Electric Vehicle Charging Bylaw Recommendations for Richmond's Multiple Unit Residential Buildings (MURBs) from Plug-in Richmond

Recommendations

Notes: Recommendations with an asterisk * have a detailed rationale below the list.
"Net cost" refers to the cost after deducting any applicable government or other rebates.

1. * Given the initial infrastructure cost of metering individual vehicle electricity consumption and the ongoing cost of monitoring and billing (spending dollars to track pennies), use a flat rate charge by the MURB to the vehicle owner of $35 per month in the absence of mutual agreement on another rate or consumption metering.

2. * Encourage BC Hydro to increase the step 1 electricity rate consumption allocation for each electric vehicle owner from 22.2 kWh to 32.2 kWh per day so the flat rate charge by the MURB to the vehicle owner can be reduced to $28 per month.

3. Allow MURBs to require that electric vehicle owners supply their own 240V electric vehicle supply equipment (EVSE) with an appropriate NEMA plug for a 240V receptacle close to their parking stall.

4. To dramatically reduce the electrical power demand on the MURB and on the grid, allow MURBs to require electric vehicle owners to set their vehicles' charging timers to start at midnight and only override to start charging immediately in an emergency.

5. * Allow MURBs to install an electrical load management module to serve four 240V EVSEs on one 40-amp circuit by using round robin electrical switching at a time interval selected by the MURB so that each vehicle is provided with a 40-amp electrical supply in turn.

6. Allow MURBs to require that electric vehicle owners pay for 25% of the net cost of an electrical load management module that serves their vehicle including cases where the module is installed at a later date as more electric vehicles are added to the system.

7. Require both existing MURBs (upon request for charging from a resident electric vehicle owner) and new construction MURBs to install and pay for the net cost of wiring from the electrical panel to a central point in the parking area for sufficient 40-amp circuits to service half the number of parking stalls using load management modules. For example, a parking area for 48 vehicles would require six 40-amp circuits. Require existing MURBs to have at least one 40-amp circuit available in the electrical panel and connected to the wiring. Require new construction MURBs to have all the required circuits available although they will not be connected to the wiring until needed.

8. Allow existing MURBs to require that electric vehicle owners pay for the net cost of wiring from the central point in the parking area to a junction box at a point where a future load management module can be installed to serve four parking stalls then wiring from that point to a point close to their parking stall including an appropriate NEMA 240V receptacle.

9. Require new construction MURBS to install a 240V capped receptacle box at every parking stall and unwired conduit from the stall to a junction box at a point where a future load management module can be installed to serve four parking stalls then unwired conduit from that point to the central point in the parking area.

10. Require existing MURBs to pay for the net cost of increasing the electrical power supply to the electrical panel, if necessary, the installation of required 40-amp circuits in the panel and the installation of load management modules as these become necessary.

11. Where the EVSE and 240V receptacle (and possibly the load management module) are outside and exposed to the elements, require the MURB to pay for the net cost of suitable outdoor housings for the receptacle and load management module and require the electric vehicle owner to supply an EVSE designed for outdoor use or a suitable outdoor housing for it.

Details

1. Flat rate charge instead of individual vehicle electrical consumption metering:

    1.1 Calculating cost of maximum electricity consumption per electric vehicle:
    - Maximum annual kilometers driven = 18,000.
    - This equates to approximately 50 kilometers per day, 7 days per week.
    - Vehicles driven more than 18,000 kilometers are likely charging at destination or along route for excess kilometers.
    - The electricity consumption per kilometer driven varies by vehicle model and depends on city or highway and accessories on or off, but the maximum consumption using EPA combined city/highway is roughly 0.2 kWh per kilometer driven. For 18,000 kilometers, that equals 10 kWh per day or 3,600 kWh per year.
    - There are two different residential electricity rates, step 1 and step 2, plus rate rider and GST. The mid-point between the two rates including rate rider and GST is $.117975 per kWh.
    - The annual electricity cost of 3,600 kWh is approximately $425 or $35 per month.

    1.2 Cost of electricity consumption for vehicle driven less than 18,000 kilometers annually:
    - Assume annual kilometers driven = 12,000.
    - Electricity consumption would be 2,400 kWh per year.
    - Annual electricity cost would be approximately $283 or $24 per month.

    1.3 Flat rate charging to electric vehicle owner for electricity consumption:
    - Assume vehicle owner is charged a flat rate of $35 per month by the MURB.
    - An owner driving 18,000 kilometers per year pays for the electricity consumed.
    - An owner driving 12,000 kilometers per year pays an extra $11 per month, $0.37 per day.
    - Compare this to the extra cost and time required to install individual consumption metering, track the monthly consumption and bill it to the vehicle owner each month.

