INSTALLING ELECTRIC VEHICLE CHARGING IN YOUR BUILDING:

A guide to the selection, installation and maintenance of electric vehicle chargers in Multi-Unit Residential Buildings

Strata Guide

Plug In BC
A program of the Fraser Basin Council

British Columbia | cleanBC GO ELECTRIC

GLOSSARY

EV: Electric Vehicle

MURB: Multi-Unit Residential Buildings and Mix-Use Commercial/Residential Buildings

EVSE: Electric Vehicle Supply Equipment

ZEV: Zero Emissions Vehicle

DCFC: Direct Current Fast Charging

EVEMS: Electric Vehicle Energy Management Systems

OCPP: Open-Source Compatible Charging System

WELCOME!

This guide will take you through the selection, installation and maintenance of electric vehicle supply equipment (EVSE) in Multi-Unit Residential Buildings (MURBs), providing a step-by-step template to the process of making Electric Vehicle charging widely and easily available.

EV uptake is growing rapidly, particularly among the increasing number of individuals and families living in MURBs, and with that growth is the need for EV charging. The majority of charging occurs at home, so access to "at-home" charging is a critical factor determining whether households will purchase an EV. Retrofitting an existing MURB for EV charging presents unique challenges, so this guide aims to assist you in navigating the process of installing EV chargers efficiently and effectively.

Who is this guide for?

This information is for building owners, managers, and operators of multi-unit residential buildings and mixed-use commercial/residential buildings (MURBs), to support this important, ongoing transition to clean energy vehicles. It has been developed by the Fraser Basin Council, in partnership with the province of British Columbia's CleanBC Go Electric Program, and in consultation with industry experts, to provide the most reliable and relevant information.

Benefits of Electric Vehicle Charging in MURBs

The most important consideration in the installation of EV charging infrastructure, regardless of building type, is strategic planning for the future success of the buildings. While it may be attractive, particularly from a financial standpoint, for condo boards, strata councils or property developers to address requests to install charging stations on an as-needed basis, this approach is likely to lead to considerable challenges and costs down the road. Ensuring that charging installations in MURBs focus on future needs through the use of solutions that also make sense for today, is critical to supporting the continued successful uptake of EVs over the long-term.

The following are some of the potential benefits of installing EV charging stations:

- Enhanced property value: Drivers prefer overnight, at-home EV charging , and research has shown that the proximity of EV chargers correlates with higher property value. Under the BC Zero Emissions Vehicle (ZEV) Act, 10% of new vehicles will need to be ZEVs by 2025, stepping up to 100% by 2040. This, and the growing EV market, will increase demand for homes with installed EV chargers.
- Reduced costs for residents: While station operators add increasing charging fees for public EV charging, the cost of electricity for charging an EV at home remains relatively low, usually under $30/month. This is over 75% less than the cost of gasoline for a comparable car in BC. If using networked chargers, a strata can set prices to fairly account for the cost of infrastructure, chargers, electricity, parking, or any combination of these.
- Improved air quality: Availability of EV charging at home is a driver of EV uptake. More EVs means less car exhaust, reducing toxic carbon monoxide, cancer-causing agents, and respiratory irritants in and around buildings. It can also reduce the energy consumption of on-demand ventilation systems, which don't have to work as hard when air quality is better. In BC, most of the electricity is generated from renewable power, so EVs also dramatically reduce greenhouse gas emissions.

> **"100% of new cars will need to be Zero Emissions Vehicles by 2040."**

Basics of Electric Vehicle Charging in MURBs

If MURB residents aren't able to easily access EV charging in their homes, they are far less likely to become EV owners. Charging access is complicated by the added administrative layers associated with multi-residence buildings, Strata bylaws and rules, more complex technical requirements and the associated higher costs. The goal is to reduce these barriers and make EV charging easily available to BC MURB residents. To start, let's review the types of EV charging available:

CHARGING LEVELS

Level 1 (120 V, AC)

This type of charging uses 120-volt (V) alternating current (AC), delivered by a standard three-prong household plug. Generally, EVs come with a Level 1 charger as standard equipment, which can add 5-8 km of range per hour, which can meet the daily charging needs of most commuters in an overnight charge.

New 120 V outlets are rarely installed for EV charging, but existing outlets can provide economical access to charging where Level 2 is not available, or coupled with other charging levels as part of a larger EV strategy. Controllers can also be added to 120 V outlets to control access and monitor and/or levy fees for use.

