

"EV Ready" Requirements

Clean Air Partnership Presentation

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DESIGNING A BETTER TOMORROW

Electrical Engineering
Electric Transportation + Low Carbon
Architectural Lighting Design
Information + Communications Technology
Master Systems Integration



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ABOUT BRENDAN...

- **Director of Electric Mobility & Low Carbon Strategy, AES Engineering** – Sept. 2019
- **Principal Consultant, McEwen Climate & Energy** – 2018-2019
 - Assisted with municipal EV Ready requirements development
 - Authored report for NRCan “EV Ready Requirements Framework”
- **Sustainability Manager, City of Richmond** – 2013-2018
 - Led development of Richmond’s 100% “EV Ready” requirement for residential parking in new developments – the first such requirements in the World.
- **Massachusetts Institute of Technology** – 2010-2013
 - Master City Planning
 - Associate Director of MIT CoLab Green Economic Development Initiative



- Quick review of EV trends
- Importance of access to “at home” charging
- About EV Energy Management Systems
- Municipal 100% “EV Ready” requirements for new residential developments
- “EV Ready” existing MURBs

EV TRENDS

CANADA'S EV TARGETS

- 10% of passenger vehicle sales by 2025
- 30% by 2030
- 100% by 2040



Lithium-ion battery price outlook

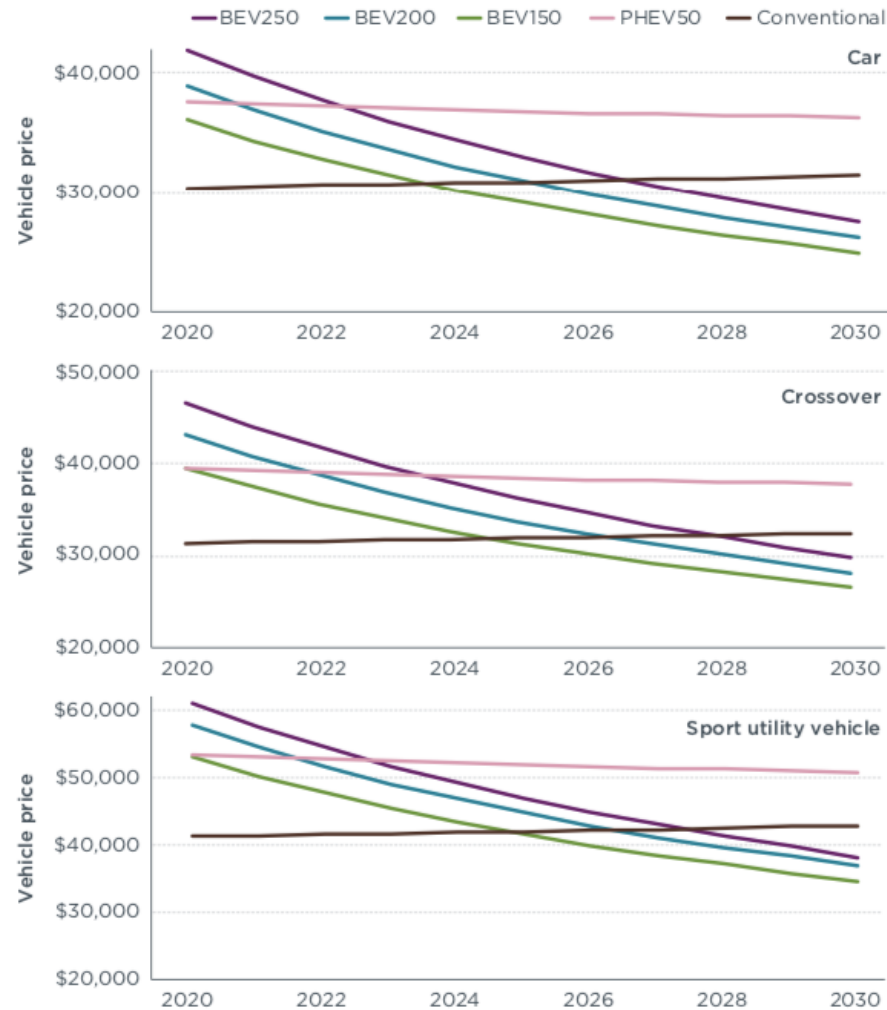
Lithium-ion battery pack price (real 2018 \$/kWh)



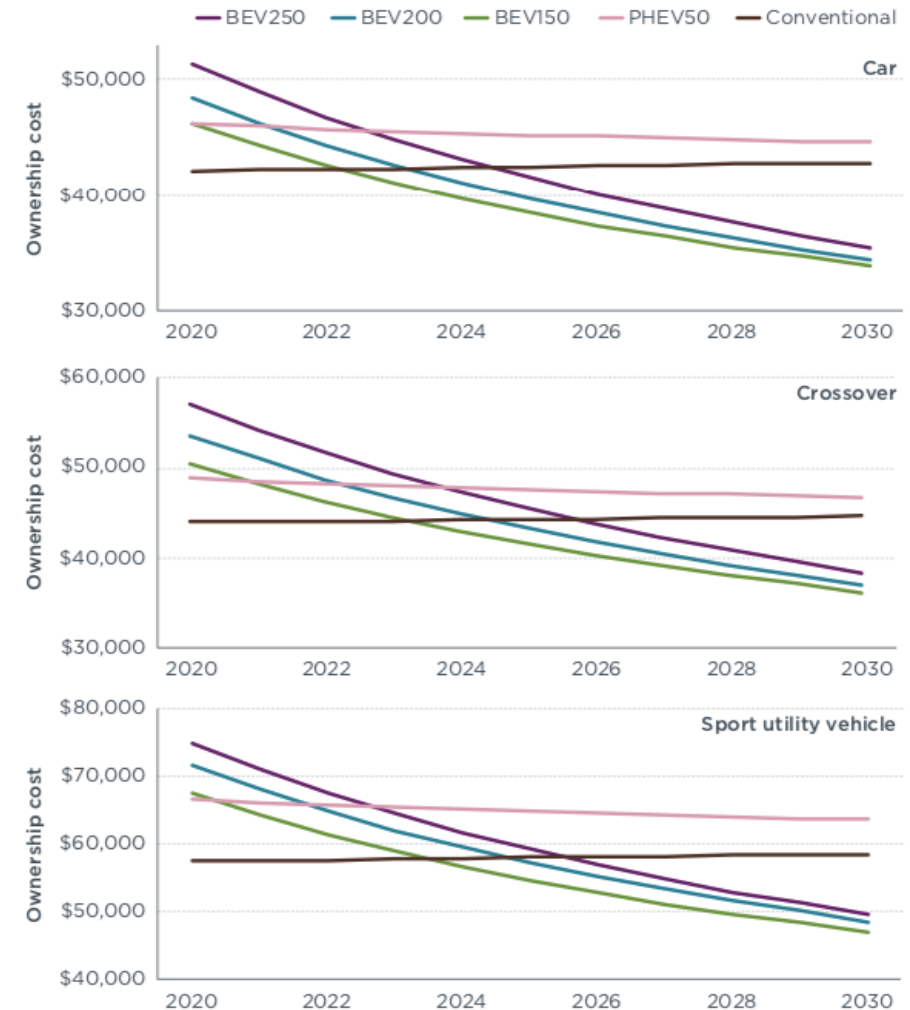
Source: BloombergNEF

EV "PRICE PARITY" (NO INCENTIVES)

Purchase Price



Lifecycle Ownership Costs



THE NEED TO SUPPORT ACCESS TO EV CHARGING

WHERE DO WE CHARGE?

