

Innovations in Electric Vehicle Charging

EV Infrastructure Project: Multi Unit Residential Buildings (MURBs)

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MURBs: An Overview

What are MURBS?

- Multi Unit Residential Buildings (condos, apartments, etc.)

What is the Issue?

- Some municipalities are introducing bylaws for ensuring EV charging infrastructure is considered in new construction, which is great!
- Problems remain with existing buildings. The overwhelming majority of MURBS were designed and built without considering EVs
- Transformer and related built electrical infrastructure won't accommodate large numbers of dedicated Level 2 chargers



MURBs: A Solution

Dedicated vs Shared or Managed

- Dedicated power to each parking stall can be cost prohibitive, and quickly exhaust any spare installed electrical capacity
- By installing EVSEs that share or manage power, far more EV owners have the ability to charge
- Charging may not be as fast as with dedicated, but most EV charging happens overnight, and most EVs are charged long before morning
- Leads to a much more efficient use of electrical resources
- Sharing and load management will also reduce demand charges and smart charging schemes can avoid charging during high TOU tariff times

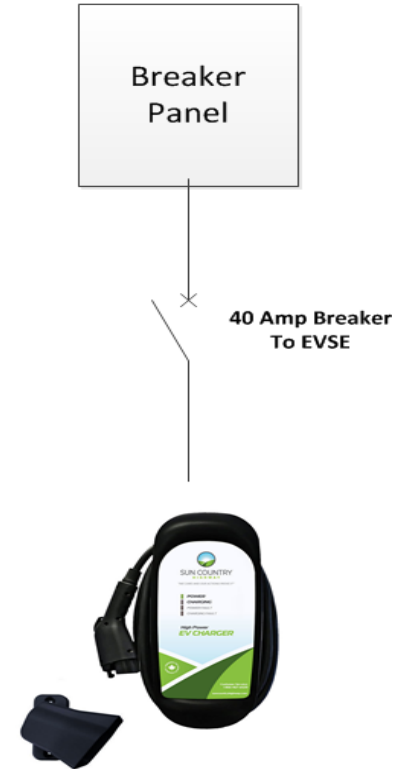


MURBs: What is a Dedicated Load?

Dedicated:

- Each EVSE gets its own circuit.
- Load calculations must assume each EVSE runs independently and therefore be taken as a constant load.

Dedicated

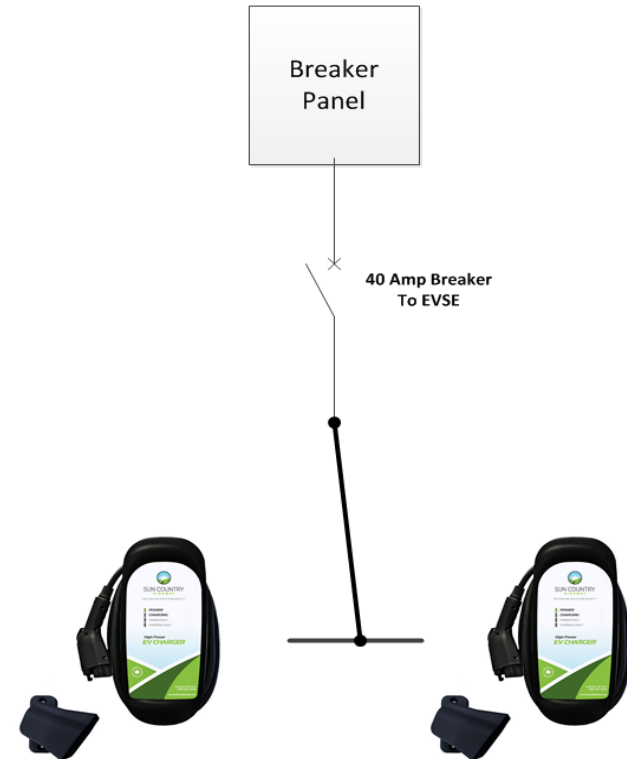


MURBs: What is Load Sharing?

