Closing the electric vehicle charging infrastructure gap

Canadian Vehicle Manufacturers' Association

May 11, 2022

For Canada to achieve the target for all new light-duty cars and passenger trucks sales to be zero-emission by 2035, more ambitious government action is required to help Canadians make the switch to electric vehicles. A critical component of this is a commitment to building comprehensive, accessible, zero-emission vehicle (ZEV) charging infrastructure.

The barriers to ZEV adoption in Canada are significant and have been identified in numerous consumer and government surveys.[1][2][3] The primary barriers are the higher purchase price of ZEVs, concerns with vehicle range, and a lack of a comprehensive, convenient, and accessible public charging infrastructure.

Insufficient charging infrastructure (at home, work and publicly accessible) is regularly identified as one of the top barriers to consumers making the transition to purchasing a ZEV. The Government of Canada's own poll of Canadian attitudes towards ZEVs from November 19, 2020, found that a lack of infrastructure and charging concerns are the second most significant barrier to ZEV adoption.[4] This is consistent with recent industry polling of consumers that found that 47% of Canadian respondents identified a lack of public charging infrastructure as a key reason not to buy a ZEV.

To prepare Canada for a ZEV future, CVMA recommends the following actions be taken:

1. The federal government determines the charging infrastructure required for Canada to support achievement of its ZEV sales goals.

2. The federal government coordinates key stakeholders to assess the barriers and develop detailed solutions and actions to establish ZEV charging in multi-unit residential buildings and for garage orphans.

3. The federal government coordinates with utilities to ensure that as ZEV adoption increases there is an appropriate level of clean, affordable, and reliable electricity generation and associated grid infrastructure in place to support charging infrastructure.

4. The federal government establishes a ZEV charging infrastructure advisory body composed of automakers, charging infrastructure companies, provinces, municipalities, and utilities to provide advice on charging needs, technology developments and the linkage to Canada's ZEV sales targets.

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[1] New survey underscores need for more ambitious government efforts to convince Canadians to purchase electric vehicles, May 5, 2021, http://www.cvma.ca/press-release/new-survey-underscores-need-ambitious-government-efforts-convince-canadians-purchase-electric-vehicles/