- “At Home” charging critical to enabling EV uptake
- “At Work” and publicly-accessible “On the Go” are important supplements (or for hardcore EV enthusiasts, replacements)



EV CHARGING INFRASTRUCTURE TYPES

Level 1 (120 v)



~5-7 km/hr

Level 2 (208/240 v)



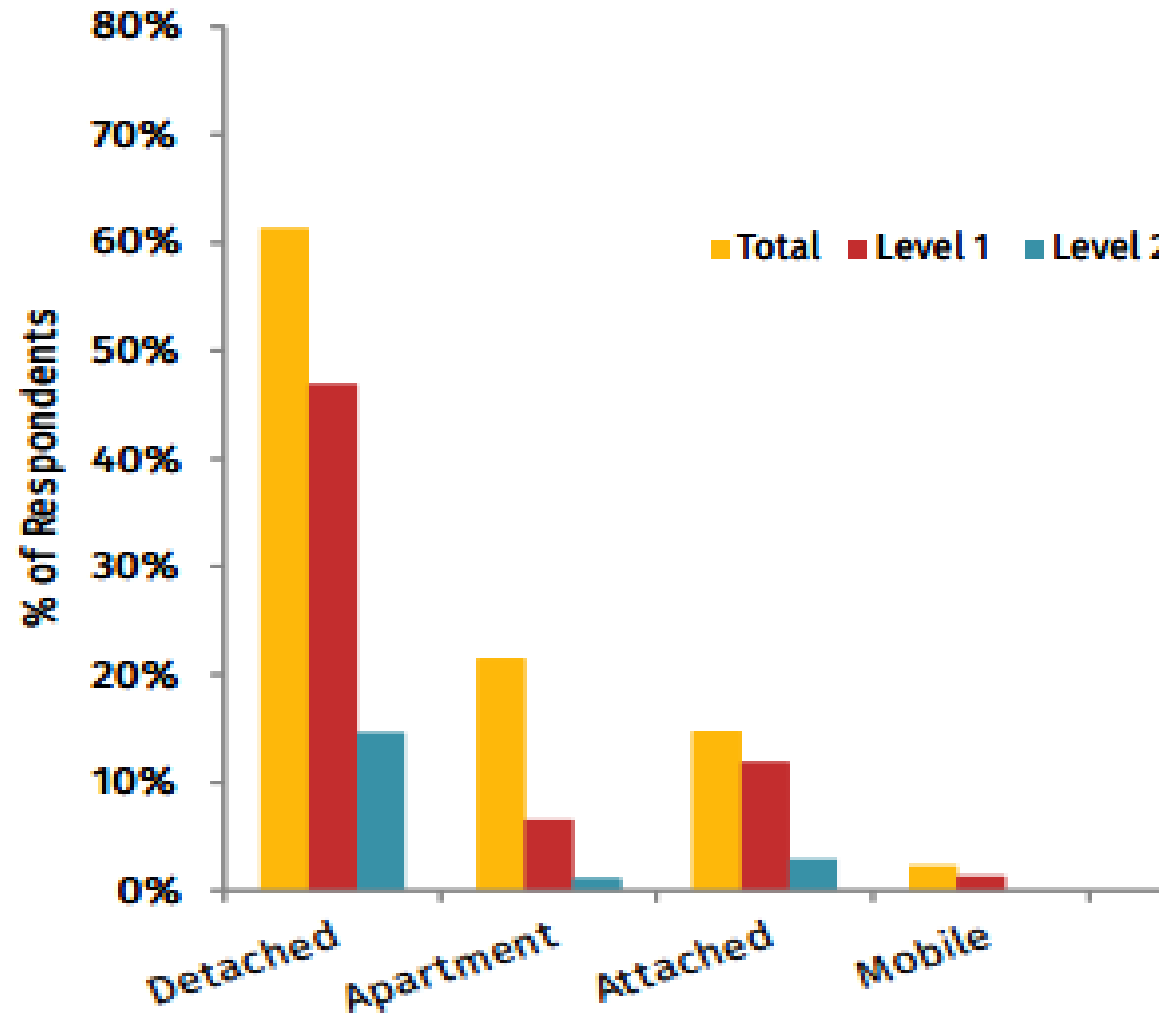
25-80 km/hr

DC Fast Charge (500 VDC)



200 – 2000+ km/hr

MOST MURB RESIDENTS DON'T HAVE ACCESS TO "AT HOME" CHARGING



IT'S COSTLY TO RETROFIT EV CHARGING INTO MULTI-FAMILY BUILDINGS

BC's previous **Charging Solutions Incentive Program for MURBs**

- Most projects installed a few EVSE
- **Average cost – \$6800 per EVSE**

(Significantly lower cost per parking space possible if design for 100% of parking stalls, using EV energy management systems... more on this later...)





