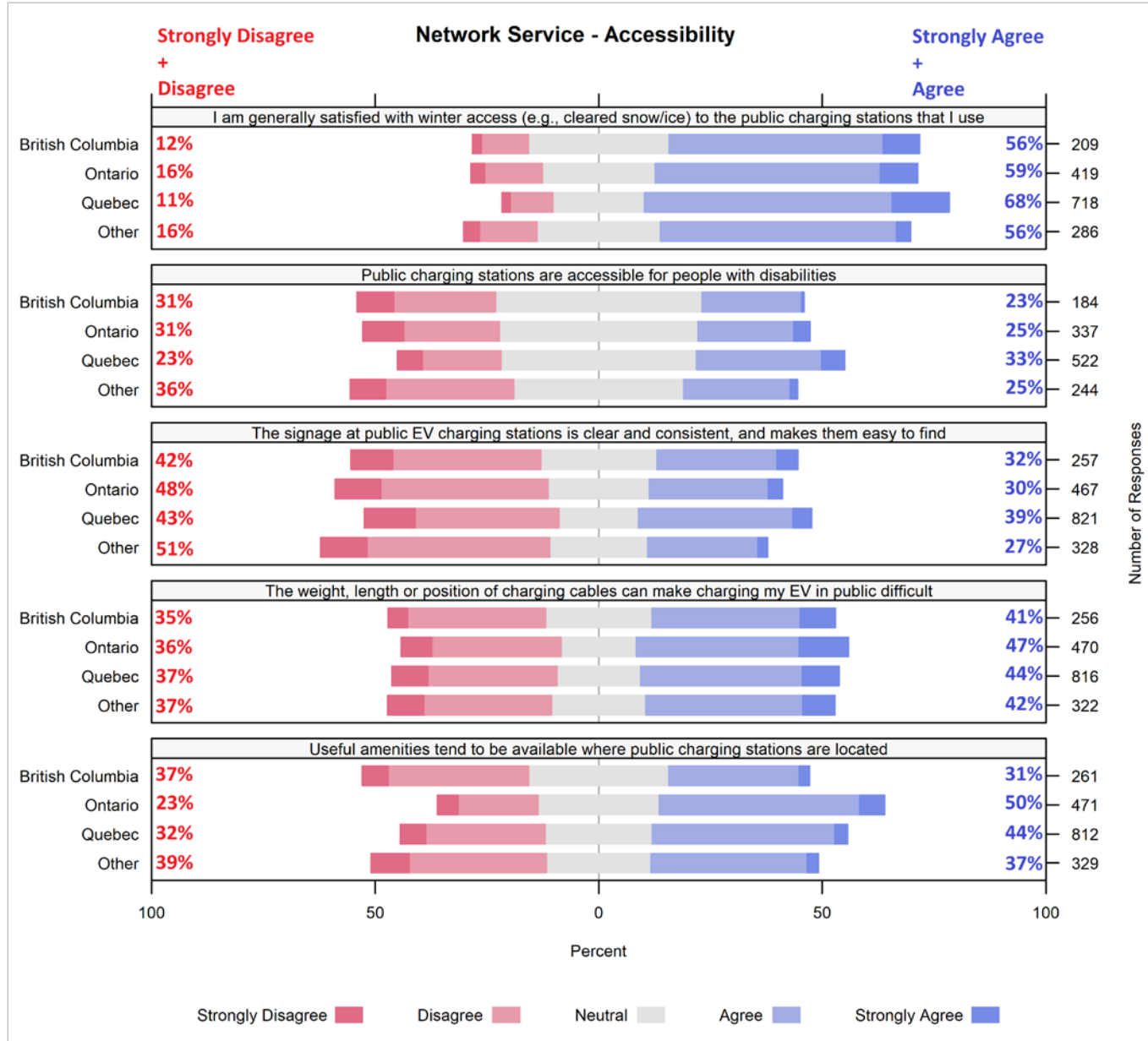
5.3 Accessibility

Figure 15 presents the Likert scale responses to statements related to charging infrastructure accessibility broken down by province. EV owners across Canada were mostly satisfied with winter access to public charging stations, with less than 16% being dissatisfied across all provinces. Additionally, around 28% of EV owners across Canada felt that public charging stations were accessible to people with disabilities compared to 29% disagreeing with the statement. Addressing the accessibility needs of individuals with disabilities at EV charging stations is of utmost importance, necessitating a design approach that takes their specific requirements into account. This issue has been studied in more detail in the previous 2023 charging experience report through in-depth interviews with survey respondents to highlight and identify challenges faced by people with disabilities while charging their EVs at public stations.