Level 2 (208/240 V AC)

Level 2 charging uses the same voltage as an oven or clothes dryer, and adds from 30 to 50 km of range per hour. Level 2 charging stations are the most common for both public and at-home charging, and many allow for networking, and/or incorporation into electric vehicle energy management systems.

Level 3 (DCFC)

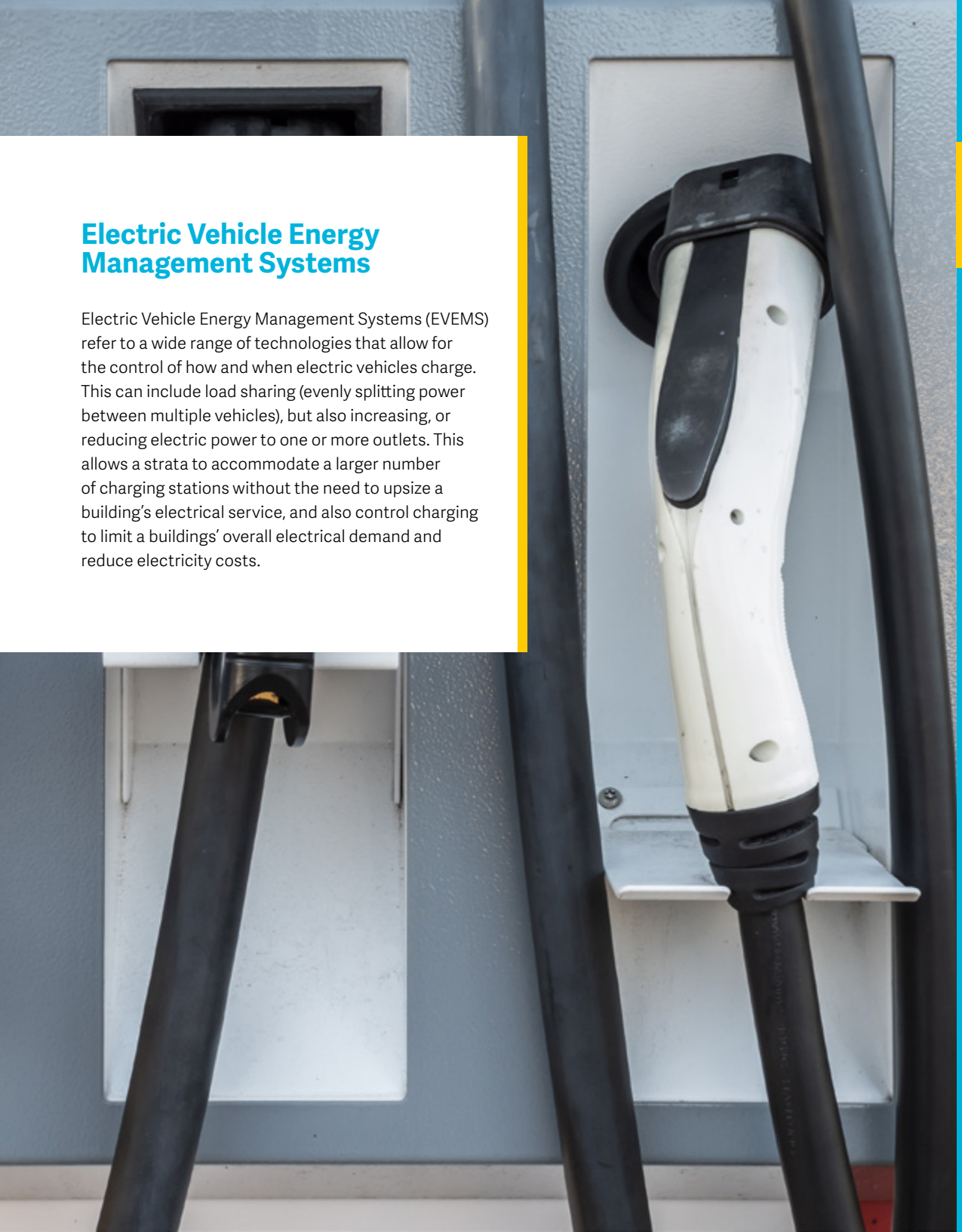
Level 3 charging, also known as Direct Current Fast Charging (DCFC) uses high voltage electricity to deliver charging that is 3 to 30 times faster than Level 2. However, higher cost equipment and upstream infrastructure make this level impractical for most residential applications.