KEY PRIORITIES TO SUPPORT ACCESS TO EV CHARGING

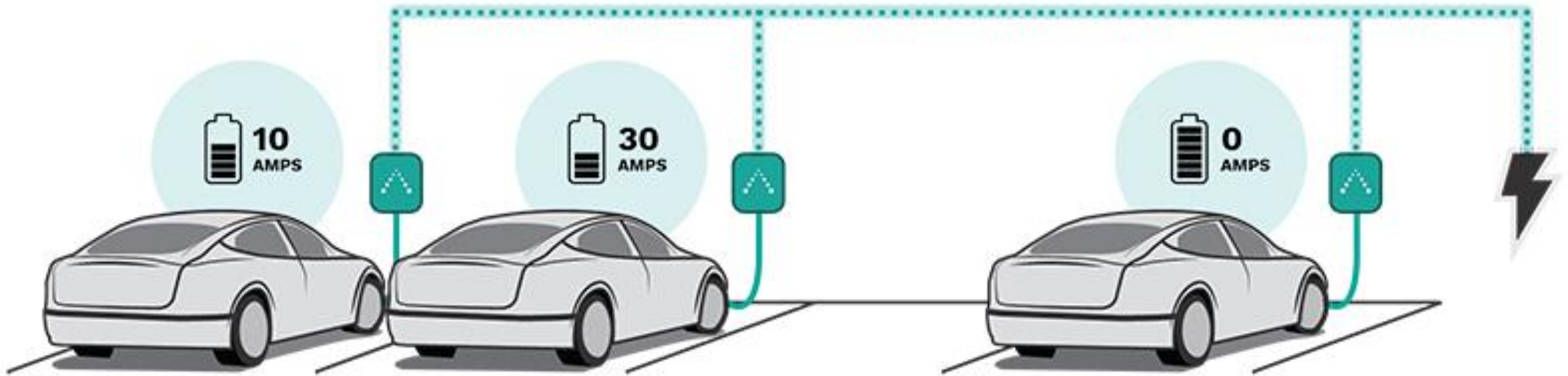
1. EV charging infrastructure requirements for new developments (especially MURB)
2. “EV Ready” parking in existing MURBs

... both enabled by EV energy management
systems

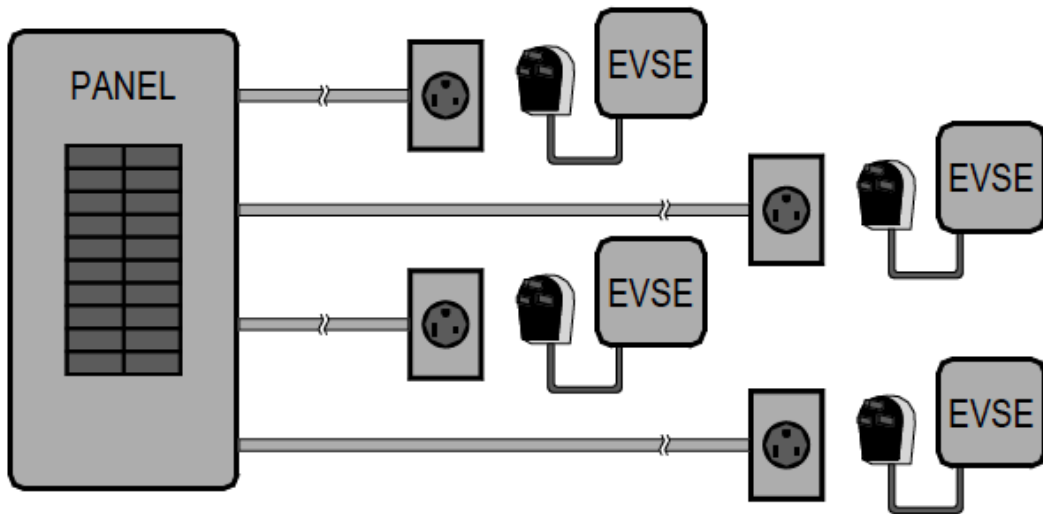
ABOUT EV ENERGY MANAGEMENT SYSTEMS

EV ENERGY MANAGEMENT SYSTEMS

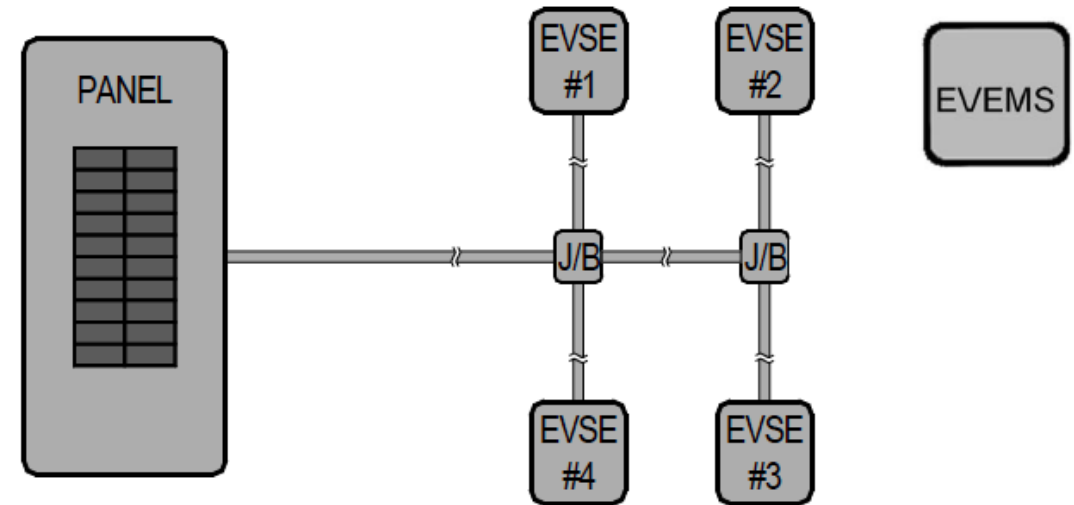
- Enabled in 2018 Canadian Electrical Code
- Standard for EVEMS in development (CSA C22.2 No. 343)