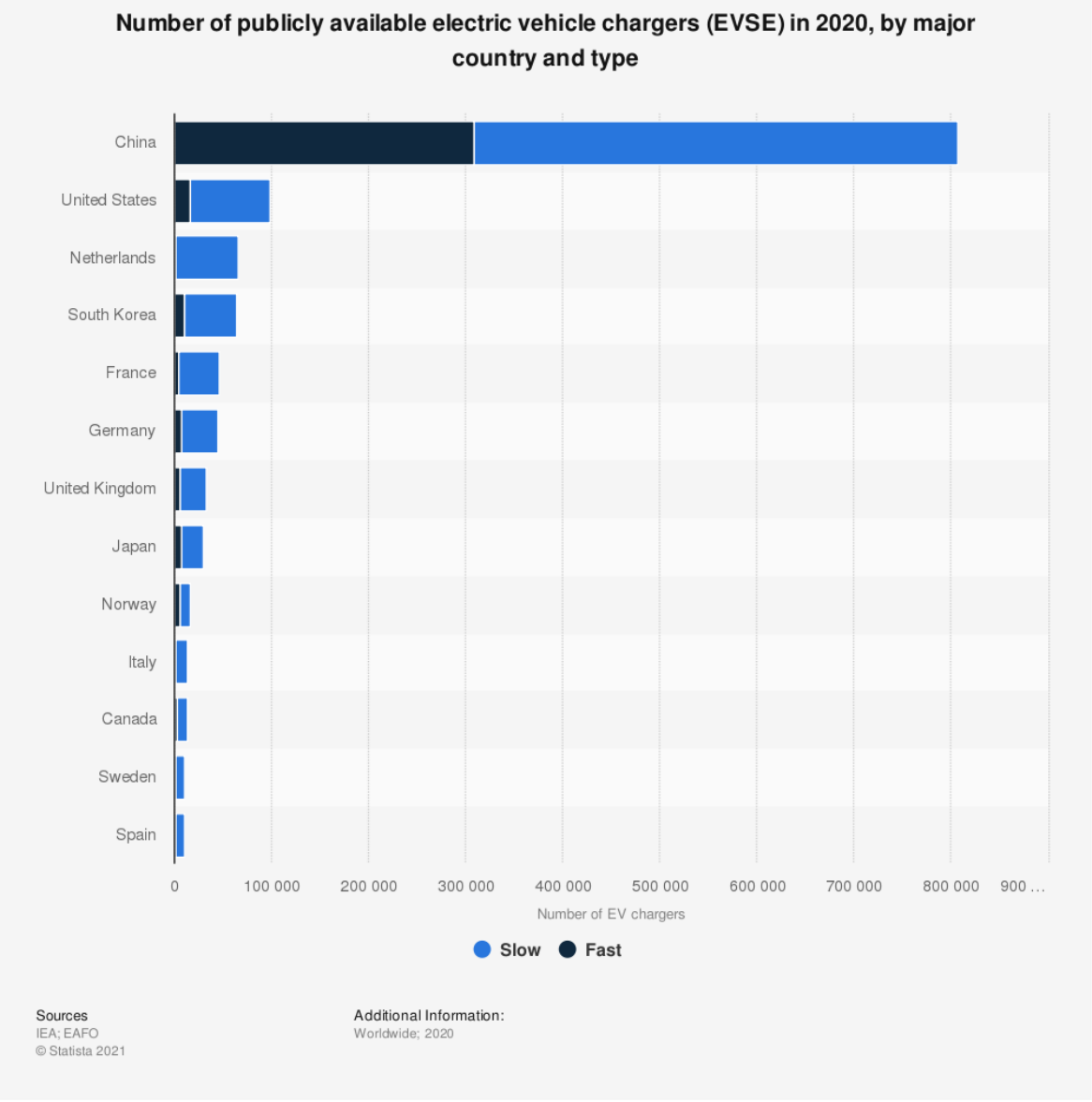
[2] Canadians hot on electric vehicles but cold on charging ability, KPMG, February 16, 2022, https://home.kpmg/ca/en/home/media/press-releases/2022/02/canadians-hot-on-electric-vehicles-but-cold-on-charging.html

[3] Canadians' Awareness, Knowledge and Attitudes Related to Zero. Emission Vehicles (ZEVs), NRCan, https://www.nrcan.gc.ca/sites/nrcan/files/057-21-NRCan_ZEVs_Final_Report_EN_accessible.pdf

[4] Internal government poll shows strong support for electric vehicle subsidy, February 11, 2021, https://globalnews.ca/news/7632277/internal-government-poll-support-electric-vehicle-subsidy/

Publicly Available Charging Infrastructure in Canada

Canada is currently lagging leading jurisdictions arounds the world on ZEV charging infrastructure. According to data from the IEA and European Alternative Fuels Observatory, global leaders on the total number of publicly available electric vehicles (EV) chargers include China, the United States, Netherlands, South Korea, and France.[5] China, with more than 800,000 publicly available chargers, accounts for over 60 per cent of such chargers in the world. As of May 6, 2022, Canada has 16,154 public chargers (defined by NRCan as EVSE ports).[6]