46% of respondents across Canada felt that the signage of public EV charging stations was not clear and 44% experienced difficulties charging due to the length, weight and position of charging cables. Around 50% of respondents in Ontario felt that public charging stations were located near useful amenities, compared to around 37% in other provinces. These trends were different for Tesla and non-Tesla owners. Tesla owners were more satisfied with the length, weight and position of charging cables (50% satisfied) compared to non-Tesla owners (30% satisfied). This is mainly due to Tesla NACS charging cables being significantly lighter than other charging cables. Additionally, 54% of Tesla owners felt that useful amenities are available next to public charging stations compared to 38% for non-Tesla owners.

Around 62% of respondents never felt unsafe while charging in public. This was a significant decrease compared to responses from the 2023 survey (73%). Respondents that did express safety concerns indicate remote isolated locations (20%) and poor lighting at night (16%) as main reasons for feeling unsafe.

Figure 15. Network service - Accessibility Likert chart. Percentages on the left refer to the proportion of disagree and strongly disagree responses whereas percentages on the right refer to the proportions of agree and strongly agree responses.



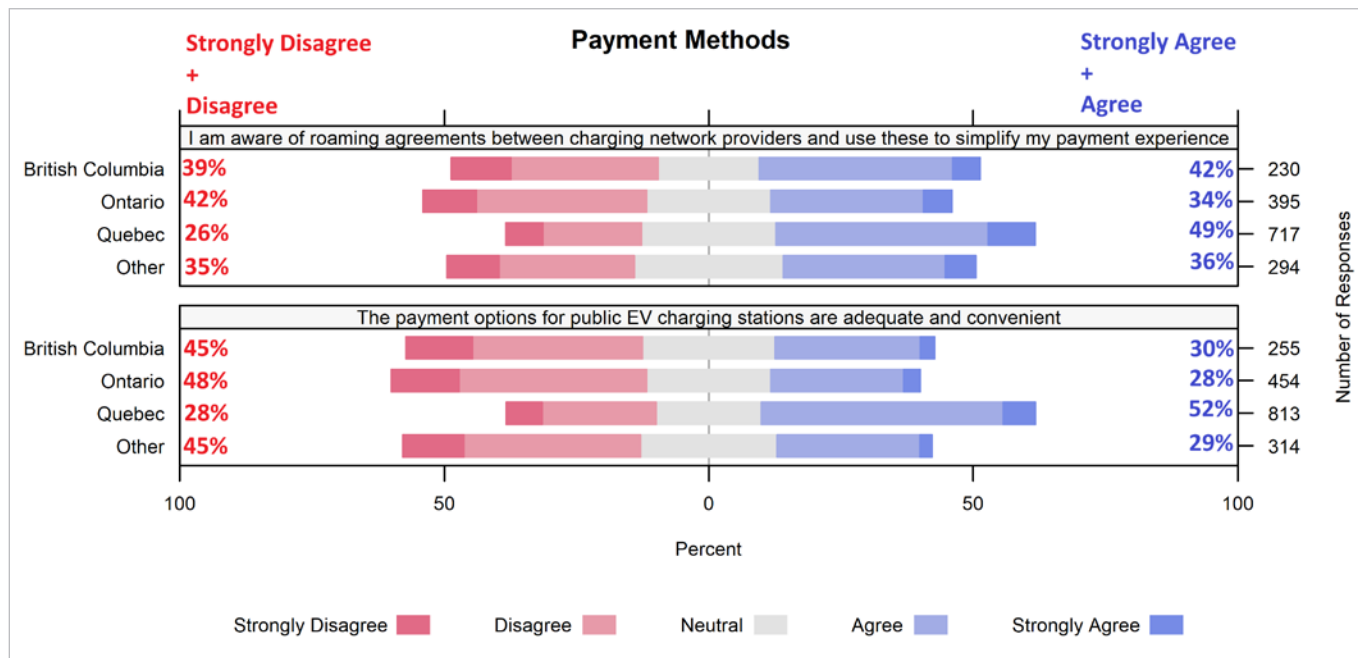
6 Costs and Payment Methods

6.1 Payment Methods

EV owners typically need to be a member of a charging network (or a partner network in the case of roaming agreements) to be able to access and pay for its charging stations. The decentralized state of the Canadian charging ecosystem often requires consumers to register with multiple networks to gain access to adequate public charging infrastructure. In fact, 71% of survey respondents indicate being a member of at least two networks. Furthermore, 33% of survey respondents are not aware of any roaming agreements between network operators, with EV owners in Quebec being more informed about agreements (49%) than other provinces (37%) (Figure 16).

