Version: 1.1

BC Hydro's electric vehicle infrastructure

Five–Year Plan – 2025

JANUARY 2022

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Executive summary

In the CleanBC Roadmap to 2030, the B.C. Government has set a target of new light-duty vehicle sales and leases in the province to be 100% Zero Emission Vehicles (ZEV) by 2035. This is an aggressive target that requires a robust and extensive refueling/recharging station network that is comparative to the existing network of gas stations that spans the province. The Roadmap also targets full provincial coverage with fast charging infrastructure by 2024.

BC Hydro's role in achieving this target is to build a seed network of electric vehicle (EV) charging stations to support EV travel and adoption across B.C. Although EVs can recharge at home, at work and at public places from a typical 120 Volt plug (Level 1 charging) or from a 240 Volt plug (Level 2 charging), direct current fast charging (DCFC) is 10 to 50 times faster and is required for long distance travel. Alternatively, fast charging also serves as a substitute for home charging where access to charging at home or work is not viable.

BC Hydro's participation in the public EV fast charging market is supported by section 18 of the *Clean Energy Act* and also the Greenhouse Gas Reduction (Clean Energy) Regulation (GGRR) and is also guided by the government's EV infrastructure planning studies. The studies[1] state that full geographic connectivity for the province would require a fast charging network of 194 sites. B.C. Government amended the Greenhouse Gas Reduction (Clean Energy) Regulation on June 22nd, 2020 to make certain EV charging stations "prescribed undertakings" and thus guarantee a public utility (like BC Hydro and FortisBC Inc.) cost recovery of its investment in EV charging stations under section 18 of the *Clean Energy Act*.

BC Hydro commissioned its first, fast charging station in the summer of 2013 and has grown its charging network to 99 stations at 72 sites as of December 2021. The existing network spans from Vancouver Island to the Alberta border and north to Prince George and Prince Rupert. Building on the fast charging sites in Prince George and Prince Rupert, BC Hydro will complete half a dozen sites along Highway 16 to connect the two cities. The existing network covers most of the communities of B.C., but only half of the geography.

BC Hydro is guided by the EV infrastructure planning studies from the provincial government in developing its planning framework, which is the basis for BC Hydro's Electric Vehicle Infrastructure Five-Year Plan (Five-Year Plan). The framework has the following principles:

1. Coverage – achieving geographic connectivity by providing EV fast charging stations across the province;
2. Capacity – meeting market demand for urban areas with high EV traffic volumes and serving as a substitute for charging at home for residents that have greater than average barriers to accessing charging;
3. Collaboration – working with the B.C. Government and other fast charging station operators to coordinate province-wide coverage and co-locating with other operators when the services are complementary; and
4. Sustainment – replacing end-of-life stations with enhanced units, rather than investing in like-for-like replacements, to ensure the network grows with the advancement of EV charging station technology (e.g., higher power and more advanced features).

1 **https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/transportation/bc_public_ld_zev_infrastructure_study_final_20210505.pdf**

The Five–Year Plan covers fiscal 2022 to fiscal 2026[2] and targets 145 sites and 325 stations by December 2025, requiring an additional 73 sites and 224 stations as of December 2021. In addition to the targeted sites and stations, the Plan will target province–wide coverage by 2024.

The gap between the provincial target of 194 sites for geographical connectivity and BC Hydro's target of 145 sites will be covered by other station operators and greater spacing between stations along remote highways[3]. For instance, FortisBC Inc. deploys charging stations in its service territory, and Ministry of Transportation and Infrastructure deploys stations in highway rest areas.

Total funding required to deliver on the Five–Year Plan is $44.8M. BC Hydro relies heavily on funding grants from Natural Resources Canada (NRCan) and B.C. Government to offset capital costs for stations. The following is a breakdown of funding for the Five–Year Plan:

Growth Capital	$40.5M
Sustainment Capital	$4.1M
Total capital budget	**$44.7M**
Less (anticipated) External Funding (NRCan & B.C. Government)	($19.3M)
Net BC Hydro Capital Spend	$25.4M
Contingency	$1.6M
Five–year Capital Budget	**$27.0M**

2 BC Hydro's fiscal year is from April 1st to March 31st and is referenced by the ending year. For example, fiscal year 2026, also referred to as F26 in short form, represents the fiscal year running from 1 April 2025 to 31 March 2026.

3 The remote highways include Highway 37 to the Yukon border, Highway 97 north of Fort St. John to the Yukon border and Highway 20 from William's Lake to Bella Coola. The provincial planning studies assumed similar spacing for remote highways as for other, more populated highways.

1 Introduction

BC Hydro's Electric Vehicle Infrastructure Five–Year Plan describes BC Hydro's medium–term investments between fiscal 2022 and fiscal 2026 in deploying a seed network of public, fast, electric vehicle (EV) charging stations in BC Hydro's service territory to support the adoption of EVs in British Columbia.

The Five–Year Plan is organized as follows:

- Section 2 explains the government policy, regulations and planning studies that inform and guide BC Hydro's participation in the fast charging market;
- Section 3 describes BC Hydro's role in the public, EV charging market;
- Section 4 discusses BC Hydro's charging infrastructure deployments to date (as of December 2021);
- Section 5 discusses the planning framework underlying the plan;
- Section 6 presents the Five–Year Plan; and
- Section 7 discusses two key attributes of BC Hydro's charging infrastructure: rates and accessibility.

2 Government regulations and infrastructure planning

Driven by an overarching climate action agenda, the B.C. Government has established policies and regulations to transition the transport sector from fossil fuels to clean electricity. The following subsections provide an overview of the regulations and policies that support public utilities to invest in the refueling infrastructure that is essential for supporting EV adoption.

2.1 *Clean Energy Act* and Greenhouse Gas Reduction (Clean Energy) Regulation

There are several government policies and regulations that support BC Hydro's investment in public fast charging service for electric vehicles. In 2010, the *Clean Energy Act* was enacted. Among other things, section 18 of the *Clean Energy Act* supports public utilities to invest in "prescribed undertakings", meaning "a project, program, contract or expenditure that is in a class of projects, programs, contracts or expenditures prescribed for the purpose of reducing greenhouse gas emissions in British Columbia" . Section 18(2) guarantees cost recovery for public utilities' prescribed undertakings, while section 3 imposes limits on the British Columbia Utilities Commission (BCUC):

> (2) In setting rates under the ***Utilities Commission Act*** for a public utility carrying out a prescribed undertaking, the the commission must set rates that allow the public utility to collect sufficient revenue in each fiscal year to enable it to recover its costs incurred with respect to the prescribed undertaking.
>
> (3) The commission must not exercise a power under the ***Utilities Commission Act*** in a way that would directly or indirectly prevent a public utility referred to in subsection (2) from carrying out a prescribed undertaking.

The Greenhouse Gas Reduction (Clean Energy) Regulation (GGRR) set out various "prescribed undertakings" for the purposes of section 18 of the *Clean Energy Act*. Section 5 of the GGRR, which was added in June 2022, describes the requirements for an EV charging station to be a prescribed undertaking.

> 2) A public utility's undertaking that is in a class defined as follows is a prescribed undertaking for the purposes of section 18 of the Act:
>
> (a) the public utility constructs and operates, or purchases and operates, an eligible charging station;
>
> (b) the public utility reasonably expects, on the date the public utility decides to construct or purchase an eligible charging station, that
>
> (i) the station will come into operation by December 31, 2025, and
>
> (ii) if the station will be located in a limited municipality, the number of eligible charging sites in the municipality on the date the station will come into operation will not exceed the site limit for the municipality on that date;
>
> (c) if an eligible charging station comes into operation on or after January 1, 2022, the station uses or is configured to use the Open Charge Point Protocol.