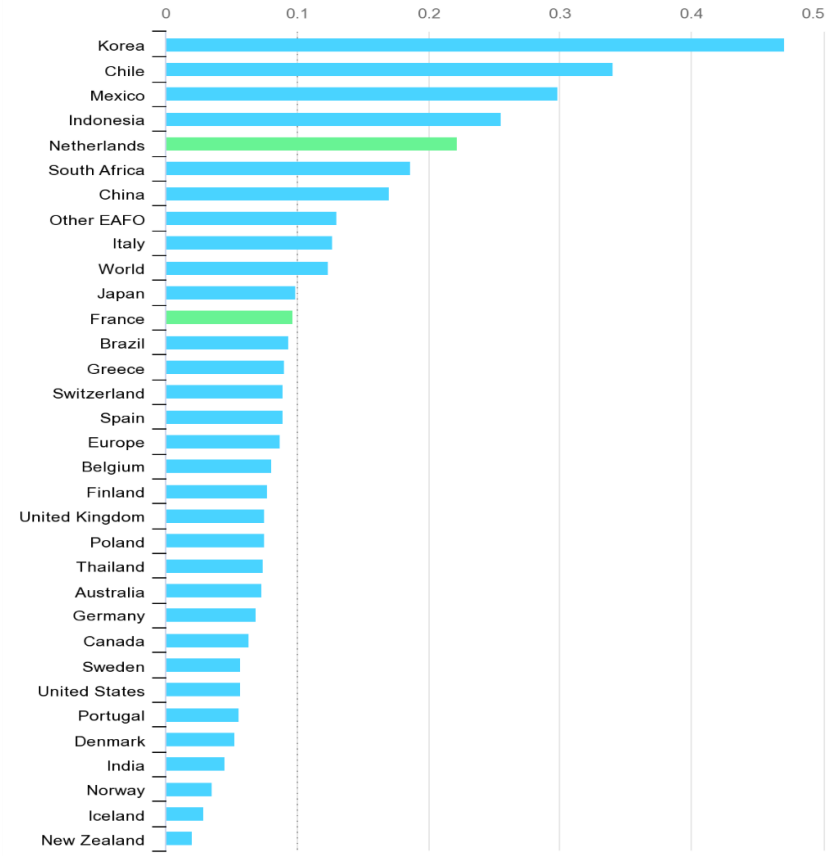
[5] According to IEA and EAFO, slow chargers are defined as those providing between four and 22 kilowatts of power with fast chargers providing above 22 kilowatts.

[6] Electric Charging and Alternative Fuelling Stations Locator, NRCan, https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/electric-charging-alternative-fuelling-stationslocator-map/20487#/analyze?fuel=ELEC&country=CA

Given the integrated nature of the North American auto industry, it is essential for Canada to remain aligned with the United States in the development of ZEV charging infrastructure. The United States is ranked second behind China with 82,263 slow chargers and 16,700 fast chargers installed across the nation. The Biden Administration has committed to installing 500,000 new chargers with an investment of USD $7.5 billion.[7] For comparison, Canada has committed $680 million to install 50,000 new ZEV chargers and hydrogen stations.[8] An aligned approach will support the transformation to ZEVs and is essential to ensuring Canada continues to enjoy all the tremendous benefits and opportunities of our integrated industry.

The European Union's Alternative Fuel Infrastructure Directive (AFID) has recommended that EU countries aim for 1 public charger per 10 EVs on the road, a ratio of 0.1.[9] Using this metric, Canada has 0.06 public chargers per EV, well behind the EU average of 0.09 and the global average of 0.12.

Ratio of public chargers per EV stock by country, 2020[10]



[7] FACT SHEET: The Biden-Harris Electric Vehicle Charging Action Plan, https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/13/fact-sheet-the-biden-harris-electric-vehicle-charging-action-plan/

[8] Zero Emission Vehicle Infrastructure Program, NRCan, https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/zero-emission-vehicle-infrastructure-program/21876

[9] DIRECTIVE 2014/94/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0094

[10] IEA analysis based on country submissions, complemented by EAFO (2021) and EV Volumes (2021).

