Multifamily Retrofits Power Efficient Design Guide

A Retrofit Planning & Design Guide for Multi-Unit Residential Buildings

Prepared for:

BC Retrofit ACCELERATOR
Powered by ZEIC

dunsky
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List of Acronyms

ASHP	Air Source Heat Pump
ccASHP	Cold-Climate Air Source Heat Pump
BESS	Battery Energy Storage System
BIA	Battery-Integrated Appliance
BTM	Behind-the-Meter
CE Code	Canadian Electrical Code
CSA	Canadian Standards Association
EERE	Electrical Energy Regulating Equipment
EMS	Energy Management System
ERV	Energy Recovery Ventilator
EPR	Electrical Planning Report
EV	Electric Vehicle
EVEMS	Electric Vehicle Energy Management System
EVSE	Electric Vehicle Supply Equipment
GHG	Greenhouse Gas
HP	Heat Pump
HPWH	Heat Pump Water Heater
HRV	Heat Recovery Ventilator
HVAC	Heating, Ventilation, and Air Conditioning
MURB	Multi-Unit Residential Building
NELI	New Electrical Load Installation
PCS	Power Control System
PED	Power Efficient Design
TES	Thermal Energy Storage
TSBC	Technical Safety BC
VBBL	Vancouver Building By-Law
VFD	Variable Frequency Drive

Introduction

In coming years, multi-unit residential buildings (MURBs) will face increasing demands for new electrical equipment, including:

- Electric **space heating and cooling** equipment, notably **heat pumps**.
- Transitioning from legacy fossil fuel systems to electric **domestic hot water** systems.
- Adoption of **electric cooking** in place of gas.
- **Electric vehicle (EV) charging**.

Adoption of these electrical technologies is being driven by improving technology, consumer demand, and government policies. These technologies can:

- Improve occupant **health and comfort**.
- Enhance **affordability** – for example, EVs have lower total lifetime cost of ownership compared to gasoline vehicles, particularly when charged at home. Similarly, heat pumps are often lower cost compared to separate heating and cooling systems.
- Reduce **greenhouse gas (GHG) and air pollutant** emissions.

However, without careful planning, these new loads can quickly exceed the capacity of MURB's existing electrical infrastructure. **Increasing MURB's electrical capacity can represent substantial costs and logistical challenges** to electrification projects.

Power efficient design (PED) provides an opportunity to defer or avoid such costly electrical upgrades. PED refers to strategies that optimize electricity use to stay within buildings' capacity limits. Accordingly, PED strategies are key tools to ensure that MURB electrification can proceed efficiently, economically, and at scale. MURB owners will benefit from guidance and plans to electrify their buildings in a power efficient way.

Power efficient design (PED) refers to a range of strategies that limit peak electrical demand to avoid overloading building electrical infrastructure, including utility services, switchgear, feeders, and individual dwelling unit panels.

Electrification is the process of replacing technologies or systems that rely on fossil fuels with electric alternatives, such as heat pumps, electric water heaters, induction stoves, and electric vehicles and chargers.

Multi-unit residential buildings (MURBs) are residential buildings containing multiple dwelling units that share electrical and/or mechanical infrastructure. For the purposes of this guide, MURBs include apartment buildings, condominiums, rental buildings, housing co-operatives, and other multi-unit residential buildings where shared systems influence electrical capacity planning and electrification decisions.

Purpose of this Guide

This Guide describes PED strategies for existing MURBs. It is intended to provide **actionable insights** to engineers, contractors, energy advisors, property managers, and other stakeholders involved in electrification projects.

This guide will help readers to:

- **Understand the new electrical energy demands facing MURBs** and how these demands could exceed the capacity of buildings' electrical infrastructure.
- **Help their MURB clients plan for electrification**, including how to anticipate and prioritize new demands for energy, understand the future drivers of electrical demand growth, and implement good solutions today that can avoid barriers for future electrification retrofits.
- **Understand a wide range of PED strategies** applicable to MURBs.

In short, **this guide highlights** promising practices for electrifying MURBs **efficiently within the constraints of the building's existing electrical service capacity.**

HOW MUCH CAN PED SAVE ON ELECTRICAL UPGRADE COSTS?

Electrical service upgrades are often one of the most significant cost drivers in MURB electrification retrofits projects.