Load Sharing/Power Sharing:

- Control of the current drawn by multiple EVSE on a single circuit to ensure the capacity of the circuit is not exceeded, and that maximum charging is achieved at each EVSE based on the available capacity.
- Load calculations must assume each circuit is fully loaded and a constant load.

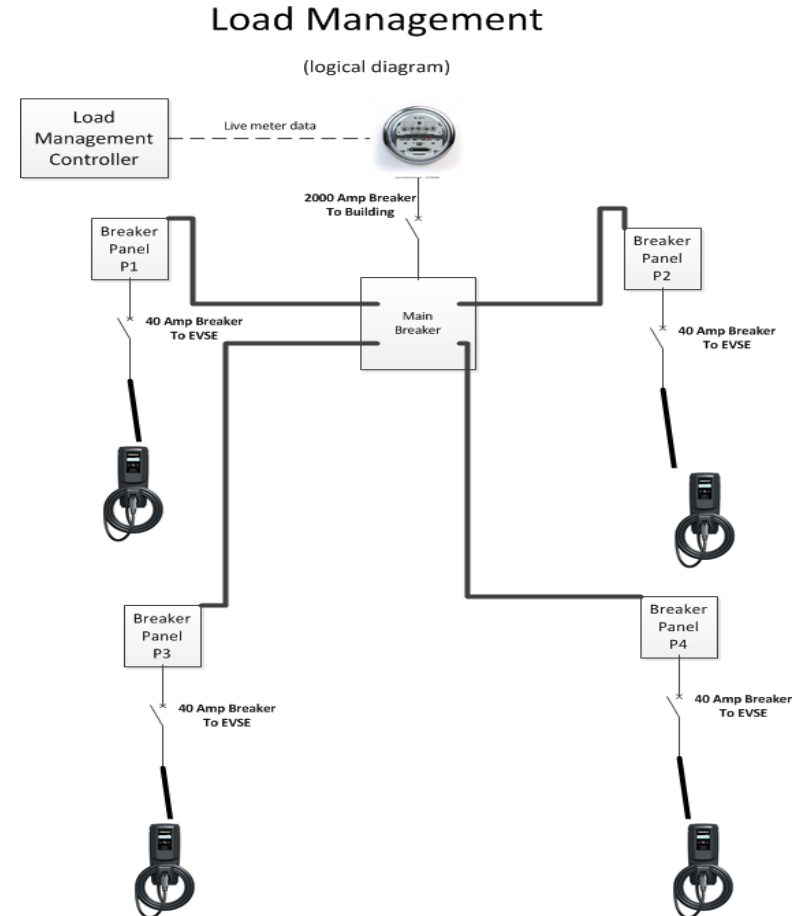
Power Sharing



MURBs: What is Load Management?

Load Management:

- Control of the current drawn by the EVSE, at the main switchboard of the building or sub-panel.
- The available power for EV charging is dynamic, and can take advantage of the excess capacity in the building overnight



MURBs: Considerations for Load Mgmt

Energy:

- A minimum performance level of 12 kWh per EVSE, over an eight (8) hour overnight period. Load management and/or load sharing may be implemented. (source: AES EV Charging Requirements Analysis Report, aesengr.com)
- L1 will not meet this minimum performance.
- Performance requirements may change if V2G services become reality.

Equipment:

- When utilizing a Load Management solution, the user will not be able to bring their own charging equipment. The building will need to provide the equipment and engineering to ensure that new equipment is correctly configured.
- Load Sharing can be mixed within the building but each circuit must contain compatible hardware.



