

WARRANT ARTICLE DESCRIPTION

The Department of Planning and Community Development (DPCD), in extensive consultation with the Building Department¹, proposes an amendment to the Zoning By-Law that would add new Electric Vehicle (EV) Charging requirements (Section 6.10) to replace paragraph Section 6.04.15. The change would require 100% of the parking spaces be **EV-Ready Spaces C**—as defined by staff distinctly from the State Commercial Building Code—in new construction and substantially rehabilitated residential uses. In addition, one- and two-family buildings regulated by the State Residential Building Code would be required to have a least one individual branch circuit rated for Level 2 charging (**EV Ready Spaces R**). Note that three-family buildings of any number of stories are regulated by the State Commercial Building Code. No change is proposed to non-residential uses; that is, 15% of those parking spaces are still required to be **EV-Ready** as defined in the latest edition of the Commercial Building Code.

The submission of this article fulfills the vote of Town Meeting in Fall 2021 that staff propose a zoning amendment requiring 100% EV readiness to support Level 2 charging in multifamily uses, and a Level 2 charging requirement for smaller residential uses.

Introduction

Petitioners Jesse Gray, Scott Englander et al. submitted a warrant article to Fall Town Meeting 2021 that would require all residential parking spaces to be EV Ready as defined in the State Building Code. Staff readily agreed with the petitioners' objective; namely, to avoid costly retrofits as demand for reliable EV charging increases in residential uses. However, the article relied on the Building Code's definition EV-ready that would (a) require an excessive and enormously expensive electrical service demand not likely to be approved by the utility and (b) preclude the use of the Automatic Load Management Systems (ALMS), a provision allowed under Article 625.42 of the Massachusetts Electrical Code (MEC) that provides an inexpensive and pragmatic 100% EV readiness solution.

The Massachusetts Department of Energy Resources (DOER) agreed with the Town's Chief Electrical Inspector that the definition of EV-Ready in the Commercial Building Code does *not* allow for the use ALMS.² DOER acknowledges that a working group is drafting a revision for the tenth edition of the Building Code and a Net Zero Stretch Code option to be implemented in January 2023 that would allow ALMS to be installed as an alternative to meet the State's EV ready mandate, though staff has not seen any language that would ensure reasonable charging rates for residential uses. (DOER encourages the Town to submit public comment.) Therefore, staff devised a new definition that would rely on a minimum power-transfer performance standard that would ensure reasonable overnight charging rates when 100% of parking spaces are occupied by a charging EV.

The concept of the minimum power-transfer standard has been widely adopted in various counties in Canada that mandate 100% EV readiness in residential parking areas. As part of its due diligence, the DPCD has had discussions with Brendan McEwen of AES Engineering, a firm that has advised Canada on its EV charging zoning policy and that is active in recommending changes to the International Energy Conservation Code (IECC) and the National Electric Code (NEC) to leverage ALMS technology—referred to as Electric Vehicle Energy Management System (EVEMS) in Canada.

How ALMS Work

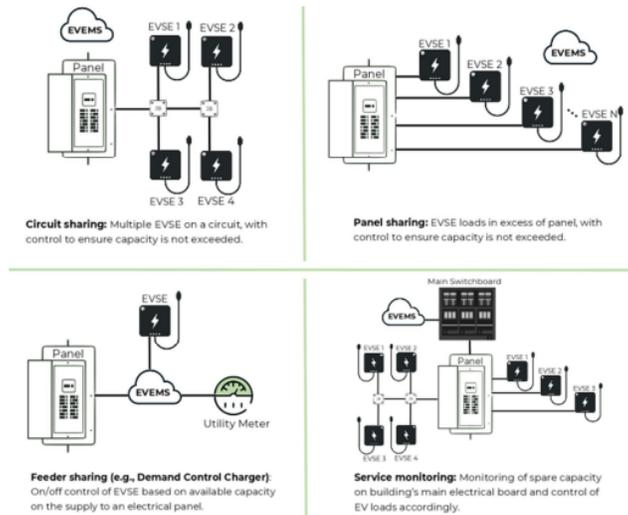
ALMS allow multiple Electric Vehicle Service Equipment (EVSE) to charge safely on one electrical circuit rated for one EVSE. Although the speed of charging slows when multiple EVs are charging at

EVSE served by an ALMS, a ratio of four EVSE to one circuit is reasonable for overnight charging in residential uses.

Drivers of internal combustion engine (ICE) vehicles wait until the gas tank is near empty to fill up. Unlike drivers of ICE vehicles, EV drivers do not wait for the EV’s battery to be depleted but instead “top off” or replenish their daily driving range, which is an average of 39 miles per day for the typical American driver, according to the U.S. Department of Transportation (2019). Therefore, slower charging times are appropriate when vehicles are parked for longer periods such as overnight.

Figure: Different electrical configurations enabled by ALMS.

Source: Brendan McEwen, AES Engineering³



To clarify, if four parking spaces are served by one circuit managed by an ALMS, the maximum power will need to be shared if more than one EV is charging at one time. If only one EV is charging, it would draw full Level 2 charging power.

Why Is the Building Code Definition of EV Ready Insufficient?

The State Building Code defines EV Ready Space as “a designated parking space which is provided with one *dedicated* 50-ampere branch circuit for EVSE servicing Electric Vehicles.” The term “dedicated” or “individual” is defined in Article 100 of the Massachusetts Electrical Code (MEC) as “a branch circuit that supplies *only one utilization equipment*.” Under this definition, multiple EVSE would not be allowed to connect to one circuit rated for one EVSE. Note that the Building Code does not prohibit the installation of ALMS, but it does *mandate* the installation of at least one EV-Ready space.

