



City of Richmond

Report to Committee

To: Planning Committee **Date:** December 12, 2016
From: John Irving, P.Eng. MPA **File:** 10-6125-07-02/2016-
Vol 01
 Director, Engineering
Re: **Electric Vehicle Charging Infrastructure in Private Developments**

Staff Recommendation

That the stakeholder consultation program to consult on the development and implementation of electric vehicle charging infrastructure in new private developments, as described in the staff report titled "Electric Vehicle Charging Infrastructure in Private Developments" from the Director, Engineering, dated December 12, 2016, be endorsed.

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 Director, Engineering
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REPORT CONCURRENCE		
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER
Building Approvals	<input checked="" type="checkbox"/>	
Development Applications	<input checked="" type="checkbox"/>	
Policy Planning	<input checked="" type="checkbox"/>	
Transportation	<input checked="" type="checkbox"/>	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: DW	APPROVED BY CAO

Staff Report

Origin

In January 2014, Council adopted the Community Energy and Emissions Plan, which includes *Action 18: Set minimum requirements for electric vehicle infrastructure in new developments.*

This report supports Council's 2014-2018 Term Goal #4 Leadership in Sustainability:

Continue advancement of the City's sustainability framework and initiatives to improve the short and long term livability of our City, and that maintain Richmond's position as a leader in sustainable programs, practices and innovations.

4.1. *Continued implementation of the sustainability framework.*

4.2. *Innovative projects and initiatives to advance sustainability.*

Background

In 2010, Council adopted targets in Richmond's Official Community Plan to reduce community greenhouse gas (GHG) emissions 33% below 2007 levels by 2020, and 80% below 2007 levels by 2050. The 2041 Official Community Plan also includes a target to reduce energy use by 10% below 2007 levels by 2020. These targets are in line with what climate science suggests developed nations will need to achieve to have a good chance of avoiding an increase of 2 degrees Celsius in global average temperatures above pre-industrial levels, which is considered a threshold for dangerous climate change.

Richmond's 2014 Community Energy and Emissions Plan (CEEP) outlines strategies and actions for the City to take to reduce community energy use and GHG emissions, including:

- **Strategy 7: Promote Low Carbon Personal Vehicles**
 - **Action 18:** Set minimum requirements for electric vehicle infrastructure in new developments.

Modeling undertaken as part of the CEEP indicates Richmond's 2050 emissions reduction targets can only be achieved with the near-universal adoption of zero emissions personal vehicles by the 2040s. The CEEP states that the City will pursue the widespread adoption of low carbon vehicles, in coordination with senior levels of government and industry.

Electric Vehicles (EVs)

Plug-in Electric Vehicles (EVs) include:

- **Battery electric vehicles (BEVs)** – A vehicle that runs on electricity stored in batteries and has an electric motor rather than an internal combustion engine.
- **Plug-in Hybrid Electric Vehicles (PHEVs)** – A vehicle equipped with a plug that can use either electricity or gasoline fuels. PHEVs typically have smaller batteries than BEVs and use a gasoline engine to provide additional range.

EVs realize near-zero GHG and air contaminant emissions when using power from BC's electric grid. BC is considered one of the most attractive markets for EVs in North America, given its relatively low cost of power and "green" consumption trends.

City Action on Electric Vehicles

The City has demonstrated leadership by being one of the first municipalities in the region to establish policy providing for home access to EV charging. Section 8.5.2 d of the 2041 Official Community Plan currently includes policy for new private multifamily developments to include EV charging infrastructure. This policy specifies that "a minimum of 20% of parking stalls be provided with a 120 volt receptacle to accommodate electric vehicle charging equipment [and] ... an additional 25% of parking stalls be constructed to accommodate the future installation of electric vehicle charging equipment (e.g. pre-ducted for future wiring)".

The City has also led in deployment of public EV charging. In 2012, Council approved a cost sharing project with the Province that allowed the installation of public EV charging stations at Steveston, Thompson and Cambie Community Centres, and City Hall. Currently, there is no cost charged for this public charging service. Use of these stations increased eight-fold between 2013 and 2015, which may suggest that providing this public charging is playing a role in growing demand for EVs. In November 2016, Council directed staff to evaluate the development of a "fast charging" station network, and report back to Council with recommendations for implementation; staff are currently undertaking this investigation and will recommend a course of action to Council later in 2017.

EV procurement is an important part of the City's Green Fleet Action Plan. To date, the City has purchased four EVs, and additional procurement is planned in the future.