- Increasing the capacity of individual suites' panels and electrical feeders can cost $5,000 to $10,000+ per suite.
- The costs to upgrade utility services and shared electrical infrastructure (e.g. transformers, switchboards, etc.) are highly variable. Recent publicly available cost estimates have ranged from $1,000 to $5,000+ per suite.[1]

Utility service upgrades can also entail substantial project delays, often exceeding 2 years for typical upgrades.

Proactive planning using PED strategies allows buildings to maximize their existing capacity and save significant capital and time.

[1] See e.g. FRESCo. 2023. *MURB Electrification Retrofits*. Prepared for Landlord BC.

How to Navigate of this Guide

This guide is organized into two parts. To navigate these sections, click on the titles following (→I) to sections of interest

Part I – Background

These sections define the conditions that shape MURB electrification, including what is driving new electrical loads, how existing building systems are configured, and how electrification projects are planned and assessed.

- →I **What's Driving Electrification?:** Outlines the policy, market, and occupant-driven drivers increasing electrical demand in MURBs.
- →I **Overview of Building Systems**: Summarizes MURB electrical infrastructure and commonly-electrified energy consuming systems.
- →I **Planning for Electrification**: Introduces Electrical Planning Reports (EPRs) and outlines the step-by-step process for MURB electrification planning.

Part II – Power Efficient Design (PED) Strategies

These sections present the core content and this guide, focusing on practical strategies to apply power efficient design (PED) in MURB electrification retrofits.

Overview of Power Efficient Design Strategies: Introduces four broad PED categories and provides navigable links to the remainder of Part II.

- →I **STRATEGY 1 - Optimize Load Calculations**: Explains how CE Code load calculation methodologies can be used to identify available electrical capacity.
- →I **STRATEGY 2 - Efficiency and Right-Sizing:** Provides system-by-system guidance (centralized / in-suite) for efficiency and sizing to reduce peak power draw.
- →I **STRATEGY 3 - Energy Management Systems:** Describes technologies that shift controllable loads off-peak.
- →I **STRATEGY 4 - Onsite Energy Storage Systems:** Outlines on-site storage technologies (battery and thermal).
- →I **Illustrative Examples:** Demonstrates how PED strategies can be applied in practice through example MURB retrofit scenarios.

Appendices

Appendices to this guide provide supporting technical and regulatory information, including electrical planning requirements, applicable codes and regulations, and detailed load calculation methodologies.

PART 1

What's Driving Electrification?

Increased demand for space cooling and at-home EV charging

- **Increasing importance of space cooling:** In British Columbia, recent extreme heat events have prompted the province to implement policy around tenants' ''right to cool''. For instance, the BC Building Code now requires all new residential buildings to maintain at least one living space below 26°C.[2] For existing MURBs, protective measures such as installing portable air conditioning units can help protect vulnerable residents. While these units rarely overload individual unit's panels, their combined increase in power draw can be sufficient to overload the building's electrical capacity[3]. This is driving heat pump installation, as they provide both efficient heating and cooling.
- **EV charging infrastructure:** In BC, EV adoption has grown rapidly in recent years, with EVs representing an increasing share of new vehicle sales, driving demand for reliable at-home charging. Many local governments in BC require all parking in new residential developments to be "EV Ready" for Level 2 charging[4]; this impacts residents' expectations for existing buildings. The CleanBC EV Ready Rebate program has made over 200 existing multifamily buildings 100% EV Ready, matching the infrastructure futureproofing in new construction. Recent amendments to the Strata Property Act and Regulations also aim to facilitate the installation of EV charging stations in existing MURBs.[5]

Policy momentum accelerating electrification

Regulatory pressure to phase out fossil fuels in the Vancouver region is coming from both provincial and municipal levels of government.

- **Provincial level:** The *CleanBC Roadmap to 2030* signaled the Province of BC's intention to regulate that all space and water heating equipment replacements have efficiencies exceeding 100% by 2030, which would effectively require conventional boilers and furnaces to be replaced with heat pump technologies.[6] Likewise, forthcoming changes to the *BC Alterations Code*, which are expected to introduce energy performance requirements for retrofits, with compliance thresholds varying

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[2] BC Housing. (2023). *Low-income and social housing electrification roadmap.*
[3] BC Housing. (2024). *Maintenance matters #23: Electrification in multi-unit residential buildings.*
[4] Power Efficiency Project. (2025). *Overview of power-efficient design.*
[5] BC Housing. (2024). *Maintenance matters #23: Electrification in multi-unit residential buildings.*
[6] Province of British Columbia. (2022). *CleanBC roadmap to 2030.*

according to renovation scope. For larger projects, this could require upgrades to meet current BC Building Code energy standards. While the specific policy measures and implementation timelines continue to evolve, the overall direction is toward increasing building electrification and higher building performance.