COMPATIBILITY AND NETWORKING

Many chargers are able to connect to a network via hardwired connection, wi-fi and/or cellular signal. This allows for more advanced controls and can provide a variety of functions including:

- billing or payment collection
- remote monitoring and updating
- online reservation systems
- mobile app integration
- display screens for communication
- charging station reports
- user access controls

The cost and number of features vary by equipment capacity and network provider, and some chargers' network connections are proprietary (i.e. charger can only run on the manufacturer's own network), while others (i.e. those using non-proprietary systems, such as OCPP) can run on compatible 3rd party networks.



Electric Vehicle Energy Management Systems

Electric Vehicle Energy Management Systems (EVEMS) refer to a wide range of technologies that allow for the control of how and when electric vehicles charge. This can include load sharing (evenly splitting power between multiple vehicles), but also increasing, or reducing electric power to one or more outlets. This allows a strata to accommodate a larger number of charging stations without the need to upsize a building's electrical service, and also control charging to limit a buildings' overall electrical demand and reduce electricity costs.

STEPS TO EVCS INSTALLATION

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1.3 Gather Information

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3.3 Develop the Final Design

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5.1 Develop an EV Charging Policy

5.2 Conclude your Agreement with Network Service provider (if applicable)

1.1 Start the Conversation about the Installation of Electric Vehicle Charging

Any process has to start somewhere, and for installing EV chargers in a MURB, this usually means talking to the strata council about the idea. It is best to start the conversation with an exploratory and collaborative tone, not trying to push any specific outcome. A strata council is more likely to authorize any activity regarding EV charging if they are included in the process, and engaging them early on in a constructive fashion will prevent them from feeling excluded, or surprised by the process. As most councils are volunteers, if one or more people outside the council are able to take the lead on the project, it may help it progress more quickly. Communicating the intended steps to engage membership on the question of EV charging, and how this information would be used can provide comfort regarding the process, and help a council to understand that they are not committing to anything definitively at this stage. Recognize that there can be many factors that impact a strata's desire to install EV chargers: resource and time requirements, perceived fairness of access and distribution of costs, responsibility for managing an EVSE system, strata administrative requirements (e.g. rules development), and others. The better you are able to speak to, and plan for these concerns at the start, the greater the chance of project success.

1.2 Survey Residents

Before planning an installation, a strata first needs to understand if its members are supportive of the idea. A simple survey is one of the easiest ways to accomplish this. A short preamble followed by a few relevant questions, such as the below, is a good way to start gauging interest in EV charging.

"Did you know that by 2040, new gasoline and diesel cars will no longer be available for purchase in BC? Looking ahead, our strata is thinking about how to plan for this, reduce our emissions, and improve air quality around our homes. Please help us do this by filling out this short survey about electric vehicle charging.

1. Do you own a plug-in electric vehicle?
2. Are you considering buying an electric vehicle?
   - **a.** If yes, when are you considering purchasing one (e.g. this year? next year? within 2-5 years? within 5-10 years?)
3. If you drive, on average, how many kilometres do you drive in a week?
4. Are you interested in the possibility of installing electric vehicle chargers in the parking area?
   - **a.** Would you be interested in having EV charging at your parking stall(s)?
   - **b.** If yes, how many stalls would you want to equip with charging?

Thank you for your input!"

In some cases, a strata council may be unwilling to explore EV charging at all, which can be frustrating for interested strata members. While a cooperative approach between strata members and the council is always best, it is possible to trigger a special general meeting or to add a resolution to the agenda of an annual general meeting by obtaining a written petition supported by 20% of a strata's voting members.

1.3 Gather Information

Once you have determined the level of support for EV charging, this should be communicated to the strata council. The next step is to gather information about the building and its electrical infrastructure in order to determine what kind of installation makes the most sense. This should include the data below - note that acquiring these may require access to the electrical room or authorization from the strata council or property manager, so it's best to make sure you have this first.

Budget available for installation - Although this may change over the course of the process, it is good to have an idea of how much funding is likely to be available for an EV charging installation, or phases thereof. This may be challenging to determine in some cases, but a review of the strata's financials and building depreciation report and/or asset management plan can help shed light on how much funding might be made available for new capital expenditures.