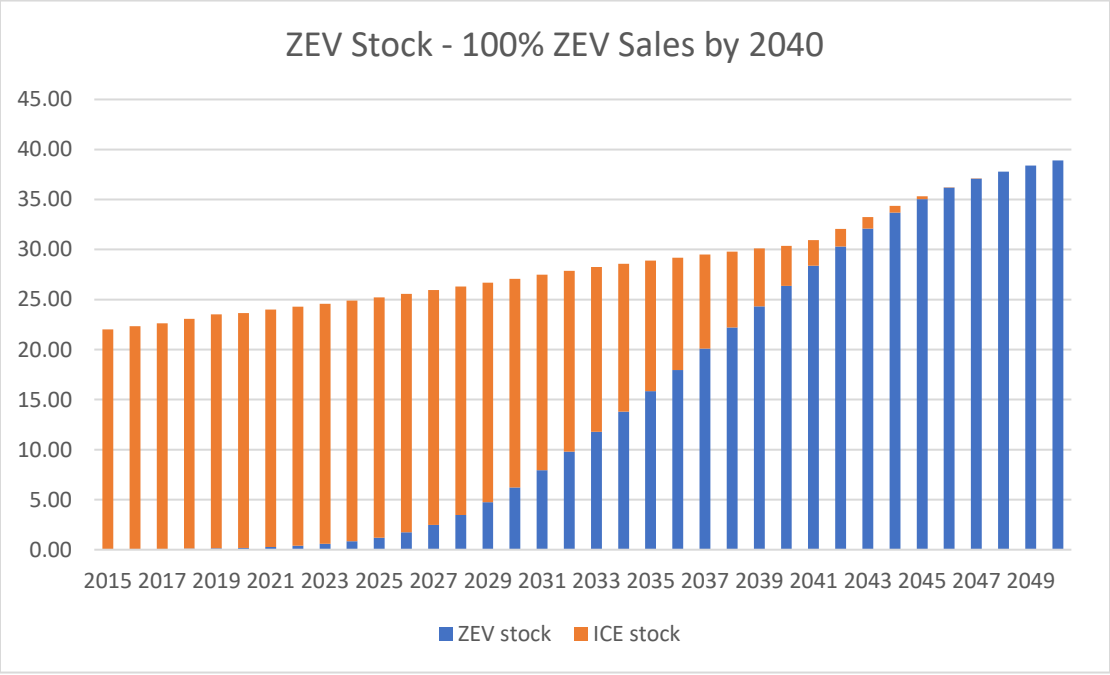
As Canada works to achieve the 100% ZEV sales target by 2035, significantly more charging infrastructure will be required. Compared to other jurisdictions with similar ZEV goals, Canada has one of the least comprehensive and ambitious charging infrastructure plans.[11] Most leading ZEV jurisdictions undertake regular, comprehensive, and public assessments of the charging infrastructure required to achieve ZEV adoption goals (outlined below).

ZEV Charging Outlook, 2030

Projections	Canada[1]	UK[2]	Germany[3]	California[4]
ZEV fleet	4,600,000	10,000,000	10,000,000	5,000,000
Public chargers	66,154	300,000	1,000,000	714,000
ZEV to charger ratio	69.5	33.3	10.0	7.0

1- Canada: 50,000 charger commitment plus 16,154 currently installed
2- UK: Taking charge: the electric vehicle infrastructure strategy
3- Germany: National Centre for Charging Infrastructure
4- California: California Energy Commission Electric Vehicle Charging Infrastructure Assessment

For Canada to keep pace with California, an additional 650,000 public chargers (defined by California as public and shared private chargers) need to be built in the next 8 years. According to the Canada Energy Regulator, if Canada were to achieve 100% ZEV sales by 2040 (below the current 100% ZEV sales target for 2035), the on-road ZEV stock would reach 39 million vehicles by 2050.[12] **To achieve the recommended ratio of 1 public charger per 10 EVs on the road, Canada would need 3.9 million public chargers by 2050.**



[11] EV Charging Assessment Report, NRCan, https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/resource-library/3489
[12] Canada's Energy Future 2020, Canada Energy Regulator, https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2020/net-zero/index.html

Cold weather ZEV operation is regularly cited by Canadians, particularly in rural areas, as a concern with ZEVs.[13] The colder climate in Canada will require ZEVs to be charged up to twice as much as in warmer climates. This will put additional demand on the Canadian public charging network in the winter months not witnessed in other warmer jurisdictions and will likely require an even higher ratio of chargers to EVs on the road.