2.2 CleanBC Plan, *Zero-Emissions Vehicles (ZEV) Act* and CleanBC Roadmap 2030

In March 2019, the B.C. Government released its CleanBC plan. A key element of the CleanBC Plan is a reduction of greenhouse gas emissions in the transportation sector through a shift from the use of fossil fuels in favour of clean and renewable energy.

In the same year, on May 30, the BC government also enacted the *Zero-Emissions Vehicles (ZEV) Act*. The *ZEV Act* stipulates percentage targets for new light-duty vehicle sales and leases in B.C. that

must have zero emissions, as follows:

- 10 % by 2025
- 30 % by 2030
- 100 % by 2040

These targets are amended by the **CleanBC Roadmap for 2030**, which sets new, more aggressive ZEV targets:

- 26% by 2026
- 90% by 2030
- 100% by 2035

In addition to EV sales targets, the Roadmap targets full geographical connectivity with EV infrastructure by 2024.

Achieving these targets requires consumer acceptance of electric vehicles as a replacement for internal combustion engine vehicles, which depend on various factors:

- Variety of models available (e.g., SUVs, pick-ups);
- Price of EVs (net of incentives) relative to internal combustion vehicles;
- Driving range per charge and "range anxiety" perceived by prospective purchasers; and
- The availability of charging infrastructure.

All the above factors need to be adequately addressed through a concerted effort by government and EV industry participants. The availability of charging infrastructure will need to be provided by a variety of industry players including auto makers (as in the case of Tesla and VW/Electrify Canada), charging services start-ups, and regulated utilities.

Following Phase One of its Inquiry into the Regulation of Electric Vehicle Charging Service, the British Columbia Utilities Commission (BCUC) recommended that persons providing EV charging services that are not already a public utility (private sector) be exempted from BCUC regulation. Examples from the current market include automakers like Tesla and oil companies like Suncor/Petro Canada. On March 18, 2019 such an exemption was provided through Ministerial Order M104, allowing persons not otherwise a public utility to provide EV charging services without regulation by the BCUC. EV charging services provided by non-exempt public utilities (e.g., BC Hydro, FortisBC) continue to be regulated by the BCUC.

2.3 Provincial EV charging infrastructure planning

Along with regulations and policies, the B.C. Government has also conducted studies relating to the availability of charging infrastructure that is required to support the mass adoption of electric vehicles and to achieve the targets set out above. Each study discussed below was based on a common set of guiding principles (as taken from the studies named below):

1. Connect travel corridors across the province, where commuter traffic, cross jurisdictional travel or tourism is supported.
2. Ensure infrastructure deployment allows for safe, reliable and convenient travel in the province while planned at a frequency that allows travel under challenging conditions, such as inclement winter weather, including ensuring that site safety and user experience are safeguarded and as accessible as possible.
3. Support regions with dense ZEV adoption.
4. Maximize population areas served.

As early as 2013, the Ministry of Energy, Mines and Petroleum Resources (now the Ministry of Energy, Mines and Low Carbon Innovation) (EMLI) commissioned Fraser Basin Council to study the critical gaps in the existing and scheduled direct current fast charging (DCFC) network in B.C., which resulted in a report titled, "**A Gap Analysis for B.C.'s Electric Vehicle Direct Current Fast Charging Network**" (published in August 2015)[4]. The gap is the additional charging station sites required for supporting EV travel across the provincial highways.

In June 2018, the B.C. Government released "**British Columbia Direct Current Fast Charging (DCFC) Network Study: Core Network for Geographic Connectivity – An analysis of DCFC stations required for an initial core network to ensure geographic coverage for electric vehicle drivers across all of B.C.**"[5] Based on assumptions provided in the document,[6] the B.C. Government "estimated that a total of approximately 200 DCFC sites are required to provide a base-level core network connecting all of B.C.'s primary and secondary highway routes. This constitutes approximately 130 additional locations beyond those already completed or underway to fill out a core network for geographic connectivity. Additional stations will be needed throughout the province for densification in urban and suburban centres, and redundancy along primary and secondary highway routes, in particular to support higher uptake of EVs."

In May 2021, the B.C. Government published "**British Columbia Public Light-Duty Zero-Emission Vehicle Infrastructure Study**",[7] which expands the study to include a network of hydrogen refueling stations. Based on the same assumptions as in the 2015 study, the 2021 study concluded (at pages 14–15):

> The modelling output provides consistent charging site suggestions to support EV driving province wide. Entities installing infrastructure will need to find practical sites where possible along all routes which may not always coincide with model output. It is recognized that at the time of writing in 2020, an increasing percentage of EVs on the road have larger battery capacities (e.g. 64 kWh or higher). It is also recognized that particularly along northern, rural and remote highway routes, there may be challenges in finding suitable sites for fast charging infrastructure (including due to lack of electricity). It is acknowledged that in practice, most EV drivers will not fully charge their vehicle after each charging stop, and instead may charge to around 80–90%. If this were taken into account, this would result in charging stations being needed closer together. Thus, the selection of a 30 kWh vehicle not only provides consistency with the 2018 Fast Charging Network Study, it also provides an additional buffer for longer range vehicles travelling under more adverse conditions than those modelled (e.g. older vehicle, more passengers or cargo weight, colder temperatures, snow on the road).

Figure 1 (overleaf) identifies the locations of the EV fast charging sites recommended in the 2021 study.

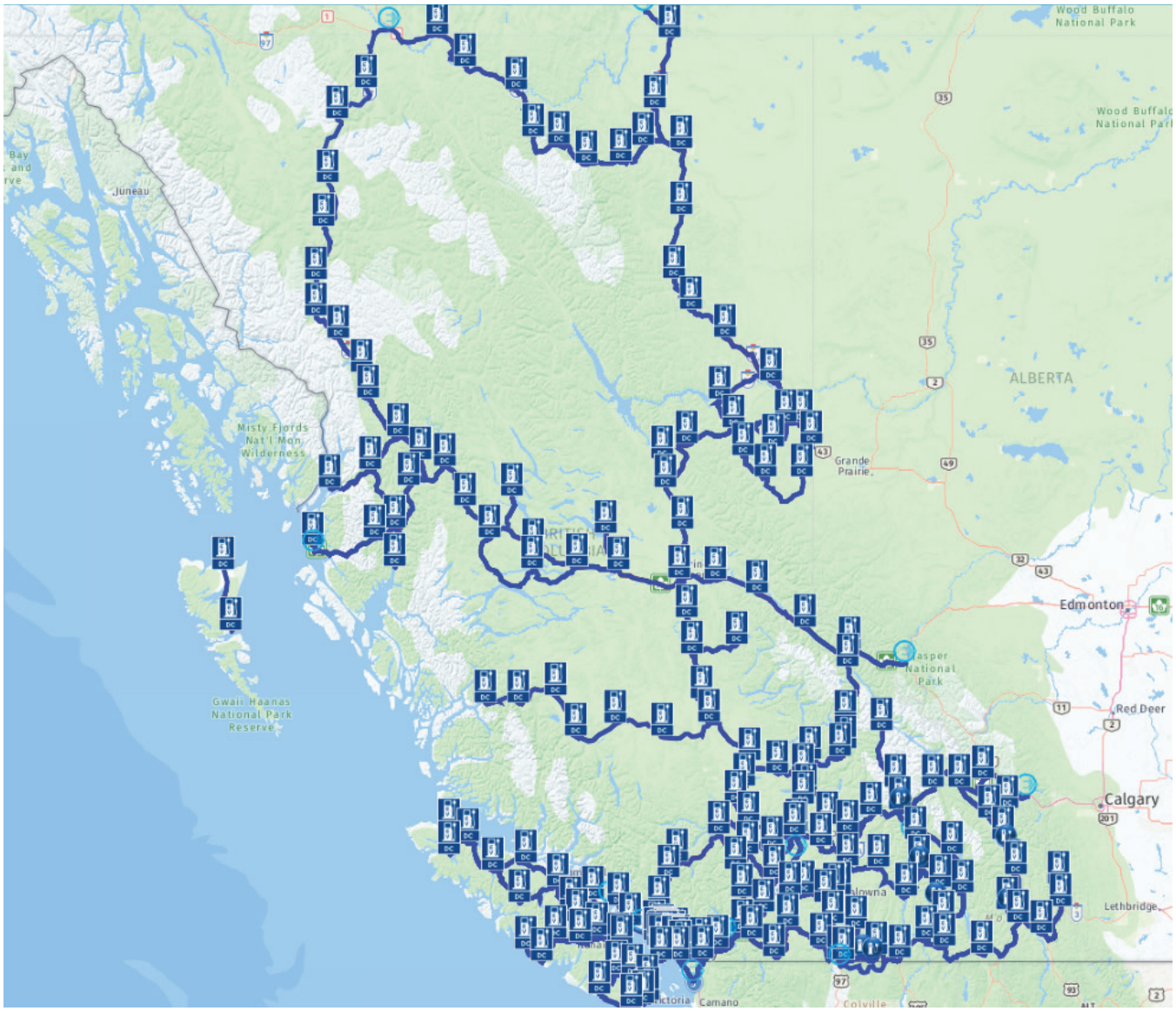
4 **https://pluginbc.ca/wp/wp-content/uploads/2015/10/BC-DCFC-Gap-Analysis-Report-FBC_Aug-2015.pdf**