Electrical utilities - As they distribute electricity locally utilities play a key role in EVSE installations. As these utilities provide power to MURBs, they possess information required in planning an installation, such as a building's electrical transformer capacity, and its peak electrical demand. If electrical service needs to be upgraded to accommodate EV charging, utilities would be the ones coordinating this work. In British Columbia, most electricity is delivered by BC Hydro or FortisBC (in Similkameen-Boundary), but some municipalities operate their own utilities (e.g. Nelson, New Westminster).

Transformer size (in kVA) - Designing the best charging installation for a building requires the knowledge of how much power can be supplied to it via the building's transformers. This is usually available from the local electrical utility, but may also be listed on the building's electrical drawings.

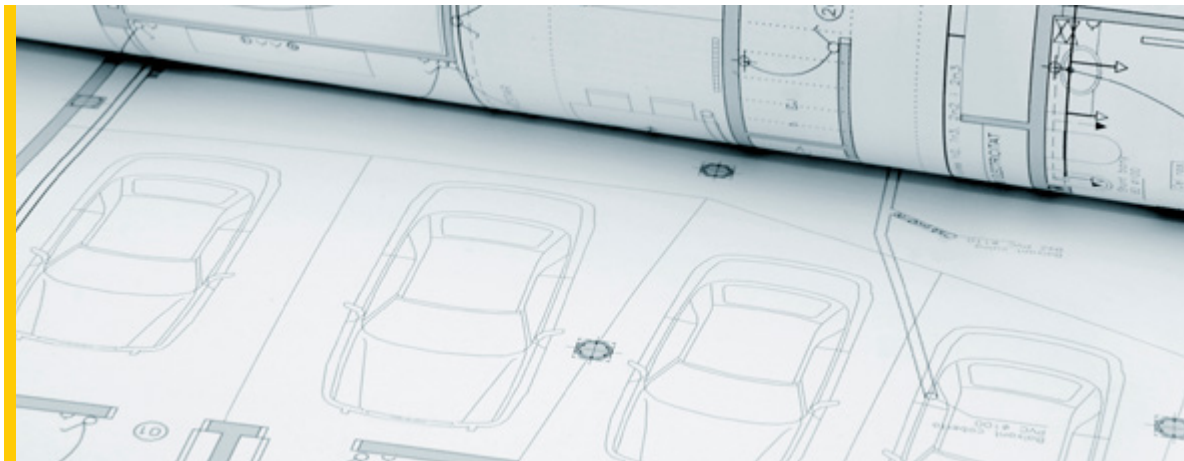
Maximum monthly building electrical demand (in kW) - Your building's maximum monthly electrical demand is necessary to determine how much 'spare' power your building has available. This is needed to figure out how many, and in what configuration, EV chargers can be installed. Max demand is available from the utility, but may require the authorization of a building's property manager or strata council for release.

Number of parking stalls (visitor, used, unused, developer-owned) - Knowing how many parking stalls are currently used for different applications is useful in determining the likely number of EV charging stations you may want to install, and in what order.

Number of open slots in electrical panel(s) - Because EV chargers will need to be supplied power from breakers on an electrical panel, knowing how many slots are free for new circuits will affect the design of an installation.
Free space in electrical room - In the case where there is inadequate space in an existing electrical panel, additional electrical panels will be required. The amount of free wall space to accommodate this will influence installation design.

Building electrical drawings - Knowing the exact location of existing electrical infrastructure as shown in building electrical drawings can help in planning a cost-optimized EV charging installation. These may be available from your local municipality or Technical Safety BC, but may require the authorization of a building's property manager or strata council for release, although the original developer of the building may also retain copies, or copies may be held on site within the building.

Architectural drawings of parking floors - Knowing where parking spaces are located relative to electrical infrastructure will help in optimizing system design. These may be available from your local municipality, but may require the authorization of a building's property manager or strata council for release, although the original developer of the building may also retain copies, or copies may be held on site within the building.



1.4 Set Your Electric Vehicle Charging Priorities

In determining your initial approach, it is valuable to think about general priorities for EV charging. A skilled contractor can create the most efficient and cost effective system by starting with your objectives, and designing to those parameters. While there are many things to consider, determining how important the following values are will help guide your building's installation plan:

ACCESS

Access to infrastructure by those who need it is critical to the success of an EV charging retrofit. While owners may want each parking stall to have its own dedicated charger, this may or may not be cost effective for an initial deployment, depending on its size and configuration. Alternative approaches might be to set up charging in visitor parking, or installing stations in clusters of adjacent parking spaces, then allowing swapping parking spaces. Using networking to limit access to paying users may be desirable.