Multiple European countries have passed legislation to guarantee payment interoperability for EV consumers. In Norway, the Norwegian EV Association introduced RFID cards that allow members to simultaneously register with all of the major charging providers and use their networks. Similar initiatives are being gradually implemented through agreements between major charging infrastructure providers and automakers (NACS adoption) in the Canadian context, and at the provincial level in British Columbia⁴⁶ and Quebec⁴⁷. 39% of respondents indicate that they agree or strongly agree that the payment options for EV charging stations are adequate and convenient while 38% indicate the opposite. EV owners in Quebec

Figure 16. Payment Methods Likert Chart. Percentages on the left refer to the proportion of disagree and strongly disagree responses whereas percentages on the right refer to the proportions of agree and strongly agree responses.



46 PluginBC (2022). Charging Card and Apps. Retrieved from: <https://pluginbc.ca/charging/charging-cards-and-apps/>

47 CAA Quebec (2022). Public electric charging stations. Retrieved from: <https://www.caaquebec.com/en/on-the-road/public-interest/sustainable-mobility/public-electric-vehicle-charging-stations/>

were found to be more satisfied with the payment options (52%) than in other provinces (29%).

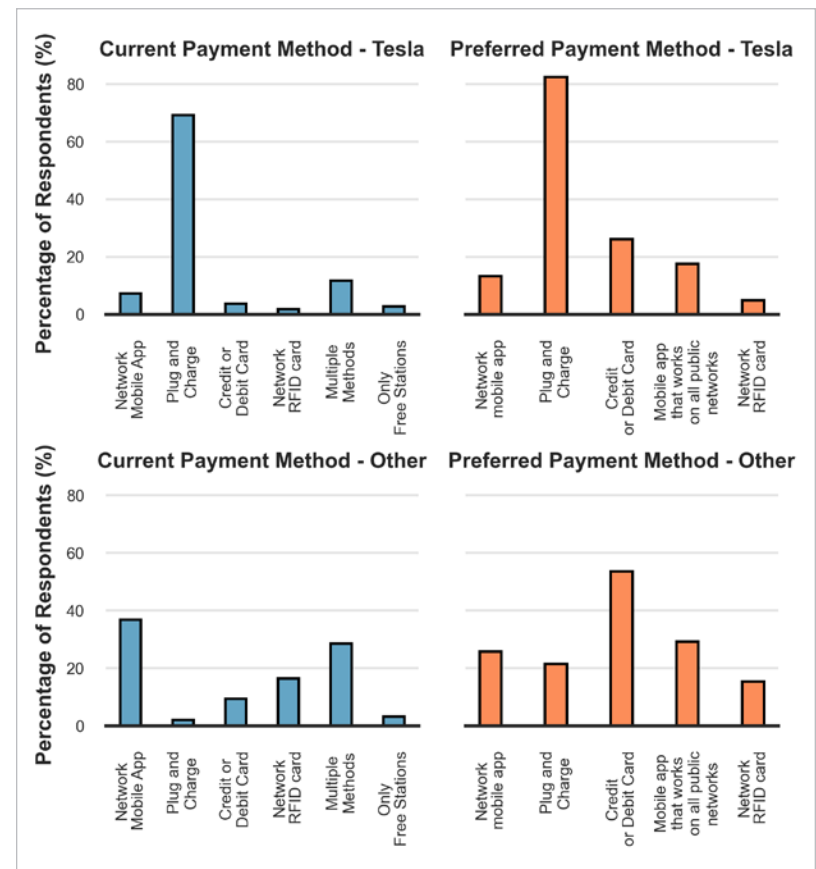
Figure 17 presents the current payment method of survey respondents and their preferred payment method. Respondents were allowed to select multiple options for their preferred payment option. Large differences were observed between Tesla and non-Tesla owners.