5 **https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/transportation/bc_dcfc_network_study_-_june_12_2018_final.pdf**

6 The modeling assumptions: 30 kWh vehicle; 3-year-old vehicle; 2 individuals in vehicle; Temperature of -10°C for Vancouver Island and Lower Mainland and -20°C for the rest of B.C.; Vehicle fully charged at each charging stop; All primary and secondary highways and major roads in B.C., as defined by the Ministry of Transportation and Infrastructure

7 **https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/transportation/bc_public_ld_zev_infrastructure_study_final_20210505.pdf**

Figure 1 BC Fast Charger Network – Based on 30kWh EV (80–120km range)



Source: **https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/transportation/bc_public_ld_zev_infrastructure_study_final_20210505.pdf** – (page 16)

3 BC Hydro's role

Similar to how BC Hydro builds and maintains essential infrastructure to provide electricity to communities across B.C., BC Hydro will build a seed network of charging stations to provide the essential EV charging infrastructure needed to support EV adoption and travel across the province. BC Hydro will also provide an alternative to home charging for EV drivers living in homes where there are barriers to charging.

BC Hydro's Five–Year Plan will result in EV charging stations that are "prescribed undertakings" as defined in section 5 of the GGRR. That is, each station deployed by BC Hydro:

> "(a) is available for use 24 hours a day by any member of the public,
>
> (b) does not require users to be members of a charging network, and
>
> (c) is capable of charging electric vehicles of more than one make."[8]

However, BC Hydro will also consider deploying stations that are not "prescribed undertakings" on a case by case basis. For example, if a proposed charging station site is in a municipality that has reached its site limit,[9] then BC Hydro may still proceed on the basis that there is sufficient demand in the area. Such a case may arise in a municipality with a small population but the location is on a popular travel corridor that has high demand for fast charging.

Section 5 of the GGRR and section 18 of the *Clean Energy Act* encourages and supports public utilities (i.e., non–exempt public utilities like BC Hydro and FortisBC Inc.) to invest in charging stations by guaranteeing full cost recovery of providing public fast charging station services and by disallowing the BCUC to "directly and indirectly" prevent the public utilities from participating in the vehicle charging market.

BC Hydro's participation in the market has established EV driving corridors outside of the urban areas earlier than otherwise if left to the market. The early presence of EV charging stations addresses the common consumer reason for not buying an EV: the lack of public recharging infrastructure.

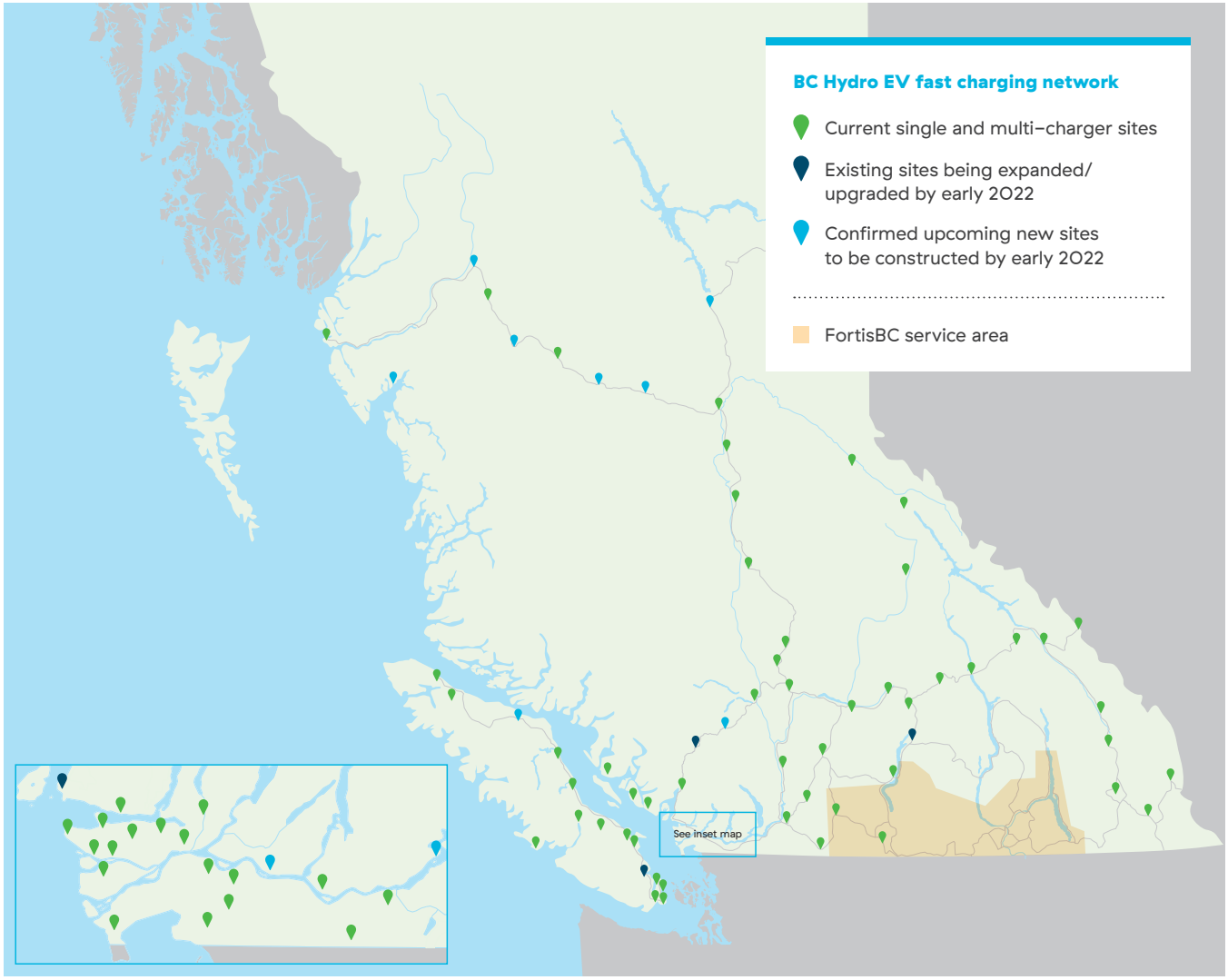
8 These stations are defined as "eligible charging stations" under section 5(1) of the GGRR.