Questions to consider:

- Who will have access to EV charging stations? (e.g. all members, only authorized users, etc.)
- How will access be controlled? (e.g. by network via RFID or App or by location, etc.)

COST ALLOCATION

How costs are allocated for installation and use of charging stations will be an important factor in system design. Determining who pays for, and retains ownership of different types of equipment (e.g. member vs strata, wiring vs charger) can help alleviate equity concerns. Likewise with the levying of fees for usage (e.g. billing per minute, per kW, or flat rate).

Questions to consider:

- What capital costs will be paid by the strata vs individual members?
- Who retains ownership of the elements of an installation?
- How will use of chargers be paid for? (monthly fee, per minute, per kWh, etc.)

COST EFFECTIVENESS

Achieving acceptable cost level will depend on available funding, as well as services required to meet other objectives. By nature, larger deployments are more expensive at the project level, but can substantially reduce the average cost of individual stalls. Careful planning of initial deployments may help to reduce the cost of later additions. While 3rd party network services can make payment collection from users easier, they often entail service fees, and may require more expensive chargers. Rebates may only be available for a limited duration, making timing of implementation important.

Questions to consider:

- Is minimising short-term or long-term costs more important?
- Is the ability to allocate accurate costs for usage (e.g. via network) more important than the additional hardware and service costs?
- If incentives are available, what are their limitations (dollar value, number of chargers, end dates, etc.)

SCALABILITY/FUTURE-PROOFING

Choices regarding infrastructure should be forward-looking, understanding that by 2040, all new vehicles sales in the province will be zero emissions. This means that planning for any installation should consider how it may affect future installations to ensure their feasibility and cost effectiveness. This may entail using EVEMS or installing lower output chargers to avoid having to upsize a building's electrical transformer, or installing oversized electrical panels, conduit and wiring to facilitate future deployments. In some cases, other building retrofits (e.g. LED lighting in parking) can reduce electrical demand, and allow for more chargers to be installed.

Questions to consider:

- How many chargers are you looking to install in the near term? Long term?
- Are you considering installing EV stations in phases?
- Are there other retrofits that can facilitate more chargers being installed?
- Do you want to be able to switch between networks in the future?

EASE OF IMPLEMENTATION

When planning EV charging deployment, thinking about how to balance strata concerns may simplify the process. For example, fully automated billing may be more costly, but can improve the sense of fairness, and help gain strata approval. In some cases, longer (and more costly) wiring runs may avoid the need to make building structural modifications, which can reduce the threshold of support needed to approve a project.

Questions to consider:

- Are members willing to switch parking spaces in order to have EV charging?
- Is the strata willing to collect payment for use of EV chargers from users directly?

1.5 Set the Scope of Work

It is important to determine at the outset what you are looking to accomplish at this phase. Are you looking to come up with a plan, pre-wire parking stalls, install chargers and initiate service, or only a subset of these? While there is often a desire to get EV chargers as soon as possible, especially among EV drivers, it is very highly recommended to develop an EV-ready plan prior to installing charging hardware. While it is possible to 'test the water' with the installation of a small number of chargers, their placement and wiring may not be amenable to a later expansion of service. Also, if a strata opts for a networked service, they will want to ensure that the service provider is capable and cost-effective for a larger rollout of charging. EV-ready plans can help avoid the pitfalls of isolated installations, and come up with a strategy that allows for measured, incremental expansion, if necessary. The cost of such a plan will depend on the building (generally several thousand dollars), but Provincial rebates may be available specifically for this purpose. An EV-Ready plan should contain the following:

1. Electrical capacity assessment

a. Determination of available spare capacity of the building proposed for implementation of EV charging infrastructure

2. Determination of minimum charging performance requirements

a. A charging performance assessment is the analysis of required charging power in order to achieve reasonable driving range, when all parking spaces are used by an EV.