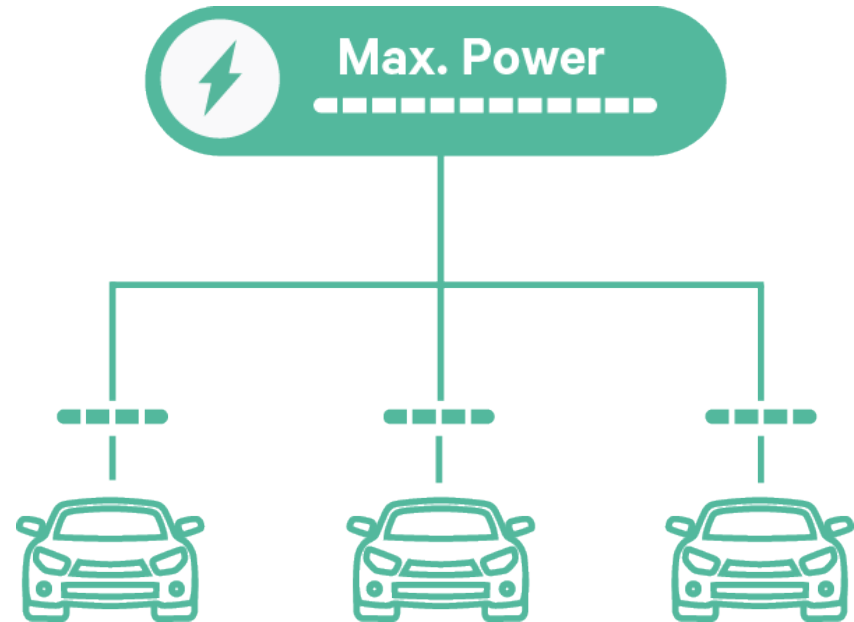
Known Vendors for Sharing Power

With Load Management and Sharing:

- Chargepoint
 - Panel using cloud management
- AddEnergie
 - Building Management System
- VariableGrid
 - Integrated current sensors at local controller

With Load Sharing Only:

- Clipper Creek
 - Hardwire between 2 EVSE
- Efacec
 - Software settings for dual port EVSE



NOTE: The above is not intended to represent product endorsements, nor an exclusive list, rather only represents the products we have tested and current at project time.

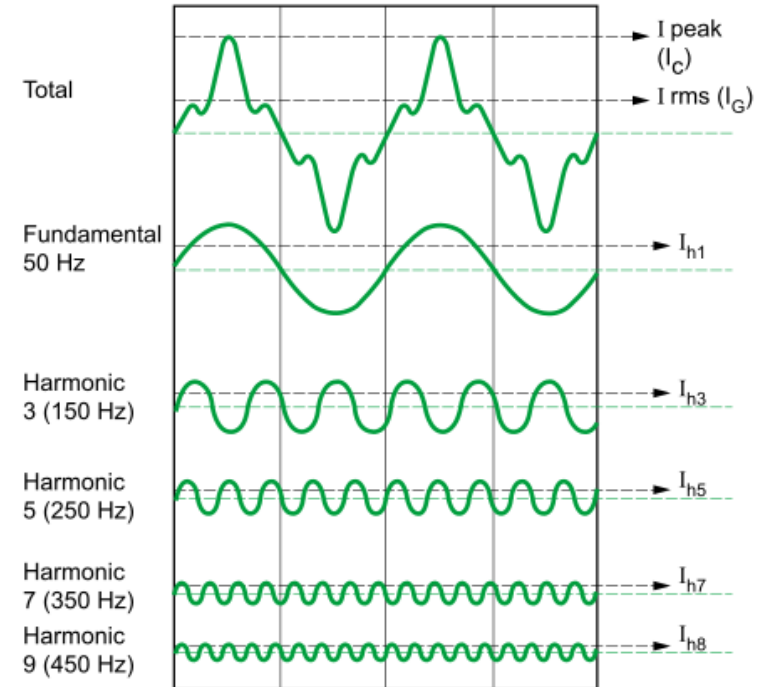
MURBs: Harmonics Considerations

What Are Harmonics?

- The presence of harmonics in electrical systems means that the current and voltage are distorted and deviate from sinusoidal waveforms.
- Harmonic currents are caused by non-linear loads connected to the distribution system.

Why Do We Care?