9 "site limit" is the number of fast charging sites per limited municipality as defined in the Greenhouse Gas Reduction Regulation: **https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/102_2012#section4**

4 BC Hydro's investment in EV infrastructure (December 2021)

BC Hydro installed its first EV fast charging station in July 2013 and now operates 99 fast chargers at 72 sites as of end of December 2021. A handful more, new dual station sites are coming online along Highway 16 between Prince George and Prince Rupert by the end of March 2022. Figure 2 below provides a map of existing sites and those under construction.

Figure 2 BC Hydro Fast Charging Network as of December 2021



5 BC Hydro's EV infrastructure planning framework

This section describes the framework used to develop BC Hydro's Five-Year Plan for investment and sustainment of BC Hydro's public EV charging station network for the period of fiscal 2022 to fiscal 2026.[10] The framework builds on the studies conducted by EMLI discussed in section 2.3 above, which discusses geographic connectivity and meeting the demand in regional markets with high EV adoption rates.

BC Hydro's planning framework was developed using the following principles for our fast charging station deployments:

1. Coverage – increasing geographic connectivity;
2. Capacity – meeting market demand;
3. Collaboration – working with the B.C. Government and other fast charging operators; and
4. Sustainment – installing enhanced rather than like-for-like replacements.

5.1 Coverage – geographic connectivity

The coverage principle means that EV charging infrastructure is in place to enable safe and convenient travel along highways and major roads within BC Hydro's service territory. The spacing between charging stations along driving corridors accommodates the driving range of EVs on the market today between charging sessions. First generation EVs that were commercially available starting in 2010 had a driving range of about 100 km on a fully charged battery, while the EV models for sale today have a range of 300 to 500 km.

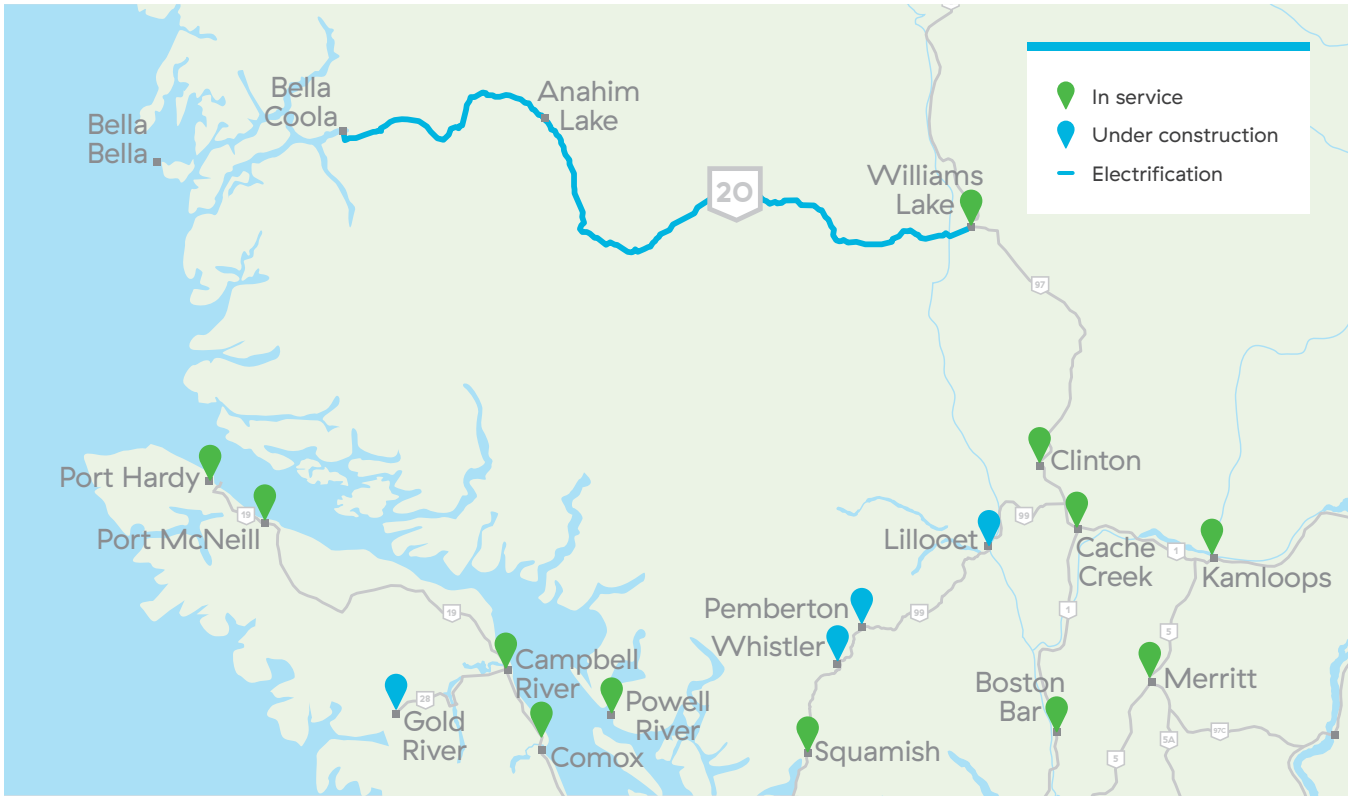
As shown in Figure 2 above, BC Hydro has already installed EV charging infrastructure throughout most of the primary travel corridors in the province. However, within BC Hydro's service territory gaps in charging infrastructure still exist in the following remote highways:

- Highways 37 and 97, between Kitwanga and Prince George (Figure 3); and
- Highway 20, between Williams Lake and Bella Coola (Figure 4).

10 BC Hydro's fiscal year is from April 1st to March 31st and is referenced by the ending year. For example, fiscal year 2026, also referred to as F26 in short form, represents the fiscal year running from 1 April 2025 to 31 March 2026.

Figure 3 Electrifying Highways (37 and 97) north to the Yukon border

Figure 4 Electrifying Highway 20 from Williams Lake to Bella Coola



In terms of geographic coverage, BC Hydro considers the following factors:

1) Stations or sites that have been planned and deployed by other entities (to avoid duplication) – For example, while the B.C. Government's **BC Public Light Duty ZEV Infrastructure Study (May 2021)** identified the need for 194 charging sites. BC Hydro recognizes that some of the sites have been deployed by the Ministry of Transportation and Infrastructure (MOTI) at highway rest areas and that some sites are in the service territory of FortisBC Inc.*;*

2) Proximity to existing charging stations – In locations or communities along travel corridors where the fast charging demand is sufficient, BC Hydro will locate a charging site that is away from existing fast charging stations and target areas in a community that are underserved.*;*

3) Availability of electrical supply: In particular, BC Hydro plans to have stations along Highways 37 and 97 to the Yukon border and Highway 20 from Williams Lake to Bella Coola with greater spacing between charging sites because of the lack of suitable electrical power supply along these remote highways.*;* and

4) Long distance driving habits on remote highways: We anticipate that drivers of these remote highways will use long range EVs that are capable of more than 300km per charge, which will allow BC Hydro to double or triple the spacing between charging sites. Typical station spacing along most travel corridors ranges from 40 to 80km.

5.2 Capacity – meeting market demand

The capacity principle addresses market demand by considering the number of stations per site, power level of the stations and number of sites in an area (municipality, region, etc.). Increasing any of these three factors will increase the fast charging capacity of BC Hydro's network in areas of high demand. Greater demand for public fast charging occurs in urban and suburban areas of the province because of two main reasons: (1) higher population in these areas, and (2) public fast charging stations as a substitute for home charging where barriers to charging at home or at work exist. BC Hydro is planning to build fast charging stations in urban and suburban areas according to demand and the supply response from other fast charging providers.