69% of Tesla owners currently pay through the ‘plug and charge’ payment method that is specific to the Tesla public charging network. The Tesla ‘plug and charge’ payment method allows users to have a seamless charging experience without needing to use an app on their smartphone or any physical card. The charging station automatically identifies the vehicle and bills the EV owner on their credit card through their Tesla profile. The Tesla owner has the option of verifying the charging session on their smartphone app. On the other hand, current payment methods were more distributed for non-Tesla owners, with 37% paying through network mobile apps (i.e using their smartphone), 29% through multiple methods, 16% using network RFID cards and 9% using physical credit/debit cards.

When given the option to select their preferred method of payment, 82% of Tesla owners indicate preferring to pay for charging through plug and charge, with credit or debit card being the second most preferred method of payment (26%). These findings indicate that Tesla owners are very satisfied with the ‘plug and charge’ model offered to them, and the switch of most automakers to the NACS plug, which will allow other automakers to access ‘plug and charge’ billing, should be a positive to the charging payment experience in the industry.⁴⁸

The preferred method of payment for non-Tesla owners were more spread out than for Tesla owners, with 54% preferring to pay using credit or debit cards, 26% using a mobile app that

Figure 17. Current and Preferred Payment Methods for Tesla and non-Tesla owners



works on all networks, 21% using plug and charge and 15% using network RFID cards. These findings suggest that non-Tesla owners, who currently rely on smartphones or RFID cards for charging, are interested in having physical debit/credit card payment options similar to those available for gas refueling. To assess the persistence of these preferences, future surveys should investigate the payment charging experience once other automakers adopt the NACS plug and implement the ‘plug and charge’ payment system.

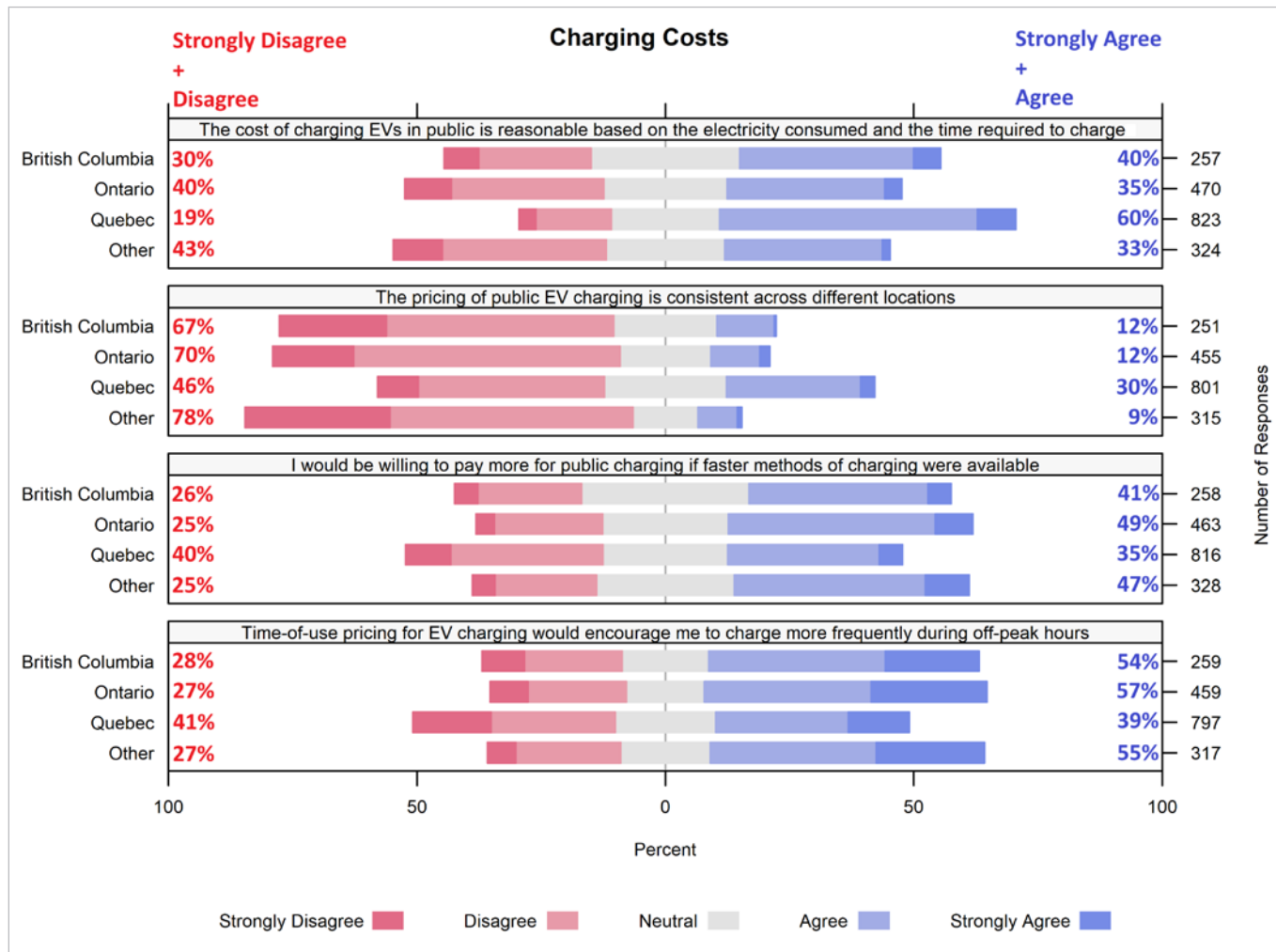
48 Yakub, M. (2023). Seven major automakers in joint venture to launch 30,000-charger network across North America. Retrieved from: <https://electricautonomy.ca/2023/07/28/seven-automakers-30000-chargers-north-america/>.