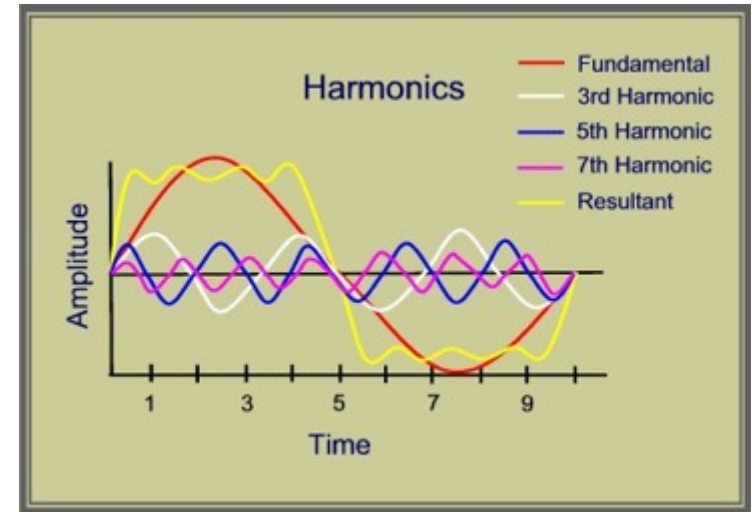
- Harmonics can damage to electrical devices, and should be reduced whenever possible.



MURBs: Harmonics Considerations

What Does This Have To Do With EVs?

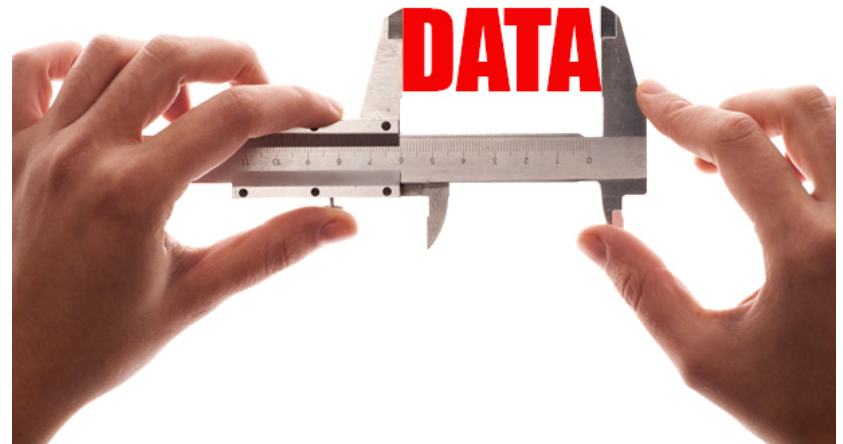
- Almost all electrical devices we buy (TVs, computers, washing machines, and EVSEs) are inspected and must not produce harmonics over a certain threshold in order to get certification from CSA or CUL.
- EVSEs are essentially glorified electrical receptacles, and by themselves, don't produce harmonics.
- The actual device charging an EV's battery from a Level 2 charger is internal to the EV, and may produce harmonics.
- EVs themselves, unlike EVSEs, do not get CSA or CUL certification, which begs the question – are they generating potentially harmful harmonics?



MURBs: Harmonics Considerations

Measurement

- The first step is to measure harmonics to see if there is indeed an issue
- Need to install high-end electrical meter capable of measuring THD and individual harmonics on our six Level 2 chargers at BCIT's Energy OASIS
- Organize groups of EVs from same manufacturer to see if there is a correlation between a particular brand of EV and harmonics
- Look for patterns or trends to predict when harmonics may become an issue in buildings



MURBs: Harmonics Considerations

Questions to be answered:

- Does the vehicle State of Charge affect harmonics?
- Does limiting power to the EV affect harmonics?
- Do Energy Management Systems need to think about harmonics in its scheduling algorithms?
- Are the harmonics more related to the number of vehicles being charged or the total energy being used by charging?



MURBs: Harmonics Considerations

Mitigation

- BCIT is still in the process of measurement, but some consideration has been given to mitigation strategies, should harmonics prove to be a concern.

Filters

- Harmonic filters are readily available from electrical suppliers that can reduce specific harmonics

OCPD

- BCIT is also investigating the use of OCPD in conjunction with advanced metrology to mitigate harmonics.



QUESTIONS & ANSWERS