5.2.1 NUMBER OF CHARGING STATIONS AT A SITE

Today, the base composition of a fast charging site requires a minimum of two charging stations. Many of the earlier sites only had a single station. BC Hydro will expand all single–station sites with a second station. The two–stations per site composition provides redundancy should one of the stations be out of service.

The number of stations per site beyond the minimum of two stations is determined by the market demand for a given site or area. BC Hydro will use usage data, such as queuing percentage[11] and utilization rates of a charging site as indicators of high demand and the need for a capacity upgrade. BC Hydro has deemed 20% queuing and higher as an undesirable customer experience,[12] triggering upgrade considerations for any site with these queuing levels.

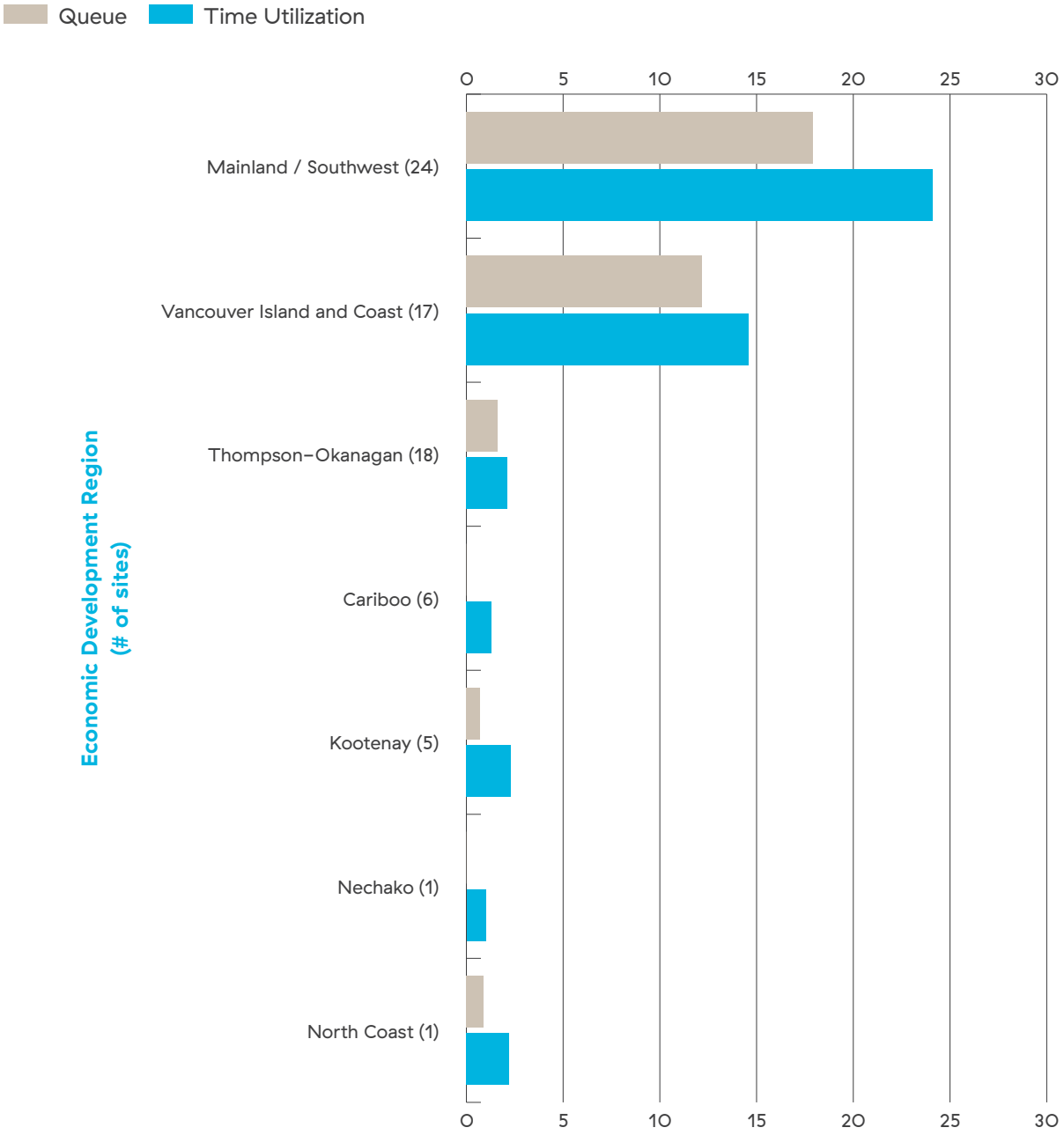
The utilisation threshold for station upgrade considerations will evolve along with the growth of the EV market and will differ by the use case of a location. That is, urban sites may have a different correlation between queuing and utilization versus rural sites. BC Hydro will continue to analyze utilization data for our network and define the different use cases over time.

11 Queuing percentage is the percentage of charging sessions that commenced within 6 minutes of a previous session at a given charging station.
12 A customer has a one in five chance of queuing at a station that has a 20% queuing statistic.

BC Hydro will also assess other conditions prior to increasing capacity at a site. For example, a site host may not have available space to allocate for more stations or an electrical service upgrade for a site is uneconomic. An alternative would be to develop a new site in the area to meet localized, high demand for fast charging.

Figure 5 below presents average charging network statistics by economic region for December 2021. The busiest stations are situated in the most populous regions: Lower Mainland and Vancouver Island. Some of the busiest stations attain queuing levels as high as 30%, warranting consideration for expansion.

Figure 5 Queuing and Utilization by Economic Region (%) – December 2021



5.2.2 HIGHER CHARGER POWER LEVELS AND CHARGING STANDARDS

The current fast charging power levels range from 25 to 350kW as defined by the Society of Automotive Engineers'[13] (SAE) Combo Charging System (CCS). An alternate fast charging standard originates from Japan, developed by Tokyo Electric Power Company (TEPCO) and implemented by Nissan, Mitsubishi and Kia. The Japanese standard is referred to as CHAdeMO, a name derived from a play on words from the loosely translated, Japanese phrase, "stop for a cup of tea".

Over the years, market forces have favoured CCS over CHAdeMO with all American and European automakers adopting CCS as the fast charging standard on their vehicles. Kia switched over to CCS several years ago and Nissan has adopted CCS in its next line of EV models coming out in 2022. As a result, BC Hydro will begin to reduce the ratio of CHAdeMO to CCS charging connectors at its charging sites moving forward. Currently, BC Hydro deploys stations that are equipped with both Japanese and North American charging connectors. A specific plan for decreasing CHAdeMO connectors is still in development given government grant funding still requires both CCS and CHAdeMO connectors.

The range of power levels is necessary because not all EVs are created equal. Older, first generation EVs with smaller batteries are limited to fast charging at power levels between 20 to 50kW while newer EVs with larger batteries can reach charging rates of 300+kW. The bulk of EV models can be accommodated with stations with power levels between 50 and 250kW.

BC Hydro currently deploys stations at three power levels:

1. 25kW stations are deployed to serve as community stations, mainly targeting older EVs that cannot charge higher than 25kW and in areas where there is only single–phase power supply.
2. 50kW stations were deployed as the initial base power level for fast charging (and until recently, the highest power rating commercially available) and is the predominant power level in our current fleet of fast chargers.
3. 100kW stations were introduced into the fleet in 2021. The ratio of 100kW to 50kW deployments will increase dramatically moving forward as fast charging power levels of vehicles increases beyond 50kW.

BC Hydro will further develop a strategy for higher power charger deployments based on operating data of 100kW stations and developments in the EV market: the fast charging capability of new EVs coming to market and the power levels deployed by other public fast charging operators. The strategy will need to strike a balance between adequate power levels to meet customer convenience (acceptable charging times) and being able to provide service for all models of EVs.

13 SAE is a North America centric automotive standards body

5.3 Collaboration

As noted at the beginning of the section, collaboration is a key component of the planning framework. BC Hydro collaborates with other charging station operators by coordinating deployment plans to avoid competing on location if the demand does not support it and to co-locate on locations where the charger operators complement each other.