6.2 Charging Costs

Another concern related to charging is cost. Lower operating and refueling costs are a major driver behind consumers' transition to EVs⁴⁹, particularly in provinces that have favorable electricity costs.⁵⁰ 47% of EV owners agreed that the cost of charging EVs at public charging stations is reasonable based on the electricity

consumed and the time required to charge, whereas 29% disagreed with the statement. Satisfaction with charging cost was also slightly more pronounced in Quebec (60%) and British Columbia (40%) compared to the other provinces (~34%) (Figure 18). This finding is expected given that Quebec and British Columbia have the 1st and 3rd lowest electricity rates in Canada, respectively.⁵¹

Figure 18. Charging Costs Likert chart. Percentages on the left refer to the proportion of disagree and strongly disagree responses whereas percentages on the right refer to the proportions of agree and strongly agree responses.



49 Geotab Energy. (2020). EV driver insights: Understanding the experiences powering electric vehicle driver behaviour. Retrieved from: <https://image.info.fleetcarma.com/lib/fe321171716404797c1674/m/1/14dc7fa3-567c-4b0b-85d9-a10e94a6b8fa.pdf>

50 CAA Quebec (2022). 5 frequently asked questions about electric cars. Retrieved from: <https://www.caaquebec.com/en/on-the-road/advice/tips-and-tricks/tip-and-trick/show/sujet/5-frequently-asked-questions-about-electric-cars/>

51 Energy Hub (2023). Electricity Prices in Canada 2023. Retrieved from: <https://www.energyhub.org/electricity-prices/>

Nevertheless, a considerable proportion (60%) of EV owners have voiced their concerns regarding the inconsistency in public EV charging pricing across different locations. In Quebec, the dissatisfaction with pricing consistency across locations was relatively lower, with 46% of EV owners expressing concerns, as opposed to other provinces where the figure stood at 72%. This inconsistency in pricing might be due to billing per unit of time, which is the prevailing practice in Canada, instead of per unit of energy in kilowatt-hours (kWh). Indeed, EV owners in Canada overwhelmingly prefer to be billed in kWh (70% of respondents) compared to per hour or per minute (11% of respondents) (Figure 19).