Analysis

Market Penetration of EVs

The price of EVs are falling, availability of vehicles is increasing, and demand for EVs is projected to grow. In 2012, BC Hydro forecasted that 20-50% of new light-duty vehicles sold in BC in 2030 will be EVs. Similarly, Bloomberg New Energy Finance estimates that, even in the absence of additional government climate policy, EVs will constitute 25-50% of new vehicle sales worldwide by 2040. A recent survey conducted by the City of Vancouver suggested that

85% of respondents would consider an electric vehicle the next time they purchased a vehicle. Many organizations, such as the International Energy Agency, have noted that government policy speeding the uptake of EVs will be necessary to avoid runaway climate change.

A number of jurisdictions illustrate how policies can speed up the adoption of electric vehicles. For example, EVs comprised over 30 per cent of vehicles sold in Norway in the first half of 2016; Norway provides significant consumer incentives, as well as access to HOV lanes, free ferries, and preferred parking. Ten American states have enacted a Zero Emissions Vehicle mandate, requiring 15 per cent of new vehicles be zero emissions by 2025, and the province of Quebec has indicated it will match that requirement. The German parliament has passed a resolution calling for the European Union to pass directives to allow only Zero Emissions Vehicles by 2030. Additionally, the European Union has drafted regulations requiring 100 percent of new and refurbished homes to feature electric access for EV charging. British Columbia has introduced incentives for EV purchases, and in 2016 announced that EVs would be allowed in HOV lanes. The market share of EVs in coming years will ultimately be dictated by EV prices, government policy, oil prices, consumer preferences, and availability of charging infrastructure.

EV Charging Infrastructure

Access to appropriate charging infrastructure is considered a key enabler of the adoption of EVs. The City can play an important role in growing demand for EVs by adopting improved standards for access to charging infrastructure.

Different “levels” of charging stations are recognized, as outlined in the Table 1.

Table 1: Common EV service equipment charging levels.

Charging Level	Voltage	Amperage	Apprx km of range per hour of charging	Time to fully Recharge (dependent on battery size)	Applications
"AC Level 1"	120 VAC	12-16 A	~ 7 km/hr	5 to 30 hours	At home, at work.
"AC Level 2"	208 / 240 VAC	<=80A (30 A most common)	15 – 45 km/hr	2 to 8 hours	At home, at work, public charging
"DC Fast Charge"	200 - 400 VAC	80-400 A	200+ km/hr	<10 min to 1 hour	Major public rapid-recharge locations

Market research suggests that approximately 80 per cent of EV charging occurs at home, with the remaining 20 per cent occurring at work and “on the go”. Thus, appropriate infrastructure in residential parking areas is necessary to support EV’s adoption. “Level 2” charging access is generally viewed as providing a higher level of service given its faster charging times; however, many EV owners report that “Level 1” (e.g. a standard 120 volt outlet) is adequate for most overnight charging.

Unfortunately, many residences do not currently have appropriate electrical connections for charging. This problem can be particularly acute in multifamily buildings. The Condominium Homeowners Association has estimated that it would cost \$8,000-\$13,000 to retrofit an electric vehicle charger in a multifamily parking area. At this cost, it can become financially unviable to acquire an EV. However, buildings can be “future-proofed” to significantly reduce these costs, as discussed below.

EV Charging Infrastructure Configurations

Buildings can provide EV charging stations, and/or be future-proofed to accommodate lower-cost installation of charging stations in the future. The following are options for infrastructure configurations in new developments:

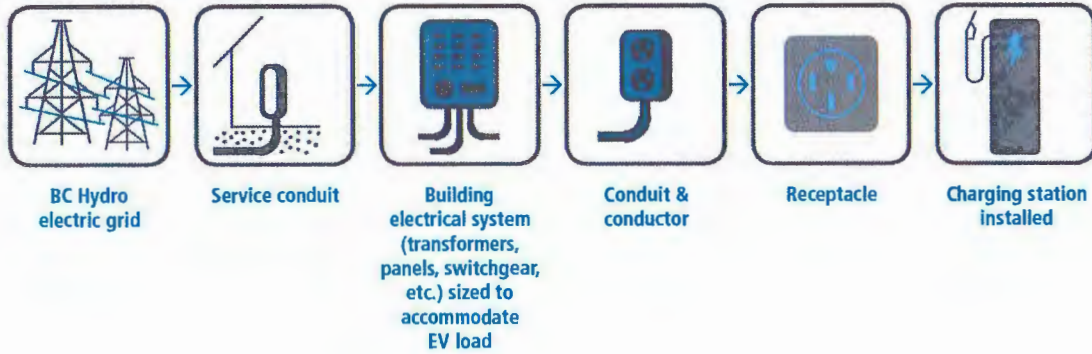
- **EV charging stations.** EV charging stations (also called EV Service Equipment) are devices used to connect vehicles to an electric receptacle to recharge an EV’s battery. Charging stations typically cost \$500-3000, making it costly to equip all parking spaces in new developments. Due to these costs, it is not recommended to require new developments to equip all parking spaces with charging stations. However, in order to develop the “On the Go” charging network, it may be appropriate to equip a small percentage of new publicly accessible commercial parking with charging stations and appropriate signage. Likewise, it may be appropriate to provide a few shared EV charging stations in multifamily developments to provide for guests and/or residents.
- **“Energized” parking stalls.** This infrastructure configuration provides parking stalls with an electrically wired receptacle dedicated for EV charging. A future EV driver need only install the charging station at their cost in order to charge their vehicle.
- **“Partial EV infrastructure” parking stalls.** This infrastructure configuration provides some features in a new buildings’ construction that will make it easier to energize stalls and install EV charging stations in the future. While installing a charging station may not be as simple as under an “energized” infrastructure configuration, providing this “partial EV infrastructure” can reduce the costs of retrofitting the building to accommodate EVs in the future.

These options are illustrated in Figure 1.

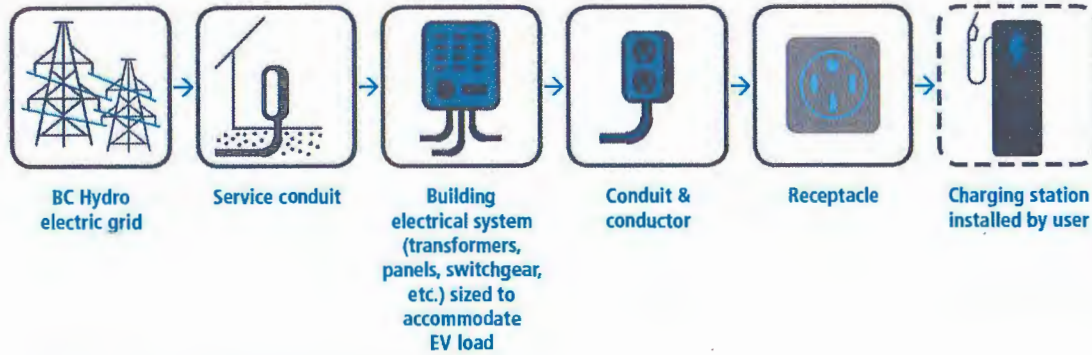
Innovative Technologies are Reducing the Cost of Implementing EV Charging

Charging technologies that can reduce the costs of EV charging infrastructure are emerging. Notably, “power sharing” technologies can allow multiple chargers to communicate so as not to exceed the capacity of a circuit, and also to time charging to occur when power costs less. Designing for such technologies can reduce the first cost of providing EV charging infrastructure, by reducing the size of building electrical systems that must be installed. These technologies can also ultimately reduce energy costs for users by coordinating vehicle charging to minimize consumer electrical costs, while still ensuring users receive sufficient charge.

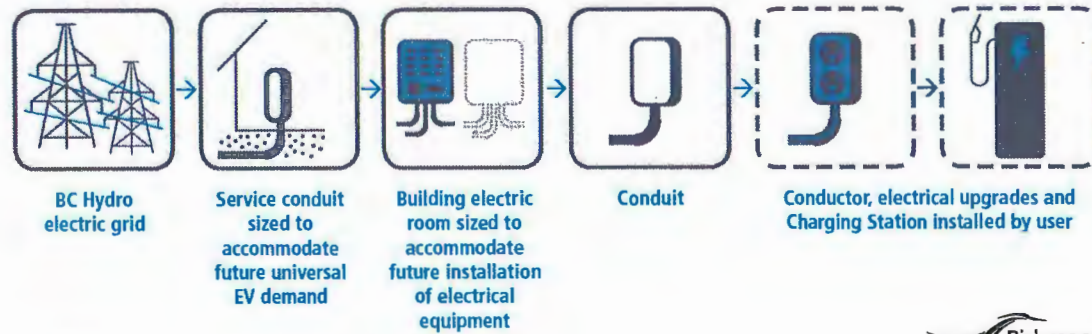
"EV Charging Station Installed"



"Energized Stall"



"Partial EV Infrastructure Stall"



V.2, Oct. 2016



Figure 1: Different potential configurations of EV charging infrastructure in new developments.