In meeting the objective of geographic connectivity, BC Hydro has avoided over 20 station locations because of its collaboration with the Ministry of Transportation and Infrastructure, Electrify Canada, Petro Canada and Fortis BC. The Fortis BC sites are in its service territory in the southern-central part of the province.

Collaboration also includes funding. All proponents of fast charger deployments mentioned above have or will receive funding support from the B.C. Government and Natural Resources Canada. Both B.C. Government and federal funding support dates back 2013 when BC Hydro installed the first fast charging station in Canada, in Nanaimo B.C.

5.4 Sustainment

BC Hydro's operation and maintenance practice and corresponding expenditures for fast charging stations were based on the fundamental asset management principle – value maximization and balance between Investment, Performance and Risk. Investment, Performance and Risk balance is used in the decision-making process and is reflected through factors such as the reliability of fast charging stations, preventive and corrective maintenance schedule, expected station availability and time to repair.

In its maintenance program, BC Hydro uses the preventive maintenance schedule recommended by the charger manufacturers in combination with a condition-based methodology and tracks the continuously evolving charger technology and its use on the BC Hydro fast charging station network to adjust the program as required.

Newly installed assets or assets with lower usage may require less frequent maintenance, while assets with high usage (>15 charging sessions per day) may need more frequent maintenance. Similarly, higher usage of a charger will lead to greater wear and tear of different charger components that consequently leads to higher maintenance cost.

Based on BC Hydro's operating experience, BC Hydro's sustainment plan utilizes a seven-year expected life for fast charger assets. Upon reaching seven years in service, BC Hydro will evaluate the condition, maintenance history, and usage of individual charging stations, to determine if replacement is required. To respond to a rapidly changing industry and advancements in EV technology, BC Hydro plans to replace end-of-life charging stations with upgraded equipment; predominantly higher power but also with new features and functionality such as load sharing, which will increase asset utilization by charging more than one car from a single charging station.

6 EV infrastructure Five-Year Plan, fiscal years 2022-2026

This section describes BC Hydro's Five-Year Plan for investment in EV charging infrastructure. The plan includes

- building new sites to electrify the remaining highways noted in section 5.1 to achieve province-wide, EV connectivity by 2024,
- building more sites in dense urban areas where we experience high EV adoption rates, and
- increasing the number of stations and power levels to further meet growing demand at busy sites.

The plan's targeted outcome is **145 sites and 325 stations by third quarter of fiscal 2026 (December 2025).**

The Five-Year Plan is a working document that will continue to evolve as more detailed planning commences for each highway corridor or urban/suburban installation. BC Hydro may add new sites or move planned sites as a result of research gathered from local stakeholders and coordination with other charging operators. The target number of sites and stations may also change over time.

6.1 EV Infrastructure deployments by economic region

Table 1 below lists the number of incremental sites and stations deployed by economic region in B.C. as of fiscal 2021 and by the end of the 5-year plan (by fiscal year 2026).

Table 1 Sites and stations by economic regions

Economic development regions	As of F21		Deployments: F22-26		By F26	
	Sites	Chargers	Sites	Chargers	Sites	Chargers
Mainland/Southwest	25	40	25	88	50	128
Vancouver Island and Coast	15	23	7	25	22	48
Thompson-Okanagan	18	18	5	25	23	43
Kootenay	5	5	3	13	8	18
Cariboo	6	7	7	23	13	30
Nechako	1	2	8	16	9	18
North Coast	1	2	10	20	11	22
North East	0	0	9	18	9	18
Total	**71**	**97**	**74**	**228**	**145**	**325**

The following charts breakdown the workplan deployments in terms of incremental sites and stations, respectively.

Figure 6 Incremental sites between fiscal years 2022 and 2026

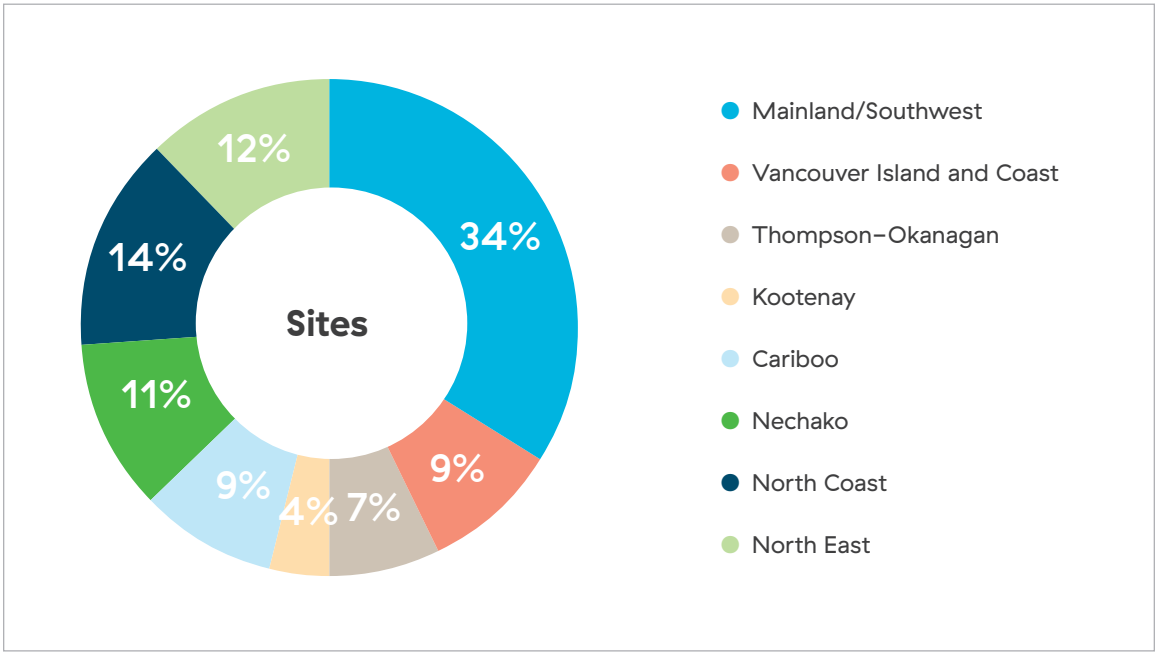
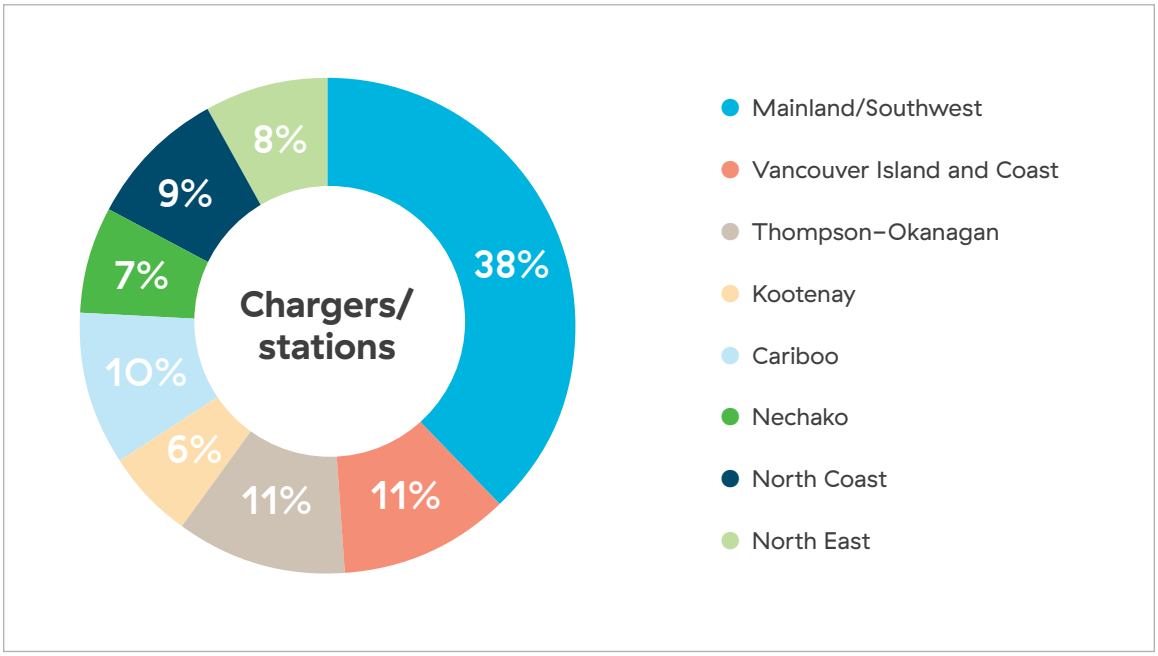