DEDICATED CIRCUITS VS. EV ENERGY MANAGEMENT

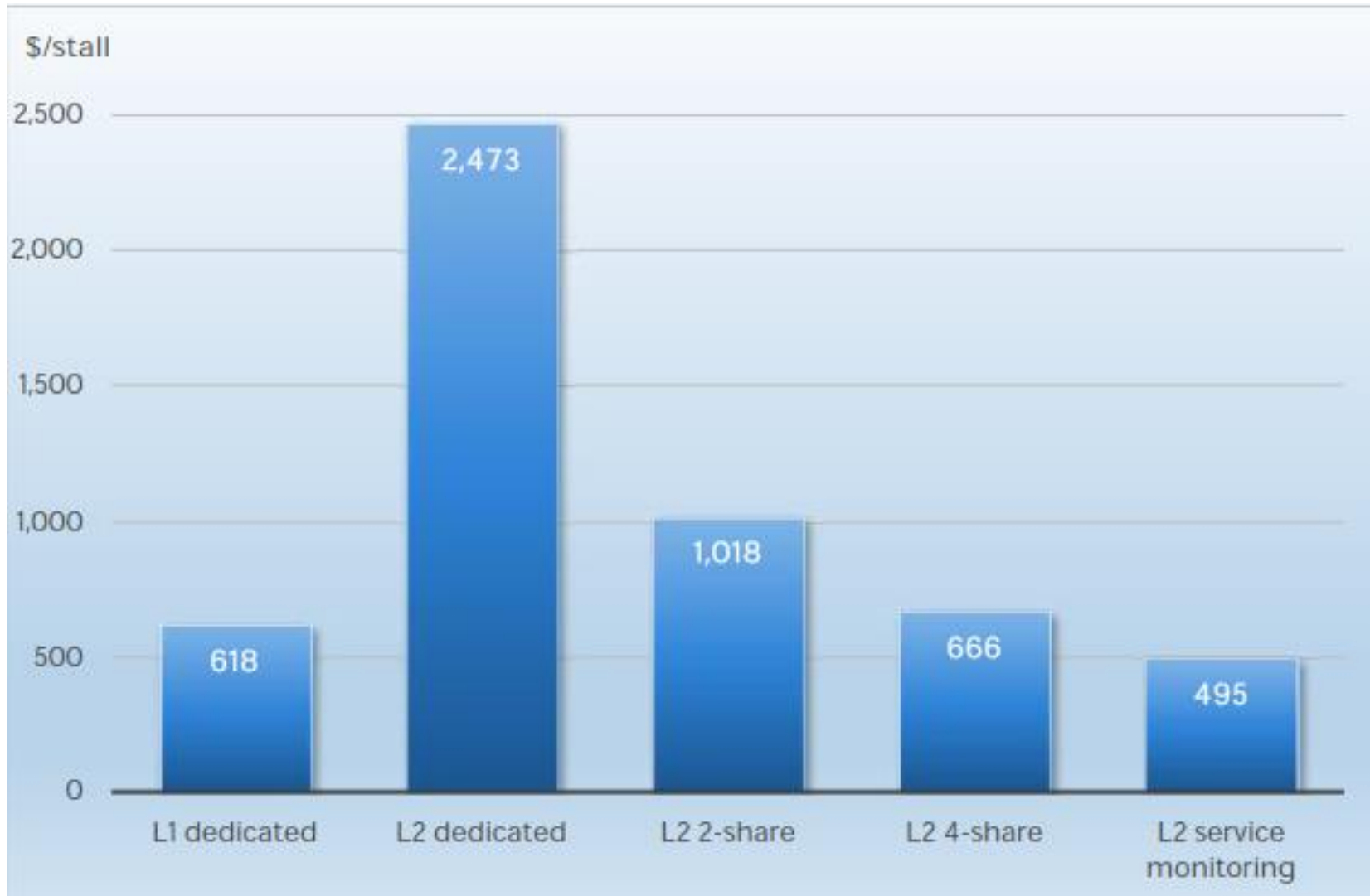


Dedicated circuits (unmanaged)
160A capacity total



Load share
40A

CONSTRUCTION COST PER PARKING SPACE DECLINE WHEN USING EVEMS - FortisBC EXAMPLE



Cost / parking space for an energized outlet



EV CHARGING INFRASTRUCTURE REQUIREMENTS FOR NEW BUILDINGS

– LOCAL GOVERNMENT LEADERSHIP



CONSIDERATIONS FOR POLICYMAKERS DEVELOPING EV CHARGING INFRASTRUCTURE REQUIREMENTS

- What electrical infrastructure to require?
- What level of charging (L1/L2)?
- What % of stalls? For what land uses?

EV CHARGING INFRASTRUCTURE REQUIREMENTS – OPTIONS FOR WHAT IS REQUIRED

Options	Description	Example Jurisdictions (Reqs for MURBs)
Partial – low completion	<ul style="list-style-type: none"> Conduit installed No provisions for electrical capacity; may be space in electrical room 	<ul style="list-style-type: none"> New York City – 20% France, Italy, Spain – varying %
Partial – high completion (“EV Capable”)	<ul style="list-style-type: none"> Electrical capacity Conduit installed (at least in hard to retrofit areas) 	<ul style="list-style-type: none"> Calgreen - 10% - 40A Oakland & S.F. – 10% - 40A (& see below)
Energized outlets (full circuit; “EV Ready”)	<ul style="list-style-type: none"> Electrical outlet serving parking space (with all requisite electrical infrastructure/capacity) 	<ul style="list-style-type: none"> Vancouver, Richmond, Burnaby, New Westminster, North Vancouver, Port Moody - 100% res. L2 Oakland & S.F. – 10% - 40A Palo Alto – 1 per dwelling unit L2
EVSE installed	<ul style="list-style-type: none"> EVSE installed 	<ul style="list-style-type: none"> Toronto (MURB, non-res) – 20% Ontario (non-res) – 20% London EN (all) – 20% Oslo (proposed)* – 50% Beijing, Qingdao* – 100%

* Reported by International Council on Clean Transportation.

IMPLICATIONS FOR RESIDENTIAL BUILDINGS

Infrastructure Option	Minimize upfront costs	Minimize retrofit costs	Simple for condo assn. / owner	Equitable for residents	Simple to enforce	Future-proof
Percentage-based (e.g. 20%)						
Partial-Low (all stalls)						
Partial-High / "EV Capable" (all stalls)						
Energized / "EV Ready" (all stalls)						
EVSE Installed (all stalls)						

EV READY vs PARTIAL COMPLETION

Upfront vs Retrofit Costs, High-Rise

Average cost per stall, 6 load-sharing options



December 2017 – City of Richmond adopted amendment to Zoning Bylaw's Parking & Loading section, requiring 100% of residential parking to be “EV ready” with energized outlet

- *For new buildings... **all residential parking spaces**, excluding visitor parking spaces, **shall feature an energized outlet capable of providing Level 2 charging or higher.***
- Outlets will be **labelled** for EV charging
- For designs using EV Energy Management Systems, a **performance requirement** can be set by Director of Engineering