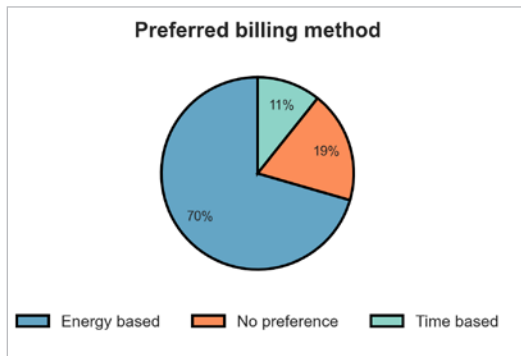


Figure 19. Preferred billing method

Billing per time unit might not be fair for owners of EVs that have slower charging times, as they would pay higher fees for the same amount of energy. Responding to these concerns, charging station providers nationwide are gradually obtaining licenses to implement a kWh energy-based billing system following the recent approval of this billing approach by Innovation, Science, and Economic Development Canada (ISED).⁵²

Lastly, 42% of respondents indicate they would be willing to pay more to charge if faster methods of charging were available. Provincial differences can be observed on willingness to pay for faster charging with EV owners in Quebec less willing to pay more for faster charging (35%) than in other provinces (46%). It is worth noting that this finding significantly differed by income level, as EV owners that have an income lower than \$80,000 were less willing to pay more for faster charging (29% willing to pay more) compared to EV owners that have an income higher than \$175,000 (49% willing to pay more). These results also differed by access to home charging. 42% of EV owners that have access to home charging are willing to pay more for faster charging compared to 31% for those who do not have access to home charging. This is mainly because this would highly impact the charging costs of EV owners that don't have access to home charging, since most of their charging needs are met at public charging stations.

Demand management approaches such as time-of-use pricing can play roles in further reducing charging costs for consumers. A large portion of respondents indicated a willingness to participate in time-of-use pricing with a favourable response rate of 49%. This trend was consistent across all provinces, except for Quebec, where EV owners were less interested in TOU pricing (39%) compared to the remaining provinces (56%). These results represent a significant decrease in the willingness of EV owners to participate in TOU pricing compared to the 2023 charging experience survey.

⁵² Innovation, Science, and Economic Development Canada (2022). Electric vehicle charging stations. Retrieved from: <https://ised-isde.canada.ca/site/measurement-canada/en/buying-and-selling-measured-goods/electric-vehicle-charging-stations>

7 Future EV Purchase Decision

The 2024 Canadian electric vehicle charging experience survey included a new section which examined future EV purchase decision intentions and factors affecting such intentions. EV owners in Canada overwhelmingly indicated that they would definitely purchase another EV in the future (86%), with less than 1% stating they would not consider buying another EV. The remaining respondents were uncertain about their decision (**Figure 20**). These findings were consistent across provinces, among EV owners with and without access to home charging, and for both Tesla and non-Tesla owners. This finding indicates widespread satisfaction with EV ownership across Canada and across a wide range of EV owners.

We explicitly asked EV owners about the impact that home charging and public charging availability have on their future purchase decision and found that the results differed by availability of home charging. 74% of EV owners without access to home charging indicated that public charging is a major or moderate factor in the future purchase decision, compared to 64% for EV owners that have access to home charging (**Figure 21**). These findings suggest that public charging is important for EV owners, regardless of whether they have home charging access. For those with home charging, this importance mainly stems from the need to charge during long-distance trips, as their regular use of public charging is limited, as shown earlier in the report. On the other hand, 88% of EV owners with access to home charging indicated that home charging is a major or moderate factor in their future EV purchase decision, compared to only 43% for EV owners without access to home charging. Given that the majority of EV owners have access to home charging, these results show the importance of access to home charging for a more widespread deployment of EVs.