3. Determine charging options for parking spaces to be made EV Ready

- **a.** A minimum of one EV Ready parking space per residential unit is provided (i.e. a parking space features a complete electrical circuit terminating in a junction box capable of providing level 2 EV charging).
- **b.** Identify if electrical service upgrades are needed;

4. Describe compatible EV Energy Management Systems, Electric Vehicle Supply Equipment (EVSE), and appropriate services

- **a.** Designation that when an EVEMS is implemented, the EVSE must be compatible with the EVEMS
- **b.** For designs where an electric vehicle energy management system is intended, the electrical infrastructure should include all communications equipment, control systems installation, licensing, and permitting required to operate the system.

5. Cost estimates Sufficient for Budgeting Purposes

- **a.** Cost estimate to install electrical infrastructure and EVSE (if applicable) to implement the EV Ready Plan

In the case where a strata opts to install charging stations without an EV-ready plan, it should be kept in mind that expansion after the fact may require the replacement of initial chargers. While this may be considered acceptable for one or two chargers, unrecoverable costs may be substantial with a larger, uncoordinated deployment. If the intent is only to do a limited initial charger deployment, in the long term is still likely to be more cost effective when done as part of a larger EV-ready plan. Make sure to communicate your intentions clearly to your electrical professional.

2.1 Seek out Qualified Professionals

While many electrical professionals are able to install EV charging stations, it is strongly recommended that a strata seek out a professional with experience and qualifications in designing systems for MURBs, as the needs and limitations are very different than installations in other settings.

Electricians, electrical engineers or engineering technicians, and EVSE firms each play a critical role in the installation of EV charging in a MURB. While electricians will typically conduct the hands-on installation of any EVSE, for deployments in any MURB an electrical engineer or engineering technician will be needed to produce electrical designs. Often, a specialized EVSE firm will retain electrical professionals for these purposes and manage the entire process, guiding the strata through the necessary steps of an installation and providing options tailored to the needs of your specific building. In other cases, the strata may opt to contract and manage the project elements separately.

Specifically, a strata should look for a professional (or firm) that is able to conduct a EV-ready plan showing options for achieving charging for all possible vehicles. Be wary of those who are willing to install isolated chargers without concern for the larger context of future strata needs. Remember that electrical design drawings need to be signed and sealed by an electrical engineer or qualified electrical engineering technician, but that this may not be required for initial planning purposes.

2.2 Get Initial Consultation and Estimates

It is generally a good idea to obtain quotes from several sources. Make sure that the firms you reach out to understand your intention and the scope of work. As a rule, you will be better served by one that has experience in installations in MURBs, and has specialization in planning for and deploying full-building installations. Note that some firms will either manage contractors too, or themselves carry out all the steps defined in your scope of work. When short-listing or selecting a quote, try to keep in mind long-term cost implications - a less expensive design may have a more expensive implementation and operation. Make sure to understand what is, and isn't included in the quotes provided to you in order to assess them fairly - separation of costs for the different project elements may be helpful for this, and in planning for future costs.

Access to the electrical room(s), all parking garage levels, and other limited access areas (e.g. office, mechanical rooms) may be required as part of the consultation, make sure that there is someone on site that is able to provide this for site visits.

2.3 Seek your Council Approval to Proceed

Once you have settled on a short-list or preferred quote, bring it back to the strata council for review and approval. Make sure you understand the quote and its elements enough to explain it to the council. It may be beneficial to bring in a representative of the firm via phone or video conferencing to answer questions.

If the strata council is unable to approve the work, ask questions to determine what issues are preventing approval - a firm may be able to modify its quote to address concerns. If the denial seems objectively unreasonable, it is possible to bring the request directly to the strata membership at a special or annual general meeting, however, this may require demonstrated support by 20% of a strata's voting members. As noted, working collaboratively with strata council is best practice whenever possible, so understanding and addressing council's concerns is more likely to achieve desired objectives faster. A council may also choose to approve a quote, contingent upon successful application for rebates.

2.4 Apply for Pre-approval

Once you have approved a quote, it is recommended that you apply for available government rebates, which can substantially reduce the costs of planning and deployment. The Province of British Columbia's CleanBC program offers three rebate streams to support EV charging in MURBs:

1) EV-ready plans rebates - fund the planning and design of an EV charging system
2) EV-ready infrastructure rebates - assist the installation of electrical equipment required for charging (e.g. electrical panels, breakers, conduit, wiring, etc.).
3) Charging stations rebates - support acquisition and installation of networked Level 2 EV chargers.