Figure 7 Incremental stations between fiscal years 2022 and 2026



The most populous region, Mainland / Southwest, receives the largest share of the new sites and stations, which is driven mainly by market demand: high population and high adoption rate for EVs.

6.2 EV infrastructure deployments to meet demand

Over 40% of the charger deployments from F22 to F26 are based on high demand and predominantly in the Mainland/Southwest region with some in the Vancouver Island and Coast region. These “high demand” charger deployments support the high volume of traffic passing through the Mainland/Southwest region and provides a substitute for home charging for EV owners that face barriers charging at home.

6.3 EV infrastructure deployments by fiscal year

The annual infrastructure deployment rate is illustrated in Figure 8 below: new sites will result in two or more incremental stations per site and expansion sites result in one or more additional stations per site. The combination of these incremental charger deployments is represented by the dark blue, Incremental Chargers trendline. As described in Section 5.4, end of life replacements of 50kW stations will be done with 100kW stations, where possible. The forecasted sustainment plan could result in 35 new, 100kW stations added to the fleet of stations by the end of the 5-year plan, depending on the number of stations that cannot have their service life extended economically. The forecasted sustainment deployments by year is added to the Incremental Chargers trendline to form the Total Chargers Deployed trendline depicted in Figure 8 below. Note that the 100kW stations installed for sustainment replacements do not increase the total charger count as they are replacements of retired 50kW stations.

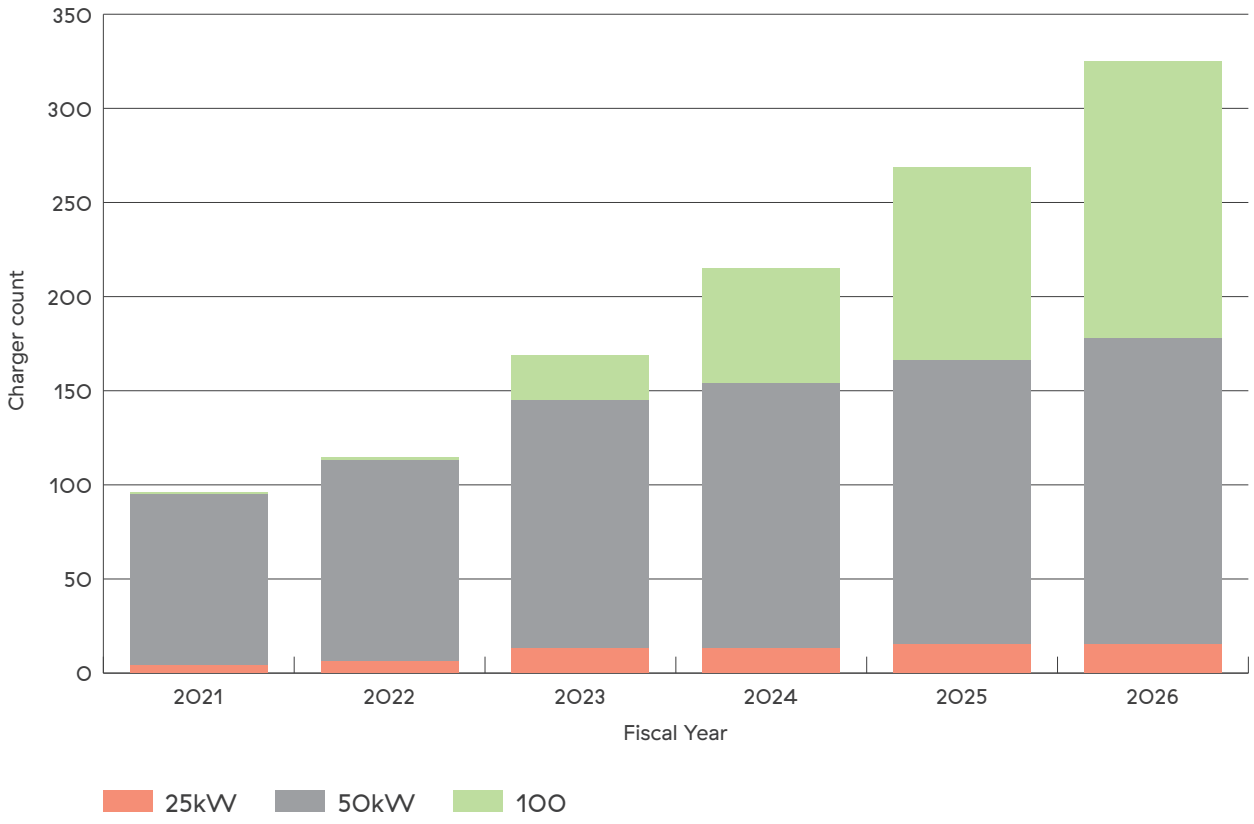
Figure 8 Fast charger workplan – annual deployments

6.4 Deployments by power level

Starting with the next phase of charger deployments (Phase 5), which is pending external funding approval (see Workplan Funding section below), the plan accelerates 100kW and higher charger deployments. At the end of the 5-year plan, BC Hydro's fast charging network should comprise between **140 to 150 stations with output of 100+kW**, which does not include the 35-100kW stations forecasted in the sustainment/replacement plan. Figure 9 below presents the growth of the fast charger fleet by power levels to address the trend in the EV market for faster charging capabilities of new EV models. At the end of the 5-year workplan, the anticipated composition of the fast charging fleet by power level is 5%-25kW, 50%-50kW and 45%-100+kW.

The Five-Year Plan focuses on increasing 100kW station deployments. However, as the EV market evolves and charger technology changes, BC Hydro will evaluate higher capacity (>100kW) stations for incorporating into future iterations of the 5-Year Plan, which will likely increase the budget for the Plan.

Figure 9 Cumulative charger deployments by power level (kW)



6.5 Workplan funding

The total capital budget for delivering the Five-Year Plan as forecasted in Table 2 below is $44.7M. As noted in the previous section, the budget will increase as BC Hydro evolves the Plan to incorporate higher power (>100kW) stations into the Five-Year Plan.