2. Reducing flat rate charge:

    2.1 Cost of electric vehicle electricity consumption at the step 1 rate:
    - For residential users, BC Hydro allocates a maximum of 22.2 kWh per day for all electrical consumption at the step 1 rate and charges any excess at the higher step 2 rate. This

penalizes electric vehicle owners since some of their daily consumption of 10 kWh for vehicle charging is charged at the higher rate.

- If all of the electricity consumption is calculated at the step 1 rate instead of the mid-point between the step 1 and step 2 rates, the annual electricity cost of 3,600 kWh including rate rider and GST is approximately $340 or $28 per month.

5. Load management module to serve four 240V EVSEs on one 40-amp circuit:

5.1 Required charging time:

- Assume vehicles have each travelled 50 kilometers and require 10 kWh of electricity per day supplied over 6-hour period between midnight and 6 am.
- Charging at 6.6 kW will require 1.5 hours per vehicle. The load management module switches the 40-amp circuit to a different vehicle at a user determined time interval, usually every half hour. Using this round robin switching, all four vehicles will be charged in 6 hours. Should a vehicle only have a 3.3 kW EVSE, it will continue charging for an additional 1.5 hours assuming the other three vehicles are fully charged. However, the power demand on the MURB electrical infrastructure during this additional time period will drop from 32 amps to 16 amps.
- Some existing EVSEs can share a 40-amp circuit, but use proprietary software and require EVSEs from the same manufacturer. A separate load management module is required that can operate with any compatible EVSE with a charging rate of at least 3.3 kW. Compatibility requires automatic reset in case of power interruption, a standard feature of most EVSEs.

5.2 Load management solutions:

- There are large and expensive commercial load management solutions requiring EVSEs from the same manufacturer with suppliers offering to install, remotely manage and handle billing in return for a fee.
- There are several EVSEs with the ability for two identical units to share one 40-amp circuit such as Clipper Creek's HCS 40 Share and Flo's X5. These are intended primarily for individual residences with two electric vehicles.
- Four of Tesla's Wall Connector EVSEs can be linked together to intelligently share power from a single circuit breaker. A distribution box with 240V terminal block is required to split power between multiple Wall Connectors. A communication cable is required between the Wall Connectors to daisy chain them so the units operate as a network. This allows one station to provide maximum power to a single vehicle, or to split power when more than one Tesla is plugged in. Maximum distance between Wall Connector units is 49 ft.
- Cyber Switching has an EV Master Controller that switches one 40-amp circuit to four EVSEs at a user determined time interval on a round robin basis. The EVSEs can be from different manufacturers and only require automatic reset in case of power interruption, a standard feature of most EVSEs. See attached EV Master Controller User Manual. The suggested list price is US $4,999, but the manufacturer has indicated that this new product could be made available in BC at a substantial discount. It appears to have the required functionality.

The CS-EVMC Series
Electric Vehicle Master Controller

Cyber Switching Solutions is introducing a new solution called the EV Master Controller (EVMC). The EVMC brings substantial savings to the installation costs of these needed charging stations as well as to the monthly utility bill.

Designed to work with myriads of charging stations, the EVMC adds efficient power management and allows for cost-effective deployment of EV charging stations in all sorts of environments. Cyber Switching has changed the established conventional concept of dedicating a 'Single Power Source' to provide power to the other charging stations, resulting in a dramatic reduction in power infrastructure needed.

The savings realized by NOT having to bring in full infrastructure for multiple charging stations greatly decreases the time frame for the return on investment.

Benefits of EVMC:

- Provides more charging stations while minimizing the installation cost of power facilities (by up to 50%).
- Significantly reduces the impact of EV charging on peak demand by up to 75% or more.
- Reduces "range anxiety" for employees and tenants, as they are assured a charge for their vehicles.
- Allows for charging flexibility with programmable rotation times and priority assignments.
- Increases employee productivity and reduce the stress and 'down time' due to having to move their vehicles to and from charging stations.
- Keeps EV fleets charged up effectively and efficiently, while keeping the utility billing at a minimum.
- Allows for greater use of grants and incentives for EV charging system projects