- **Municipal level:** the City of Vancouver's Annual GHG and Energy Limits By-Law sets carbon and heating energy intensity limits for large buildings and requires annual disclosure.[7] Building exceeding by-law limits must apply and pay for an annual carbon emissions permit fee (or adopt practices and/or retrofits that bring the building back under thresholds). Beginning June 2026, all MURBs larger than 50,000 square feet are subject to these requirements.[8] However, the City of Vancouver has paused enforcement of this by-law as of May 21, 2026.

Indoor health and comfort improvements

- **Broader non-energy benefits of electrification:** Modernizing MURBs with these technologies helps create more livable and healthier indoor living spaces, in turn increasing tenant satisfaction and retention.
- **Improved indoor air quality:** Indoor air quality significantly improves when gas cooking and heating equipment are replaced with induction ranges and electric heating systems.[9] Gas combustion appliances pose fire risks and release pollutants such as nitrogen oxides, carbon monoxide, and formaldehyde. Exposure to these is linked to childhood asthma and can exacerbate pre-existing health conditions like chronic obstructive pulmonary disease (COPD), heart disease, and diabetes.[10]
- **Enhanced thermal comfort and building resilience:** Heat pumps provide consistent temperature control year round. In the summer, they can provide additional cooling, a critical function during BC's increasingly frequent heat waves.[11]

[7] City of Vancouver British Columbia. (2023). Annual Greenhouse Gas and Energy Limits By-Law No. 13472.
[8] City of Vancouver. (2026). Report your building's energy and greenhouse gas emissions data.
[9] Columbia University Mailman School of Public Health. (2024). Switching from Gas to Electric Stoves Cuts Indoor Air Pollution
[10] Redwood Energy. (2021). *Consumers energy all-electric multifamily design guide.*
[11] Condominium Home Owners Association of BC (CHOA). (2025). Guidance for the preparation of electrical planning reports for strata corporations in British Columbia.

Overview of Building Systems

This section provides a high-level overview of electrical and energy-consuming systems commonly found in MURBs. It is intended to help readers understand how different building systems are configured and how electrification measures may affect shared electrical infrastructure. The section includes:

- a conceptual overview of electrical distribution systems in MURBs, intended for readers without an electrical background; and
- a summary of common energy end uses in MURBs and how these may be served through either centralized or in-suite systems.

Electrical Systems

Figure 1 and Figure 2 illustrate example electrical systems in a smaller and larger MURB, respectively. Important electrical systems in MURBs include:

- A **main transformer** that reduces voltages from utility distribution system voltages (e.g. 25kV, 12.5kV) to those used in building systems (e.g., 120/240V single-phase in small buildings; 120/208V three-phase or 347/600V three-phase in larger buildings). Most MURBs have one main transformer connection. However, some MURB complexes feature multiple different buildings with separate utility connections and transformers.
- The building's **service connection**. The building service is located downstream of the connection point with a utility; this may be upstream or downstream of the main transformer.
- **Switchboard / main distribution equipment**. The electricity supply is first fed into the building's main electrical distribution equipment (switchboards/central distribution panel). This equipment contains electrical disconnect switches, fuses or circuit breakers that protect and isolate electrical circuits. Power is then distributed via **feeders** through one or more stages of electrical distribution equipment. The specific arrangement varies by building and may include meter centres, panelboards, loadcentres, or combinations thereof before power reaches the branch circuits serving individual loads.
- MURBs usually have individual **metering** for each residential suite and separate metering for common loads (e.g. elevators; common areas; EV charging in shared parkades).
- From the meter centre(s), power is then delivered via feeders to suites and common area **panelboards**.
- **Branch circuits** are connected to panelboards. A branch circuit is the portion of a wiring installation between the final overcurrent device (e.g., a circuit breaker) protecting the circuit and an outlet(s).

All the above electrical systems must be sized appropriately to handle the electrical load, and may have limited spare electrical capacity to accommodate new loads.