The size of Canada's rural population and road network (1.1 million kilometres of public, two-lane equivalent roads) presents another challenge.[14] Rural Canadians represent nearly 20 per cent of Canada's population with longer daily commutes and different driving demands than urban Canadians. Enabling rural Canadians to make the switch to ZEVs requires extensive charging infrastructure be spread across a vast network, linking every small town.

Failing to build the needed charging infrastructure in advance of future ZEV sales to provide Canadian consumers the confidence to make the transition to ZEVs will significantly increase the risk of the government not achieving its sales targets. For example, a recent study of California ZEV drivers found that 20% of plug-in hybrid electric vehicle owners and 18% of battery electric vehicle owners switched back to an ICE vehicle citing convenience of charging and not having level 2 charging at home.[15]

Recommendation: The federal government determines the charging infrastructure required for Canada to support achievement of its ZEV sales goals. Such an assessment would allow governments at all levels to develop the long-term plans required to build a national charging network as well as the generation, transmission, and transformer infrastructure requirements to enable that charging infrastructure. Such an assessment should be regularly updated with public reports on the progress being made.

The assessment should incorporate the technology developments underway in the automotive industry and implications for charging infrastructure. For example, to meet consumer recharging expectations, an expanded public network will need to include significantly more DC fast chargers (with 100 kW and up to 350 kW capabilities) as well as Level 2 chargers. Without this, consumers will not be able to depend on reasonable charging times for the broad range of ZEVs coming to the market. This is particularly important for larger ZEVs that require larger battery packs to provide reasonable vehicle range.

The assessment should also break down what charger type should be installed based on location type (e.g., workplace, home, retail, public, highway network, municipal). This is key as costs associated with installing 100 kW versus 350 kW vary greatly. Over the long-term, consideration should also be given to other infrastructure needs should new technologies (i.e., fuel cells, hydrogen) become viable for widespread consumer adoption.

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[13] Survey finds that electric vehicle charging infrastructure and consumer incentives are critical to boosting rural and suburban adoption, June 15, 2021, http://www.cvma.ca/statement/survey-finds-electric-vehicle-charging-infrastructure-consumer-incentives-critical-boosting-rural-suburban-adoption/

[14] The Canadian Transportation System, Statistics Canada, https://www144.statcan.gc.ca/tdih-cdit/cts-rtc-eng.htm

[15] Understanding discontinuance among California's electric vehicle owners, Nature Energy, https://www.nature.com/articles/s41560-021-00814-9

Private Charging Infrastructure

One of the key barriers for consumers in the transition to ZEVs is limited residential charging infrastructure. Deloitte's 2022 Global Automotive Survey found that 43 per cent Canadian respondents who cannot charge their vehicles at home cited and inability to install a home charger with 33 per cent indicating that the cost of installing a home charger is prohibitive.[16]

According to the 2016 census, the most common dwelling type in Canada was the single-detached house, representing 53.6%, or 7.5 million, of the 14.1 million occupied private dwellings in Canada.[17] For these Canadians the installation of a home charger can be relatively straightforward if they have accessible parking adjacent to their home. To offset the cost of charger purchases and installation, incentives are a powerful tool.

As for the remaining proportion of dwellings, 18.0% were apartment buildings that have fewer than five storeys, 9.9% were apartment buildings that have five or more storeys, 5.6% were apartments in a duplex and 12.9% were other types of dwellings. Building owners of existing multi-unit residential buildings (MURBs) are unlikely to see ZEV charging station investment as a priority without significant government financial incentives. For condominiums, additional challenges exist regarding condominium and strata rules and legislation.