The CS-EVMC Series
Electric Vehicle Master Controller

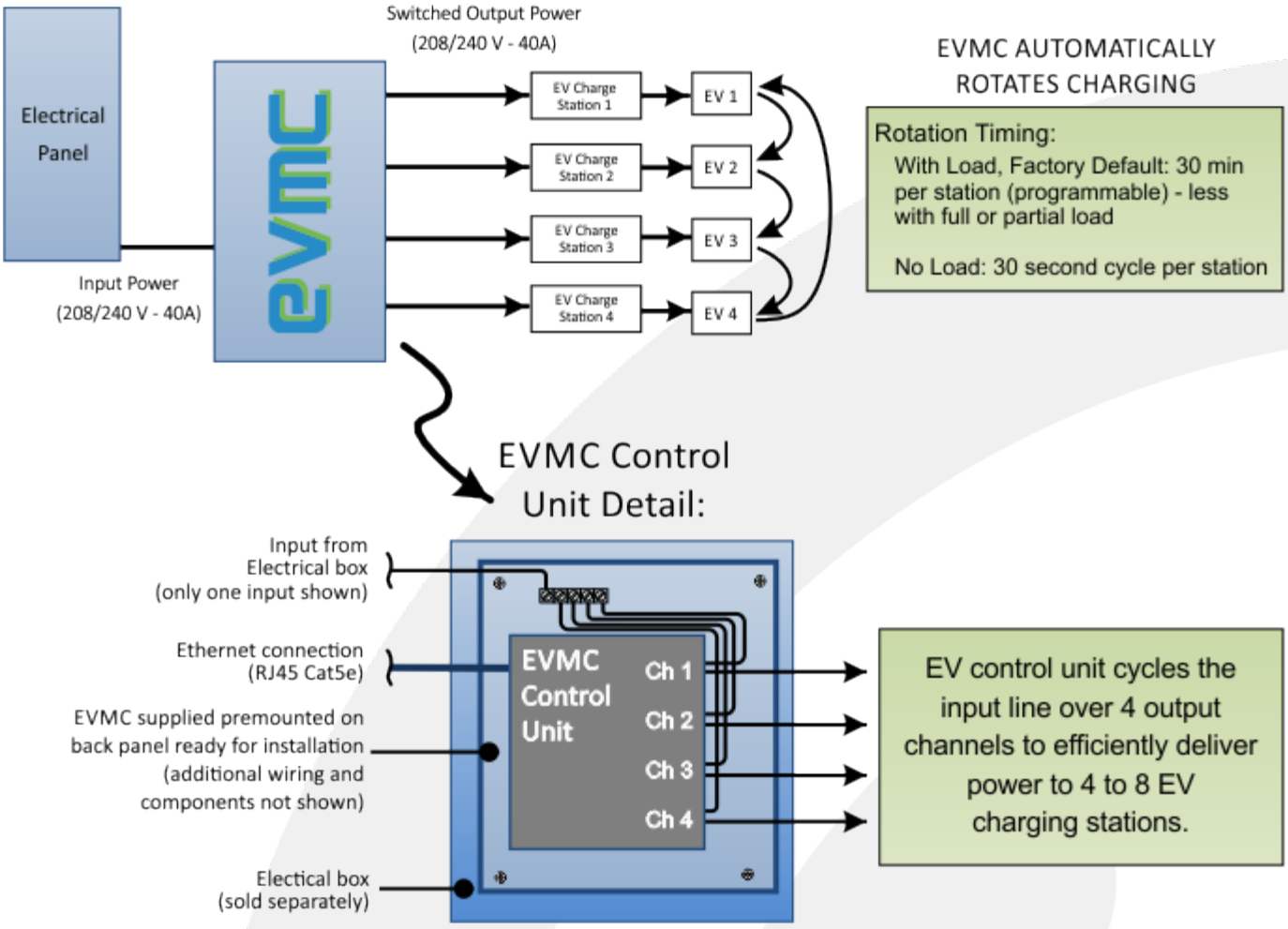
▶ One circuit for multiple locations:
- ➢ Power monitored at each location
- ➢ Set charge time for each location
- ➢ Shuts power off when utilities are charging a premium
- ➢ Focus on maximum efficiency by always searching for a vehicle to charge

▶ Rotational charging:
- ➢ Rotates the power from vehicle to vehicle on a programmable basis, allowing power to be shared with several vehicles
- ➢ Polls the charge level of each vehicle and moves on to the next if a car is fully charged

▶ Infrastructure costs reduced:
- ➢ Less need for individual circuits
- ➢ Less pipe or conduit
- ➢ Less wire or conductors
- ➢ Fewer circuit breakers
- ➢ Possible use of power from existing electrical panels
- ➢ Saves energy by not having to produce construction material
- ➢ Less greenhouse gases will be produced
- ➢ Reduces Electricity Demand Charges

Product Specifications

FEATURE	TECHNICAL SPECIFICATION
UL File	PAZX.E206903
Certifications	UL916, Energy Management Equipment CAN/CSA 22.2 No. 205-12, Standard for Signal Equipment
Output Ratings	277 Vac, 30A /; 250 Vac 2 hp, motor load ; 40A/240 Vac
# of Stations	4 - 7.7kw to 9.6kw Level 2; 8 - 3.8kw Level 2



Ordering Information

Product No.	Product Description
CS-EVMC-7700-4	Electrical Vehicle Master Controller