Table 2 Capital forecast by fiscal year

Five-year workplan capital forecast ($1,000s)						
Fiscal year	**F22**	**F23**	**F24**	**F25**	**F26**	**Total**
Growth Capital	2,302	9,174	9,008	10,148	9,894	40,527
Sustainment Capital	260	888	444	666	1,886	4,143
Total Capital	**2,562**	**10,062**	**9,452**	**10,814**	**11,780**	**44,670**
Less External Funding*	(1,125)	(3,880)	(4,025)	(4,965)	(5,300)	(19,295)
Net BC Hydro Capital Spend	1,437	6,182	5,427	5,849	6,480	25,375
						1,615
Capital Budget	5,339	5,714	5,247	5,312	5,378	26,990

* External Funding is assumed contributions from NRCan and B.C. Government

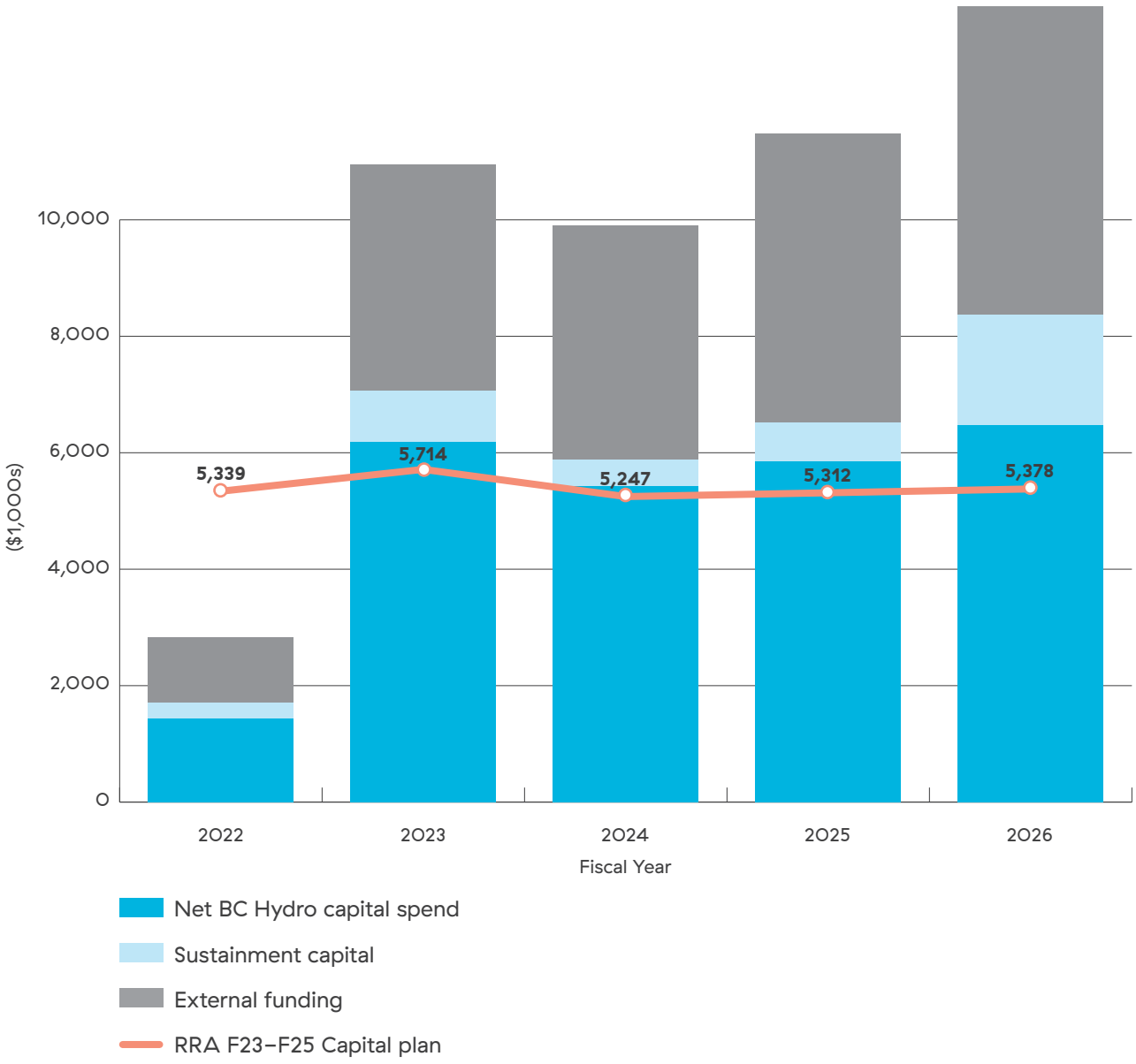
The external funding comprises federal and provincial sources: Natural Resources Canada (NRCan) and B.C. Government. Table 2 – Capital Forecast by Fiscal Year includes a federal funding cap according to the parameters dictated by NRCan's Zero Emission Vehicle Infrastructure Program[14] (ZEVIP). BC Hydro assumes to have two more successful funding applications for fiscal years 2023 and 2024 based on a maximum program funding contribution of $5M per project application. These external funding limitations will impact project funding in the latter years of the workplan, increasing BC Hydro's net cost per station built.

Figure 10 on the following page depicts the workplan's financial forecast, highlighting the heavy reliance on external funding and the alignment of BC Hydro's net capital spend with the capital plan that was filed with BC Hydro's Fiscal 2023 to Fiscal 2025 Revenue Requirements Application in August 2021.[15]

14 NRCan's Zero Emission Vehicle Infrastructure Program link: **https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/zero-emission-vehicle-infrastructure-program/21876**

15 Reference the subsection of Chapter 6 titled, *Electric Vehicle Charging Infrastructure* on page 6-92. The filing can be found at the following link: **https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/regulatory-filings/rra/00-01-2021-08-31-bchydro-f23-f25-rra-ex-b-2-application.pdf**

Figure 10 Funding model for the five-year workplan



The reliance on successful funding applications poses a significant funding risk to delivering the Five-Year Plan. To date, all fast charger deployments have leveraged NRCan and B.C. Government EV infrastructure funding. However, NRCan has indicated that its funding program is increasingly over-subscribed each year. BC Hydro will look to other funding sources to mitigate the funding risk such as CleanBC funding, which is administered by Fraser Basin Council.

7 Charging station attributes

Two key station attributes — rates and accessibility — are covered in the Five-Year Plan because they reflect recent regulatory developments and BC Hydro commitments.

7.1 BC Hydro EV fast charging rates

BC Hydro's public EV fast charging service is regulated by the B.C. Utilities Commission (BCUC). On March 15th, 2021, BC Hydro submitted a rate application to the BCUC after providing the service for free since 2017, and on March 23rd, 2021 the BCUC approved interim rates while the regulatory process commenced.

On January 26th, 2022, the BCUC issued **decision and order G-18-22**[16] that BC Hydro's EV fast charging rate application was not approved and the BCUC directed BC Hydro to request a dispensation from Measurement Canada for kilowatt-hour pricing and to re-file a rate application by Dec 31st, 2022. In the meantime, BC Hydro is permitted to continue with the interim fast charging rates, which are time based and tiered by power level: 25kW, 50kW and 100kW.

Based on BC Hydro's research, a significant percentage of customers have advocated for energy-based pricing ($/kWh), similar to how gasoline is sold by volume. This requires a direct current (DC) metering standard to be adopted by Measurement Canada. BC Hydro is uncertain as to Measurement Canada's response regarding the dispensation required for kWh pricing but BC Hydro will explore kWh pricing and idle fees over the course of 2022 in preparation to re-file a rate application as well as re-evaluating the overall pricing proposal. BC Hydro will also work with its technology and EV charging hardware suppliers to ready the network for energy-based pricing in the future.

7.2 Station accessibility

Accessibility is an important attribute that BC Hydro will incorporate at all new charging sites and site expansions moving forward. When a new charging station is added to a site, BC Hydro will build it to be accessible. BC Hydro will design for accessibility according to **BC Hydro's EV Fast Charging Design & Operational Guidelines (2021)**.[17]

Accessibility of charging station hardware will be based on market availability of equipment. BC Hydro will procure fast chargers that adhere to *Americans with Disabilities Act* accessibility standards or similar Canadian standards wherever possible.

16 https://docs.bcuc.com/Documents/Other/2022/DOC_65431_G-18-22-BCH-EV-Fast-Charging-Rates-Decision.pdf
17 https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/electric-vehicles/BCHydro-EV-Fast-Charging-Guidelines.pdf