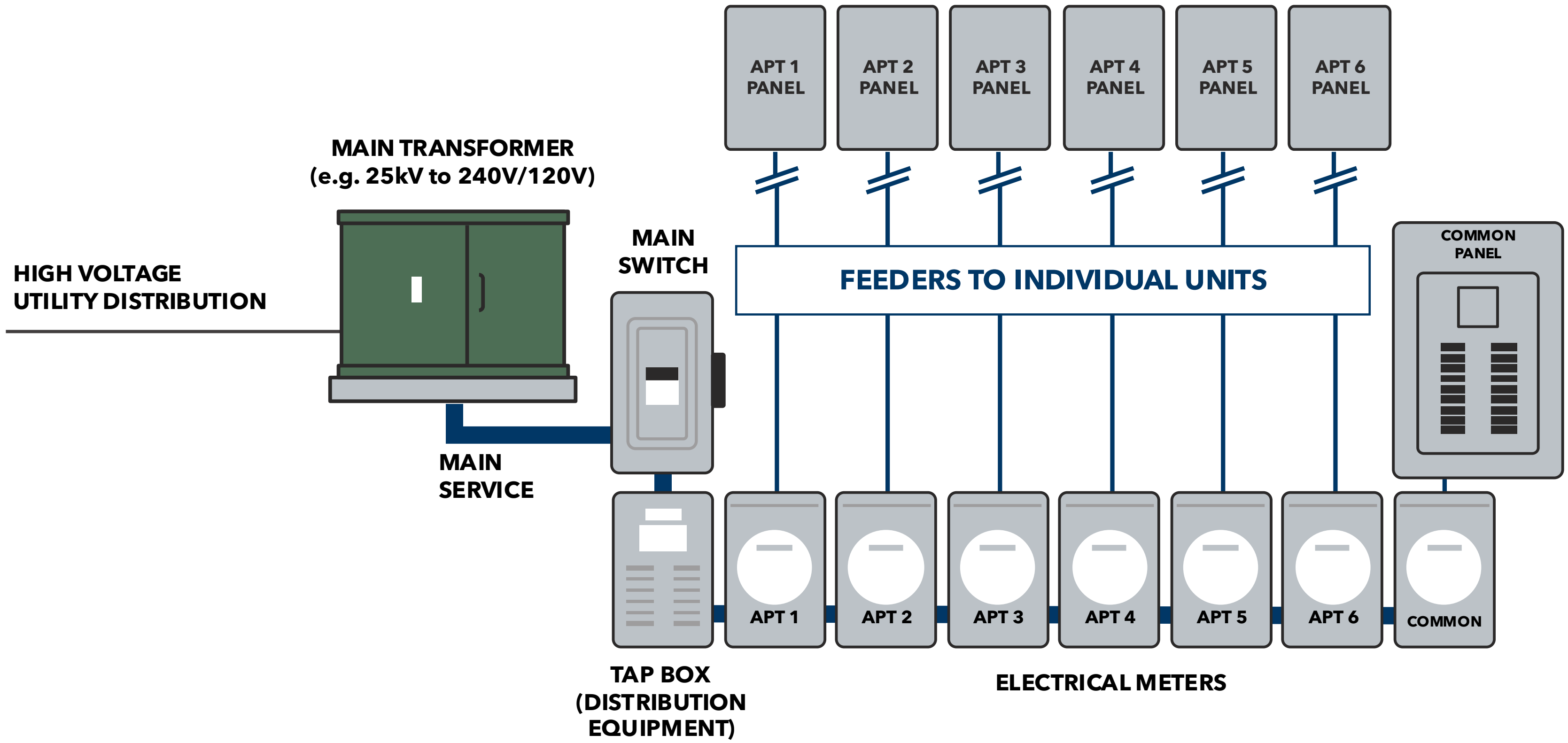

Figure 1: Example electrical systems in a small MURB.