It is estimated that at least one-third of Canadians reside in multi-unit residential buildings or MURBS (e.g., condominium and apartment buildings) or dwellings without access to a driveway or garage.[18] These dwellings pose the most significant challenges to consumer ZEV adoption as so-called "garage orphans" depend solely on publicly accessible charging infrastructure and/or workplace charging.

Lastly, for new MURB construction, regulators can set requirements for new buildings to be ZEV ready as it is considerably more expensive to retrofit. Incentives can also be put in place to promote the installation of ZEV chargers in multi-dwellings and commercial buildings. Without coordination on a national basis, new MURBs across Canada will have inconsistent charging infrastructure available to residents.

The barriers and solutions to improving charging infrastructure in existing and new MURBs and for garage orphans have been well documented by Pollution Probe and The Delphi Group in their report "Zero-Emission Vehicle Charging in MURBs and for Garage-Orphans".[19]

Recommendation: The federal government coordinates key stakeholders to assess the barriers and develop detailed solutions and actions to establish ZEV charging in MURBs and for garage orphans as outlined by Pollution Probe and The Delphi Group. Stakeholders include governments, utilities and electricity providers, industry, EVSE providers, real estate developers, property management and

[16] 2022 Global Automotive Consumer Study, Deloitte, https://www2.deloitte.com/us/en/pages/consumer-business/articles/global-automotive-consumer-study.html?id=us:2sm:3li:gacs2022:awa:auto:010522
[17] Dwelling in Canada, Statistics Canada, https://www12.statcan.gc.ca/census-recensement/2016/as-sa/98-200-x/2016005/98-200-x2016005-eng.cfm
[18] Zero-Emission Vehicle Charging in MURB and for Garage-Orphans, NRCan https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/resource-library/zero-emission-vehicle-charging-murb-and-garage-orphans/21825
[19] Ibid

apartment building owners, condo and strata boards, academia, civil society and advocacy organizations, EV owners and associations, and automakers.

Energy Generation and Transmission

Clean electricity is critical to Canada's net zero transition. According to the Canadian Climate Institute, Canada's electricity generation capacity will need to be 2.2 to 3.4 times bigger by 2050 than today[20]

A significant amount of new power generation will be required in Canada to achieve a fully electrified vehicle fleet. To ensure Canada achieves its GHG emissions reduction targets emphasis must be on clean, renewable, net-zero energy generation.

According to an estimate based on the US fleet, electrifying 90 per cent of the US vehicle fleet would increase annual electricity demand by 1,730 terawatt hours, or about 41 per cent of current levels. This would require massive investments in infrastructure and new power plants.[21]

There are various estimates of Canada's future electricity needs in response to a growing ZEV fleet from the Canada Energy Regulator, private sector analysts and provincial utilities.

- **Canada Energy Regulator**: Total electricity demand is forecast to increase by 44% from 2021 to 2050, or by about 245 terawatt hours (TWh). Half of this increase is driven by increased electrification in the industrial, residential, and commercial sectors. The other half comes from electric vehicles in transportation and the production of hydrogen. If ZEVs dominate Canada's vehicle mix by 2050, ZEVs will increase electricity demand by 70 TWh.[22]

- **ICF Grid Readiness Report:** Natural Resources Canada retained the consulting firm ICF International Inc. to carry out a study to help Canadian utilities to compare and discuss practices to understand the expected electrical energy demands from future electric vehicle fleets in Canada and the impact on electricity grids.[23] The study forecasts energy demand on the assumption that the light-duty fleet is nearly 100% ZEV by 2050 based on the previous federal target of achieving 100% ZEV sales by 2040. ICF's forecast suggests a 156.5 TWh EV load per year by 2050, representing 22.6% of current domestic annual electricity consumption. The study concludes that "requirements for EV readiness, including but not limited to grid readiness, are multifaceted and will require considerable investments in supporting infrastructure, policy, and education."