In addition, the ratio of EVSE to one circuit may change depending on use. A 12:1 ratio may be appropriate for an airport where vehicles are parked for days, but unreasonable for residential use, where a 4:1 ratio would provide a reasonable charging rate for overnight parking. Therefore, zoning can be a more nimble tool in regulating acceptable minimum charging rates for different uses when ALMS are used, unlike the Building Code.

Why ALMS Provide a 100% EV Ready Solution

Under the State’s definition, 16 **EV Ready** parking spaces would require 16 dedicated branch circuits, or a 800-amp service demand for just the parking area.

In contrast, with ALMS and a 4:1 EVSE to circuit ratio, 16 **EV Ready Spaces C** would require just 4 circuits, or a 200- amp service.

An EV does not need to draw full Level 2 charging power for overnight parking to replenishing daily driving range. However, regulations do need to ensure a minimum reduced charging rate when 100% of parking spaces are occupied with charging vehicles in residential applications.

Staff’s New Definition

For **EV Ready Spaces C**, a power transfer minimum of 2.1 kW per hour for each parking space would achieve:

- Flexibility: Level 2 charging up to full power if fewer EVs are charging concurrently
- Scalability: No requirement to install EVSE up front to demonstrate compliance (just a calculation of total continuous duty load to ensure that service capacity is designed adequately and safely to serve 100% of parking spaces occupied with EVs charging concurrently)⁴
- Reasonable reduced charging rate: Typical daily driving range could be replenished during overnight charging when 100% of parking spaces are occupied with EVs charging concurrently
- Cost-effectiveness: Electrical service capacity does not need to be upgraded each time an EVSE is installed, providing an optimal option for multifamily uses.

The standard of 2.1 kW of power is derived from the equivalent of one Level 2 EV charger drawing 42 amps of power on a 50-amp branch circuit. However, instead of one EVSE connect to this circuit, we would allow up to four EVSE. By maintaining a ratio of 4:1, we can guarantee a reasonable overnight charging rate of 2.1 kW per hour. Whereas a charging rate of 6.7 kW would provide 60 to 75 miles of driving range in three hours, a reduced charging of 2.1 kW would require about 9 hours of charging to provide an equivalent driving range—perfectly reasonable for residential uses.

The standard of 2.1 kW is derived as follows: [\[see updated calculation in latest version of WA 4/14/22\]](#)

42 amps / 1 EVSE = 10.5 amps

10 amps x 208 volts = 2,184 watts or 2.1 kilowatts

Although it is not final, DOER has drafted an update to the Residential Building Code mandating a provision for Level 2 charging in one- and two-family buildings. Staff’s proposal for **EV Ready Spaces R** is consistent with DOER’s recommendation for one- and two-family structures. For one- and two-family applications, the By-Law must avoid cross-referencing definitions in Commercial Building Code, even if the definitions themselves are identical.

Avoiding Conflicts with Building Code

Recall that the State Building Code not only defines EV Ready, it mandates that at least one parking space be EV Ready. Therefore, property owners would not be able to implement an ALMS system for 100% of parking spaces without either installing one dedicated 50-amp branch circuit for one of the spaces not served by an ALMS (doable but inefficient) or requesting a waiver from the State’s Board of Building Regulations and Standards (BBRS) . The implications, though not ideal, are practical workarounds until the Building Code is updated to allow ALMS exceptions.

Because an ALMS option might not be the right for every project, this article provides an alternative prescriptive standard that requires compliance with EV Ready as defined in the State Building Code, and yet a third option that would be a combination of the two standards.

Because different EVSE-to-circuit ratios are possible depending on the use, staff is not addressing ALMS provisions in non-residential uses at this time.

Town Counsel’s Opinion

Because the Attorney General has disapproved two recent zoning amendments prohibiting fossil fuel free infrastructure, Town Counsel Jonathan Simpson is skeptical that the Attorney General will approve this amendment, which address EV readiness infrastructure under land use. Nonetheless, he did not discourage staff from submitting this article to Town Meeting.

Staff is hopeful that the three standards provided in our definition of **EV Ready Spaces C** serve not only to assist multifamily property owners with a cost-effective solution for EV charging but also to offer parameters around minimum charging rates in a way that the Building Code might not be nuanced enough to provide.

Resources

Making Parking “EV Ready”: Requirements for New Construction & Incentives for Existing Buildings (Brendan McEwan/AES Engineering and Electric Mobility Canada February 2022) <https://emc-mec.ca/wp-content/uploads/EMC-Position-Paper-EV-Ready-Parking-2022.02.24-Formatted-EMC-Format.pdf>

EV Ready” Requirements for New Buildings: A Best Practice Guide for BC Local Governments (Brendan McEwan/AES Engineering April 2021) <https://docs.communityenergy.ca/wp-content/uploads/EV-Ready-Requirements-for-New-Buildings-Final.pdf>

¹ The DPCD’s Regulatory Division especially credits the partnership of Daniel Bennett, Building Commissioner; Paul R. Campbell, Deputy Building Commissioner; and Brian Richard, Chief Electrical Inspector.

² The Building Department and the DPCD’s Regulatory Division staff met with Ian Finlayson, Director of DOER’s Energy Efficiency Division in February 2022 to confirm this fact.

³ <https://emc-mec.ca/wp-content/uploads/EMC-Position-Paper-EV-Ready-Parking-2022.02.24-Formatted-EMC-Format.pdf>

⁴ Note that the MEC requires that EVSE served by ALMS must be hard-wired and not removable as equipment plugged into a receptacle would be. Therefore, installing receptacles are not permitted for EV ready spaces served by an ALMS.