Figure 20. EV purchase decision

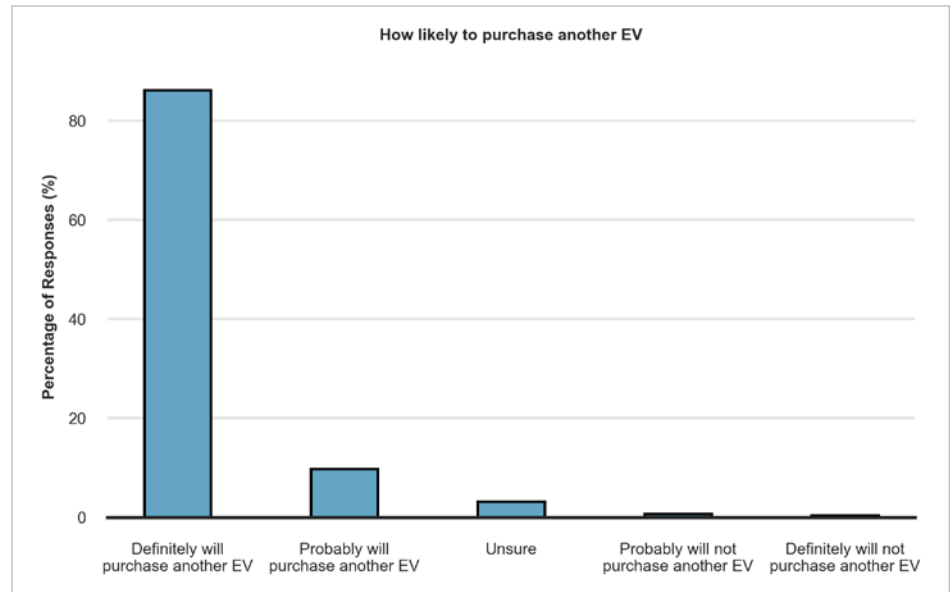
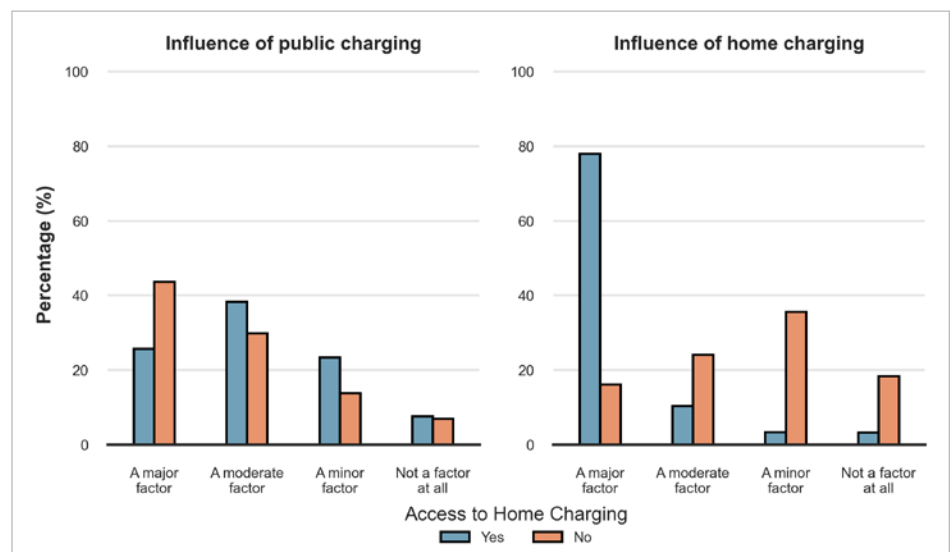


Figure 21. Influence of public charging and home charging on future EV purchase decision



In addition to public and home charging, we asked EV owners about other factors that might impact their future EV purchase decision (**Figure 22**). The two most important factors were found to be the performance of the vehicle (67% of respondents) and the cost of the EV (66%), followed by the availability of government incentives (57%), the availability of different models/types of EVs (53%) and environmental concerns (52%).

Among survey respondents, 45% financed their EV, 47% paid in cash, and 8% opted to lease. Purchase payment preferences were found to vary between new and early adopters, highlighting the evolving nature of the EV market. A larger proportion of early adopters (i.e., EV owners for more than 10 years) paid for their EVs in cash (57%) compared to recent EV adopters (i.e., those owning an EV for less than 1 year), of whom only 47% made cash purchases. On the other hand, leasing has become more popular among recent adopters, with 18% leasing their EVs compared to just 8% of early adopters. This shift in payment preferences, with more recent adopters choosing to lease rather than pay in cash, may indicate a trend toward trying out EVs before fully committing to ownership, especially as the market grows and more options become available.