RICHMOND ZONING BYLAW 8500, AMENDMENT BYLAW 9756



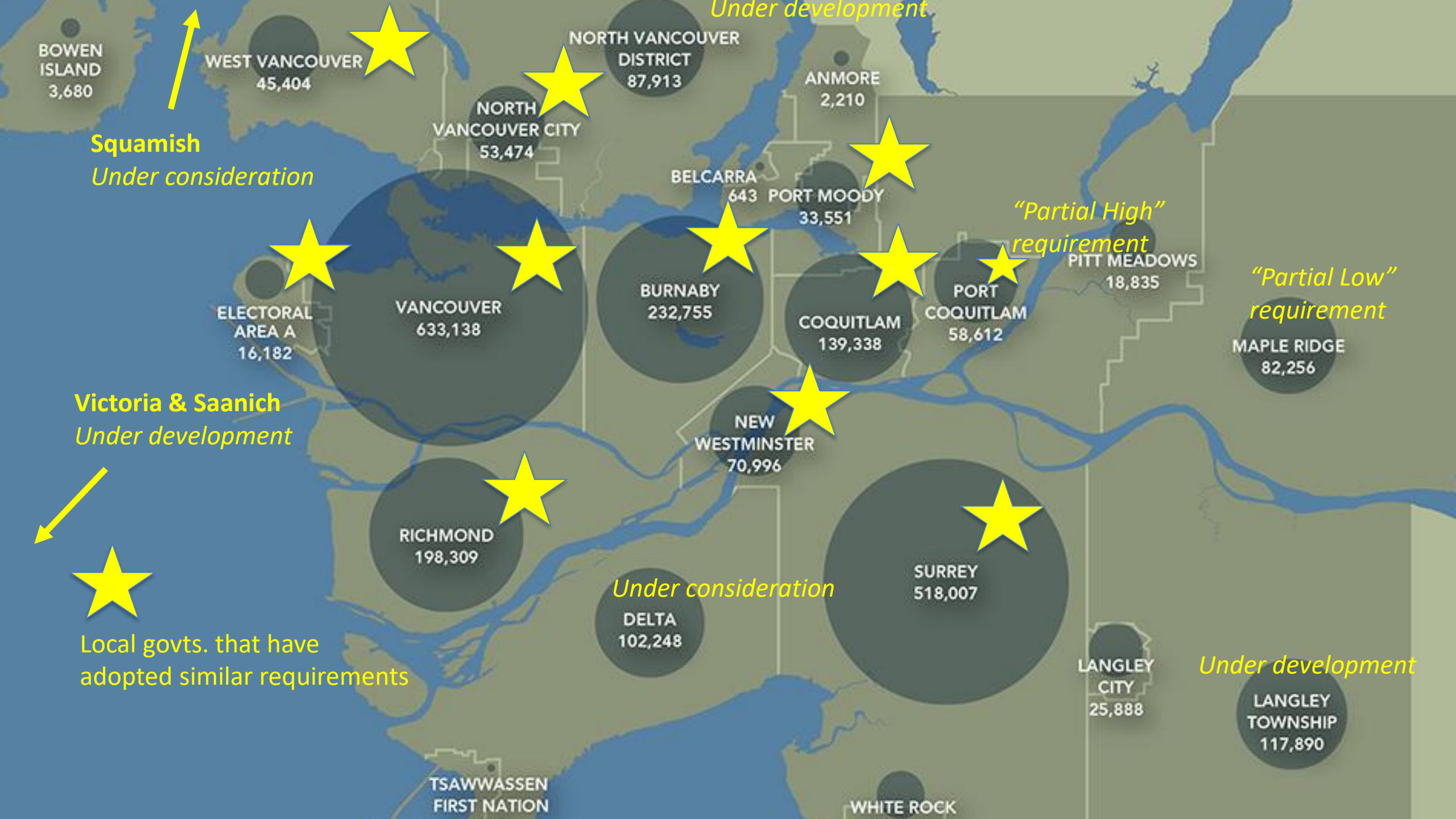
Performance Requirement for EVEMS



- Purpose:
 - Avoid “over-sharing”.
 - Ensures complete over-night charge vast majority of the time.
- Appropriate performance requirements vary based on geography (VKT, etc.)
 - E.g. Richmond & Vancouver allow 4-way sharing on a 208V 40A circuit (common configuration), as well as a variety of other potential configurations.

MINIMUM CIRCUIT BREAKER RATING (AMPS)	NUMBER OF EVSE PER CIRCUIT	
	CITY CENTRE (25 VKT)	OUTSIDE CITY CENTRE (39 VKT)
20	1	N/A
30	3	1
40	4	3
50	6	4
60	7	5
70	9	6
80	11	8
90	12	9
100	14	13
125	16	13
150	20	16

Table 1: Minimum charging performance



BOWEN ISLAND
3,680

WEST VANCOUVER
45,404

NORTH VANCOUVER DISTRICT
87,913

ANMORE
2,210

NORTH VANCOUVER CITY
53,474

BELCARRA
643

PORT MOODY
33,551

BURNABY
232,755

COQUITLAM
139,338

PORT COQUITLAM
58,612

PITT MEADOWS
18,835

MAPLE RIDGE
82,256

ELECTORAL AREA A
16,182

VANCOUVER
633,138

NEW WESTMINSTER
70,996

RICHMOND
198,309

DELTA
102,248

SURREY
518,007

LANGLEY CITY
25,888

LANGLEY TOWNSHIP
117,890

TSAWWASSEN FIRST NATION

WHITE ROCK

Squamish
Under consideration

Under development

"Partial High" requirement

Victoria & Saanich
Under development

Local govts. that have adopted similar requirements

Under development

COMMERCIAL & LOADING ZONE REQUIREMENTS

– THE NEXT FRONTIER!

- Commercial parking requirements in Metro Vancouver
 - City of Vancouver – 10% “EV Ready”
 - Surrey – 20% “EV Ready”
 - Other jurisdictions



CONSIDERATIONS FOR ONTARIO LOCAL GOVERNMENTS

- **Include in EV Strategies & workplans**
 - Ensure focus on “EV Ready”
 - Prioritize 100% “EV Ready” for new residential
 - Also consider commercial parking areas & goods delivery requirements
- **Consider mechanism**
 - BC local governments make a parking design requirement under authority to regulate parking (consider review of authority in ON)
- **Understand local approvals process for EVEMS**
 - Consider mapping approvals
- **Develop an appropriate EVEMS performance requirement**
 - Consider commissioning performance requirement analysis
- **Understand costs**
 - Consider a costing study for local building archetypes
- **Rich engagement with developers, home-builders, utilities, electrical safety authority**
 - Richmond met with developers for 1 year: dozens of meetings: shared costing study

EXISTING BUILDINGS

WHAT IS REQUIRED TO SUPPORT EXISTING MURBs?

- **Right to Charge legislation**
- **Information / Awareness** – e.g. Guide on how to achieve 100% “EV Ready”
- **“EV Ready” program to support MURB retrofits that provide 100%** (or at least a high percentage) of parking spaces in existing buildings with an energized outlet

“EV Ready” program

EVSE Incentive

Pre-Feasibility Study

**Engineering Design &
Governance**

**Common Infrastructure
Implementation**

**Branch circuit wiring &
EVSE installation**

Image Source: McEwen Climate & Energy & Origin Sustainable Design + Planning. Prepared for BC Hydro.

THANK YOU!



Questions



WHAT IS AN "ENERGIZED OUTLET"?