More information on these rebates is available at:

https://pluginbc.ca/incentives

https://goelectricbc.gov.bc.ca

Depending on how your project is phased and the terms of your agreement, you may need to conduct steps 1.5 to 2.4 several times (e.g. for EV-ready plan, EV-ready infrastructure installation, one or more charger deployment phases).

3.1 Develop the Design Options (EV-Ready Plan)

Once your strata has signed an agreement with a qualified electrical firm, they will set to work on developing a set of EV-ready design options for you to consider. They will likely need access to all the data collected during your initial information gathering, and may need to again visit the site, so make sure you have access to these available as necessary. Once this has been completed, and you have paid for the plan you will be able to complete your rebate application for the EV-ready plan (unless your plan also includes final design work, in which case you would finish the application after that has been completed).

3.2 Select your Options (EV-Ready Plan)

As part of an EV-ready plan a firm will outline options for deployment, including technology type, equipment makes, phasing, etc., per your scope of work. Ask lots of questions about the options presented, and think about how they align with your objectives. Remember to think about the long-term implications of different routes, including future needs, total cost of installation (all phases), networking fees, and electrical demand costs. A reliable firm should be able to speak to all of these and clarify the benefits and drawbacks of each option. Choose the one that makes the most sense for your building, given your goals and resources.

3.3 Develop your Final Design

Once you have chosen the design option that best works for you, electrical drawings will be required to obtain an electrical permit for substantial electrical work. These will need to be completed by an electrical engineer (P. Eng) or qualified electrical engineering technician (Eng. L). This may be included as part of your EV-ready plan, or may need to be contracted separately.

4.1 Initiate your Installation

Once you have completed designs, you can start the process of doing an installation, whether it be for infrastructure, chargers, or both. Depending on the route taken, you may need to seek contractors to conduct the installation, per your EV-ready plan. If this is the case, you will want to obtain quotes to this end. However, under some agreements the firm that produced the EV-ready plan will manage the tender process, or may employ its own electricians to conduct installations. You will want to ensure that the electrical contractor is able to communicate with the firm that made your plan in order to clarify any questions that may arise. Normally one of these parties will apply for an electrical permit on your strata's behalf.

Once the installation has been completed, a final inspection will be conducted by an electrical inspector from the municipality or Technical Safety BC to ensure work has been completed correctly prior to use. The new electrical equipment will also need to be added to your strata's electrical operating permit, which should also be conducted by one of your electrical professionals.

4.2 Complete your Rebate Application

Once your installation has been completed and paid for, you can complete your application for rebates. Ensure that you retain all receipts and proof of payment throughout the process, as well as any inspection reports, and related strata documents to ensure your application for payment is processed promptly.

5.1 Develop an EV Charging Policy

With the infrastructure and/or chargers being installed, it is a good time to determine exactly how your strata will manage EV charging. While some strata organizations have opted to modify their bylaws to accommodate EV charging, a substantially easier way to achieve the desired outcome is through strata rules, which can help to avoid legal costs and the need to register changes with the land title office. It is a good idea to know what your chargers (and network, if applicable) are capable of when going through this process. When developing these policies, it is important to consider the following:

- Who will be responsible for managing charging (installations, access, communication with network provider)?
- Who will pay for and retain ownership of chargers (excluding upstream infrastructure)?
- What is the process for adding and accessing chargers?
- How billing will occur, and at what price?
- Under what conditions may the strata limit access to chargers?
- Who is liable in case of malfunction or damage?

For more guidance on this process, see the Condominium Home Owners' Association of BC Bulletin on EV charging.

5.2 Finalize your Agreement with Network Service Provider (if applicable)

If you have opted to use an external network service provider to help manage your charging system, it is now time to conclude an agreement with them in order to activate your chargers. The cost of this will depend on the type and level of service provided, but the details should be consistent with your strata's rules. Keep in mind that you may be able to negotiate based on the size of current (and planned) deployment. If you opted for an open-source compatible charging system (e.g. OCPP), you may have several network providers to choose from, whereas you may have fewer options with proprietary hardware.

THANK YOU FOR READING!

You now have the information needed to get started on installing EV chargers in MURBs! The process is complex, yet it is unquestionably important: by taking this important step you are encouraging the further successful uptake of EVs in the future, and helping to create a more sustainable, healthier environment and community.

A Program funded by the Province of British Columbia