- **EY Canadian electric vehicle transition:** In a moderate adoption scenario where EVs represent 15% of the on-road fleet by 2030 (6.5 million vehicles), electricity demand would increase by 32

[20] The Big Switch, Canadian Climate Institute, https://climateinstitute.ca/reports/big-switch/
[21] Electrification of light-duty vehicle fleet alone will not meet mitigation targets, September 28, 2020, https://www.nature.com/articles/s41558-020-00921-7
[22] Canada's Energy Future 2021, Canada Energy Regulator, https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2021/key-findings.html
[23] ICF Grid Readiness Report, https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/ExecutiveSummary_EV.pdf

TWh, or 5.5%.[24] To supply this increase, EY concludes that power and utility companies would need to manage demand and invest in aging grid infrastructure to respond to changing load profiles.

- **Hydro Québec**: Electric vehicle adoption will increase provincial electricity demand by 3.3 TWh between 2019 and 2029, part of an expected total increase in electricity demand of 15.9 TWh (9% increase over 2019).[25]

- **Ontario Independent Electricity System Operator (IESO)**: The IESO's EV adoption forecast assumes EV sales to be relatively flat in the near-to-medium-terms, and to grow significantly in the years immediately preceding the 2035 milestone date. The 2021 planning outlook EV forecast is in line with federal government's ZEV sales targets, which projects 6.6 million EVs in Ontario by 2042, creating an annual charging demand of 24.4 TWh and a peak demand of 1,200 MW.[26]

- **BC Hydro:** BC Hydro is predicting there will be around 350,000 EVs on B.C. roads by 2030.[27] This is estimated to add an additional 1,050-gigawatt (1.05 TWh) hours of electricity load per year.

Recommendation: Given varied projections, a coordinated effort with utilities is required to ensure that as ZEV adoption increases, there is an appropriate level of clean, affordable, and reliable electricity generation and associated grid infrastructure in place to support charging infrastructure. Special attention will need to be given to the different time of use electricity demand profile associated with ZEVs versus other general electricity demands.

Advisory Body on Charging Infrastructure Requirements

Canada will fail to achieve its sales targets if it does not urgently address the well-documented ZEV charging gap. To ensure Canada has the charging infrastructure required, better coordination and consultation with key stakeholders is required. Establishing an advisory body on charging infrastructure would help to address the charging gap and make linkages between charging needs, electricity capacity and generation, grid requirements and technology developments.

Other jurisdictions with ZEV sales targets have taken this approach. For example, the German government has established an advisory board of the National Centre for Charging Infrastructure to provide input on the government's target to build one million public charging points by 2030.[28] The Centre's core tasks are to calculate charging needs, plan and coordinate the development of a

[24] Canadian electric vehicle transition, EY Strategy, https://assets.ey.com/content/dam/ey-sites/ey-com/en_ca/topics/oil-and-gas/canadian-electric-vehicle-transition-the-difference-between-revolution-or-evolution.pdf
[25] Hydro Quebec electricity demand forecast 2020, http://news.hydroquebec.com/en/press-releases/1656/growing-electricity-demand-forecasted-in-quebec-despite-the-public-health-crisis/
[26] Annual Planning Outlook, IESO, https://www.ieso.ca/en/Sector-Participants/Planning-and-Forecasting/Annual-Planning-Outlook
[27] BC Hydro, https://electricvehicles.bchydro.com/about/our-role-with-EVs
[28] National Centre for Charging Infrastructure, https://nationale-leitstelle.de/en/

nationwide fast-charging network, coordinate federal and state activities, and support municipalities in the planning and implementation of the charging infrastructure.

Recommendation: To ensure the federal government has a comprehensive, ambitious, and coordinated plan to reach its ZEV sales targets and close the charging gap, the government should establish an advisory body composed of automakers, charging infrastructure companies, provinces, municipalities, and utilities. This advisory body should report directly to ministers and provide advice on charging needs, technology developments and the linkages to Canada's ZEV sales targets.