Figure 22. Other factors influencing purchase decision

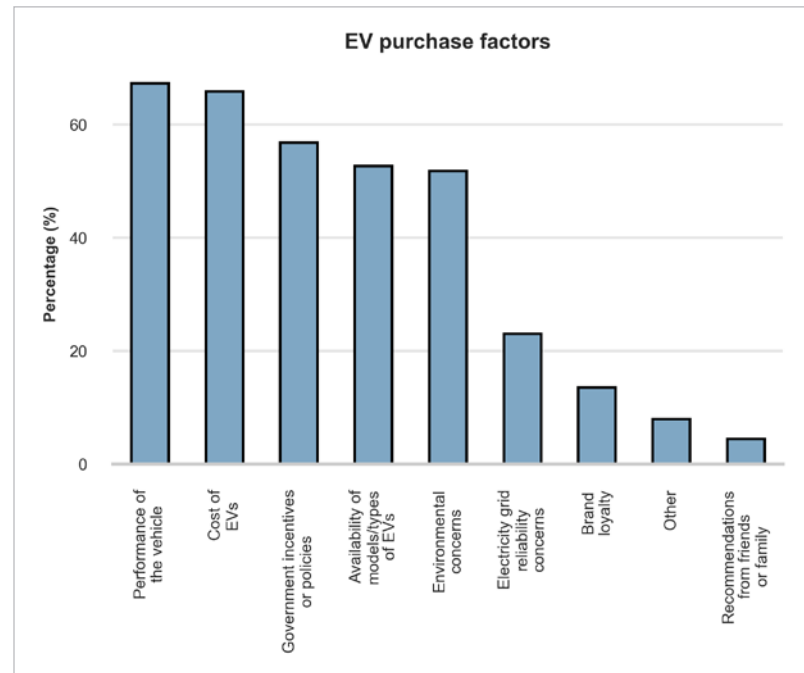
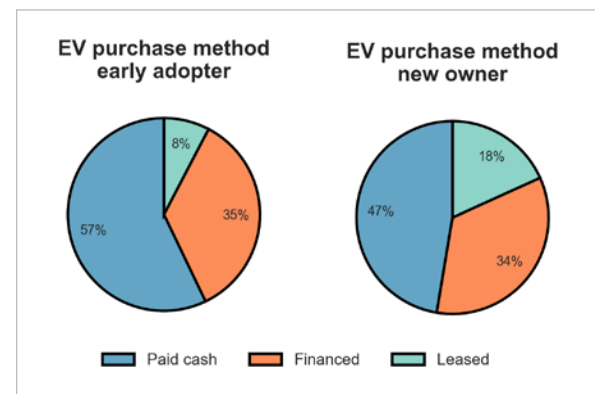


Figure 23. EV purchase method



8 Recommendations

Expand Charging Infrastructure and Improve Accessibility

> **Public Charging Expansion:** Prioritize the installation of DC fast chargers along major travel corridors to support long-distance travel and reduce range anxiety. Enhance the availability of Level 2 chargers in urban areas for residents without access to home charging. Future studies should focus on individual urban areas to identify regions with a high density of residences that lack dedicated parking or home charging access (such as multi-unit residential buildings or single-family homes). These studies would provide insights into the challenges faced by EV owners in these areas and help inform the deployment of public charging stations, improving access for these residents.

> **Home Charging Support:** Offer targeted incentives for EV owners in MURBs to install home charging infrastructure and collaborate with building owners to ease the installation process especially where dedicated parking spots are available. Introduce retrofit programs to subsidize home charger installations, particularly for level 2 chargers.

Enhance Charging Network Reliability and User Experience

> **Payment Interoperability:** Standardize payment methods across charging networks to reduce the need for multiple memberships. Encourage the adoption of “plug and charge” systems to simplify the user experience, similar to Tesla’s NACS model. Additionally, ensure physical payment methods (e.g., debit or credit cards) are available at charging stations, which is particularly important in cases of connectivity issues (with mobile apps) or in remote areas.

> **Network Reliability:** Collaborate with charging station operators for regular maintenance to reduce downtime and implement real-time monitoring and reporting systems to address outages quickly and improve network reliability.

Standardize and Regulate Charging Costs

> **Billing method:** Transition from time-based billing to energy-based billing (kWh) to provide fairer pricing for all EV owners, especially those with slower charging vehicles.

> **Pricing consistency:** Address inconsistencies in pricing between locations by encouraging transparent, standardized pricing structures across different public charging stations.

Raise EV Awareness and Consumer Education

> **Awareness Campaigns:** Conduct surveys to identify misconceptions and knowledge gaps regarding the EV charging experience among consumers. Use the findings to develop targeted awareness campaigns that address these specific concerns and improve understanding of charging options and infrastructure availability.

> **Consumer Information:** Provide clear, straightforward details on charging options, payment methods, and costs. Collaborate with automakers and local governments to ensure consistent messaging on the ease of transitioning to EVs. This should also address pricing equity, as inconsistent and high public charging prices disproportionately affect EV owners without home charging, creating a barrier to adoption. Promoting transparent and fair pricing will help make EVs more accessible.