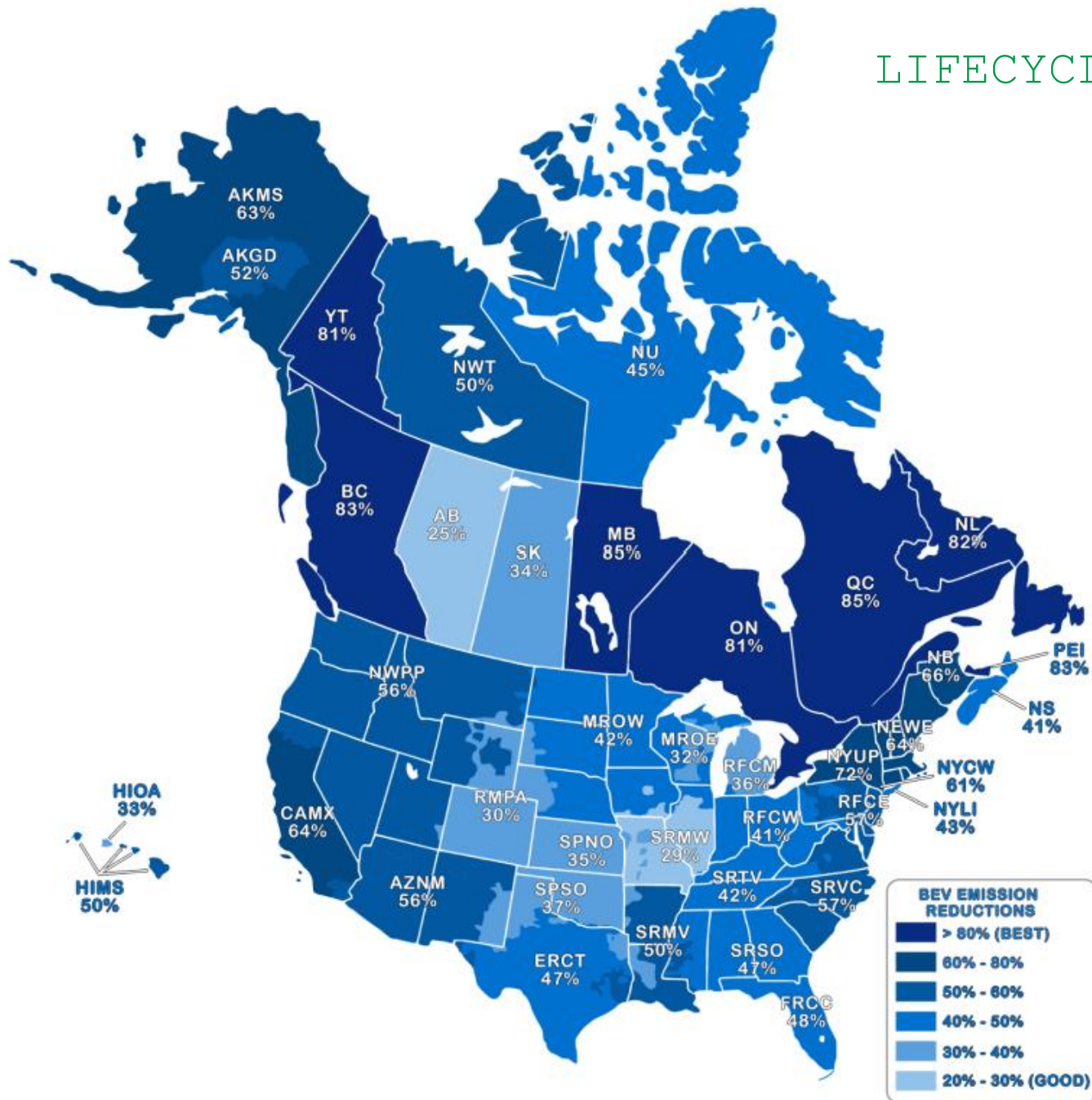


Junction Box



Receptacle

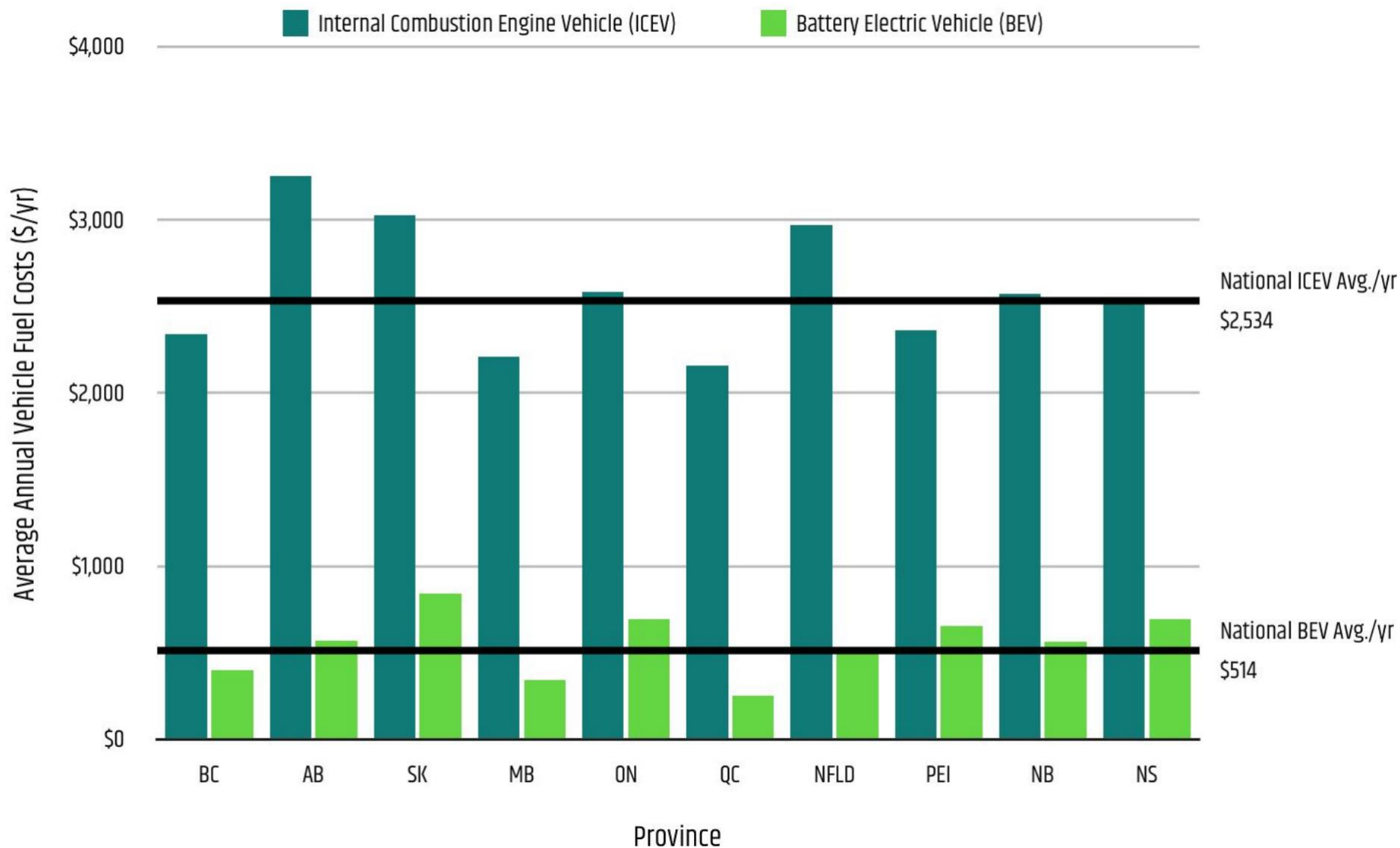
LIFECYCLE GHG REDUCTIONS PASSENGER EV



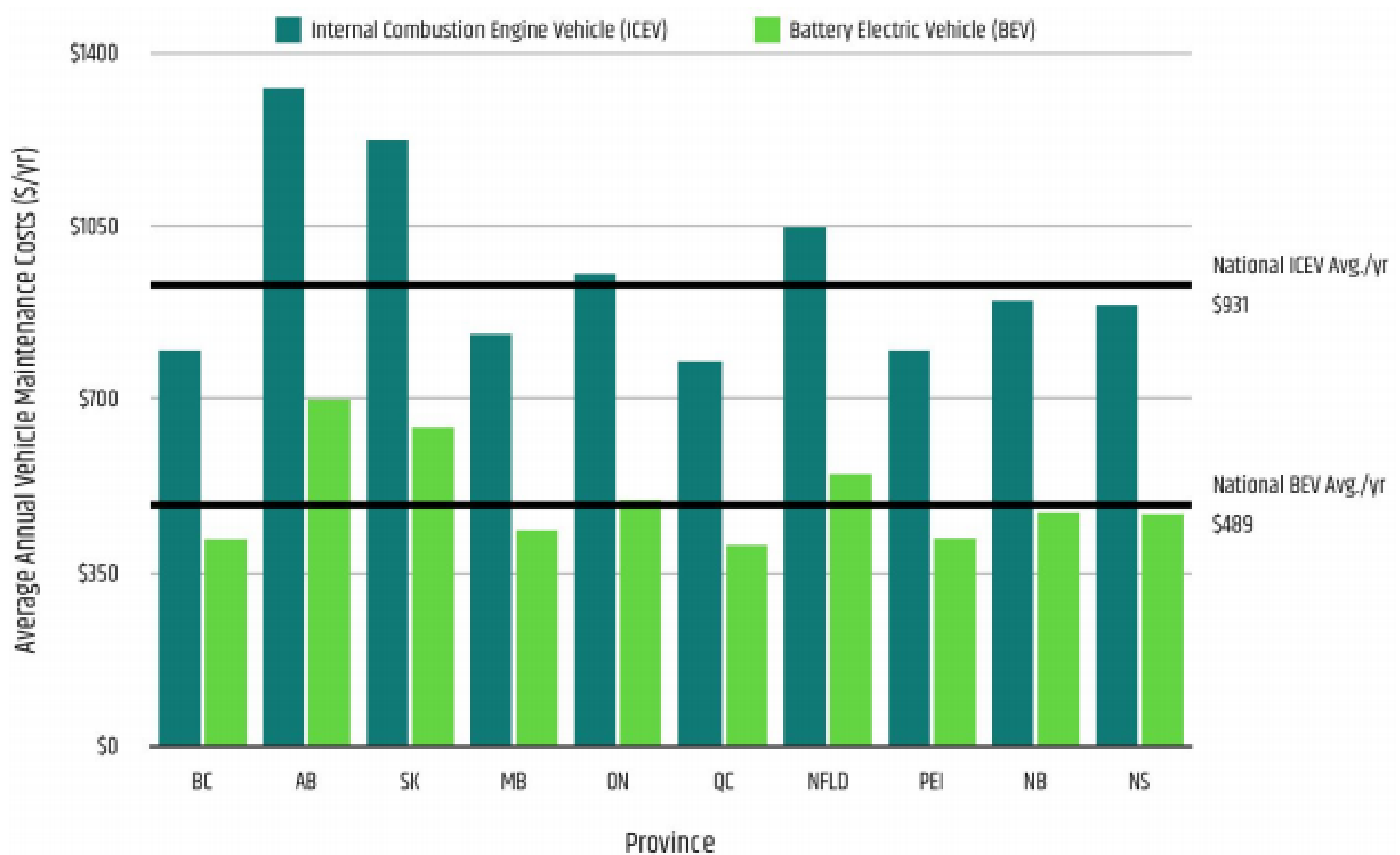
ZERO TAILPIPE EMISSIONS



EVs HAVE LOWER FUEL COSTS

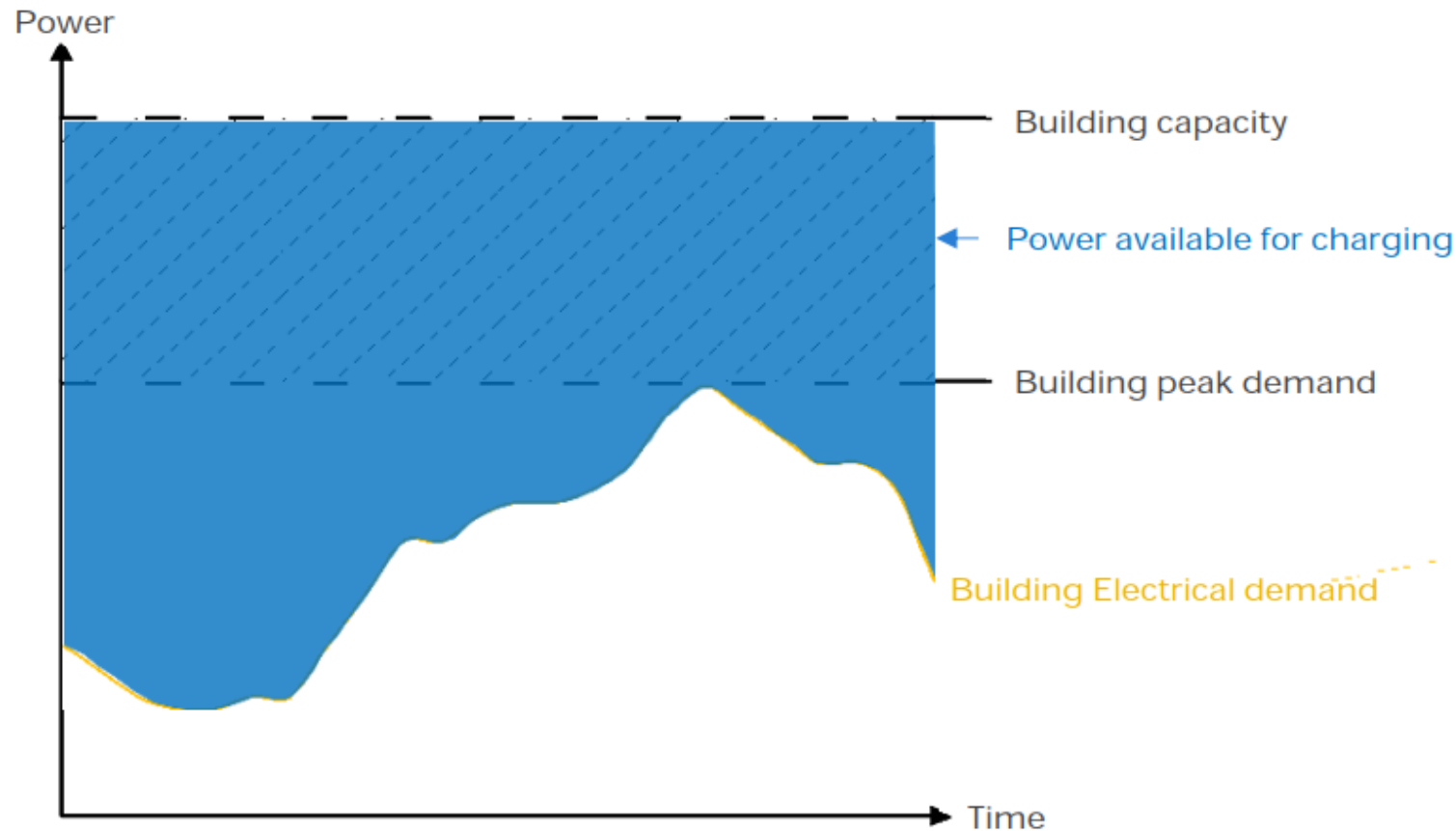