City Policy Regarding EV Charging Infrastructure in New Developments

The City has been a leader in supporting EVs adoption, being one of the first communities in the region to specify that new developments feature electrical services for EV charging – Section 8.5.2 d of the 2041 Official Community Plan currently includes policy for new multifamily developments, requiring 20 per cent of residential parking stalls be “energized” with Level 1 (120V) service, with an additional 25 per cent featuring rough-in raceway to the parking stall. This policy applies to new developments undergoing rezoning. The City has successfully applied this policy, with new developments typically complying with or exceeding these provisions.

The City now has the opportunity to build on its leadership in enabling EVs, in light of the expanding EV market and the recognition that buildings currently being constructed are expected to be used well past 2050, when widespread adoption of EVs will be necessary to achieve climate targets. It is proposed that revised EV charging provisions be developed for Council’s consideration. A revised policy provides the opportunity to:

- **Allow for Level 2 charging.** The current policy specifies Level 1 charging. Level 1 charging is viewed by some industry actors to be insufficient for the electric vehicles of the future, which may necessitate Level 2 home charging to provide sufficient overnight charge when battery is low. Staff will investigate whether both Level 1 and Level 2 should be allowed for home charging, or whether a particular infrastructure configuration should be specified.
- **Consider providing a greater proportion of households access to EV charging.** The current policy provides some form of home EV charging infrastructure access for 45 per cent of residential parking spaces. This is higher than what prevails in many jurisdictions in BC, and constituted significant leadership by the City. Nevertheless, under the current policy, 55 per cent of parking space owners will face a significant cost to implement any form of home charging. Staff will explore options to provide a higher percentage of households with access to EV charging.
- **Consider provisions for detached housing, townhouses, “at work” or “on the go” charging.** A future policy could cover a larger range of residential development, and also provide requirements for commercial developments to support charging at work and publicly accessible charging. It is important to note, however, that detached housing and townhouses typically do not have the same challenges implementing electric vehicle charging equipment as higher-density residential, mixed-use, commercial and institutional buildings. Moreover, detached housing and townhouses will typically have access to at least a “Level 1” outlet in their parking area.

Stakeholder Consultation Program

In 2016, two meetings with the Urban Development Institute were hosted by staff to solicit initial feedback on EV charging in new multifamily developments and develop principles for an updated approach. The next phase of consultation is intended to develop more detailed options for multifamily EV charging infrastructure. It is recommended that Council endorse the stakeholder engagement program outlined below, guided by the following principles:

- **Ensure reasonable costs for EV infrastructure for both developers and end users** – EV charging requirements should balance costs for both developers and end-users.
- **Better accommodate universal access to EV charging.** Explore options to support as broad access to EV charging as possible, so as to provide greater options for consumers as EVs reduce in price and allow for the high uptake of EVs that will be necessary for the City to meet its emission reduction goals. This includes realizing higher rates of coverage of EV charging infrastructure in shared parkades, and providing charging infrastructure for building typologies with private garages or carports, including townhomes, duplexes and single family residences.
- **Accommodate potential future technologies** - The requirements should be flexible to accommodate future technologies, including “load management” and power sharing solutions.
- **Accommodate at home Level 2 charging** – Level 2 home charging access is considered by many stakeholders to be important to enable the adoption of EVs. Richmond’s policy should change to accommodate Level 2 charging, and not only reference Level 1.
- **Support the “at work” and “on the go” EV charging networks** – The requirements should support the build out of the “at work” and “on the go” charging networks.
- **Evaluate development costs and incentives** – As part of developing policy, staff will evaluate the cost to future-proof new developments with different configurations of EV charging infrastructure; the extent of demand for EV charging infrastructure provisions amongst Richmond residents and homebuyers; and potential incentives or mechanisms that can help balance any incremental costs of EV charging infrastructure borne by new developments.
- **Develop workable operating models for future strata corporations** – As part of stakeholder consultation, staff will investigate how best to ensure that stratas can properly manage EV charging infrastructure and electricity costs.

Options for Council's consideration will be further developed as part of stakeholder consultation. The following consultation program will be carried out with Council's endorsement:

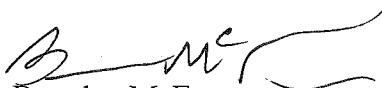
- Condominium owners focus group(s)
- Developer workshop
- Small builders workshop
- Local EV user groups (formal and informal groups)
- EV charging service providers
- Meetings with staff from the province, Metro Vancouver and other municipalities

Financial Impact

None.

Conclusion

This report reviews EV charging infrastructure considerations and options, and recommends that staff engage in stakeholder consultation and report back to Council with recommended options for EV charging infrastructure policy.



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