EVs HAVE LOWER MAINTENANCE COSTS



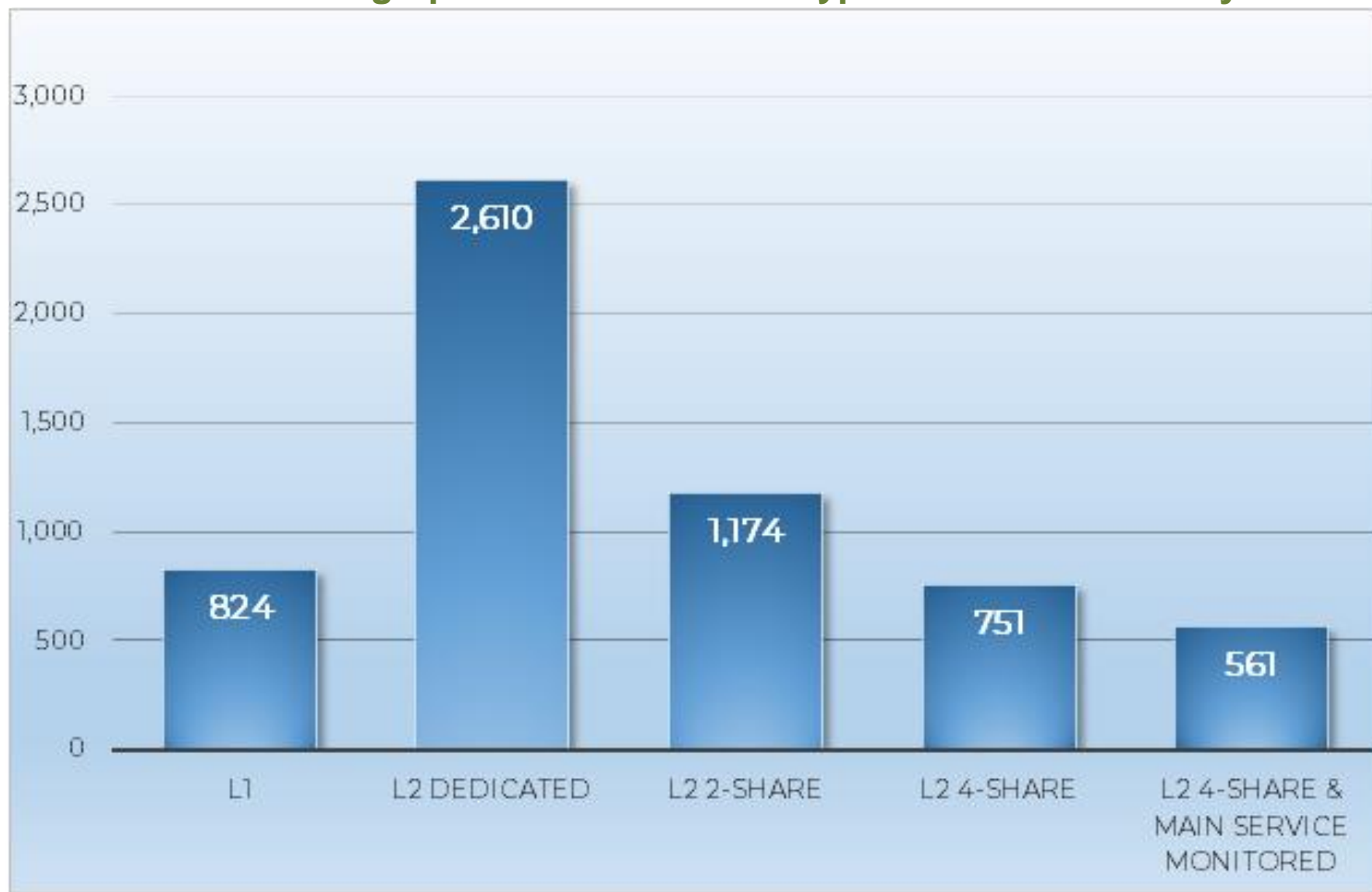
SERVICE MONITORING EVEMS

- Monitoring the main electrical board of a building to determine available spare capacity in real-time, and control of EVSE accordingly.



CITY OF RICHMOND COSTING STUDY

Cost / Parking Space for MURB archetypes – 100% “EV Ready”



Source: AES Engineering. 2017. Prepared for City of Richmond.

RESOURCES TO SUPPORT IMPLEMENTATION

- Costing study (CoR)
- Residential EV Charging: A Guide for Local Governments (CoR BCH)
- Report – Electric Vehicle Charging Infrastructure in Shared Parking Areas (CoR & BCH)