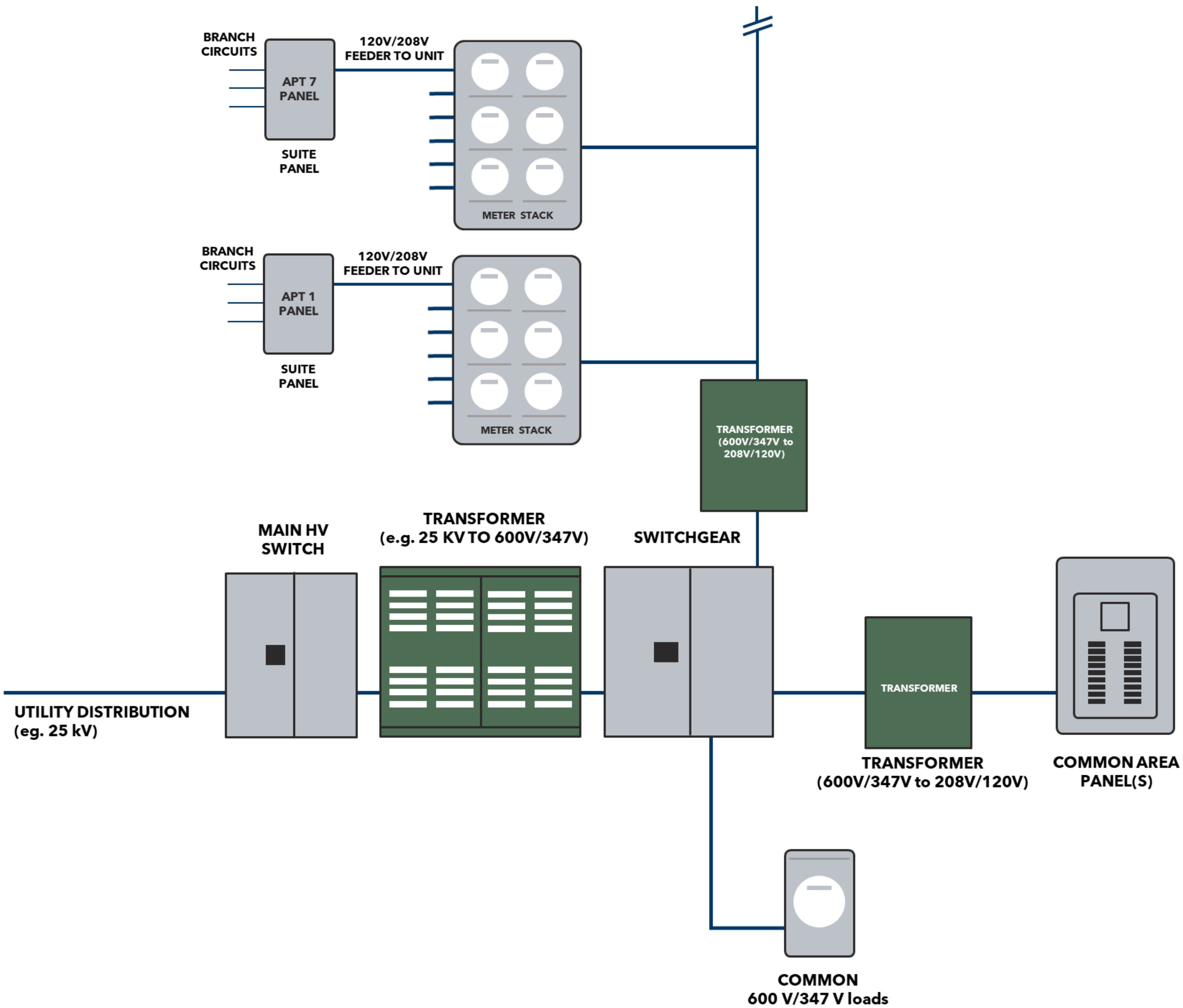

Figure 2: Example electrical systems in a large MURB.

Central Versus In-Suite Energy Services

Sometimes electrification involves switching systems from central systems to those that are provided from suites' electrical panels. For example, a building might transition from a centralized common gas-fired system distributing hot water to supply radiant space heating in units to heat pumps supplying each individual suite. Or a central ventilation system supplying gas-heated air to common hallways might be replaced by ventilators in each individual suite, providing improved fresh air delivery and reducing common gas consumption. In these circumstances suite panels must have sufficient capacity and space for breakers to accommodate the new loads.

There are a variety of energy services we depend on our buildings to provide, including:

- Space heating and cooling
- Ventilation / fresh air
- Hot water heating
- Cooking
- Lighting
- Various "plug-load" appliances (e.g. refrigerators, household appliances)
- EV charging

Space conditioning, ventilation, and domestic water heating loads may be provided by central common electrical power supplies and serve central loads and/or zonal systems grouping multiple residents (see Figure 3).

Conversely, all loads other than EV charging can be provided from suites' individually metered electrical panels. However, even when loads are fed from a suite's individual panel, upstream shared electrical systems (e.g. shared feeders and the building's service) must have sufficient capacity to accommodate the aggregate load.

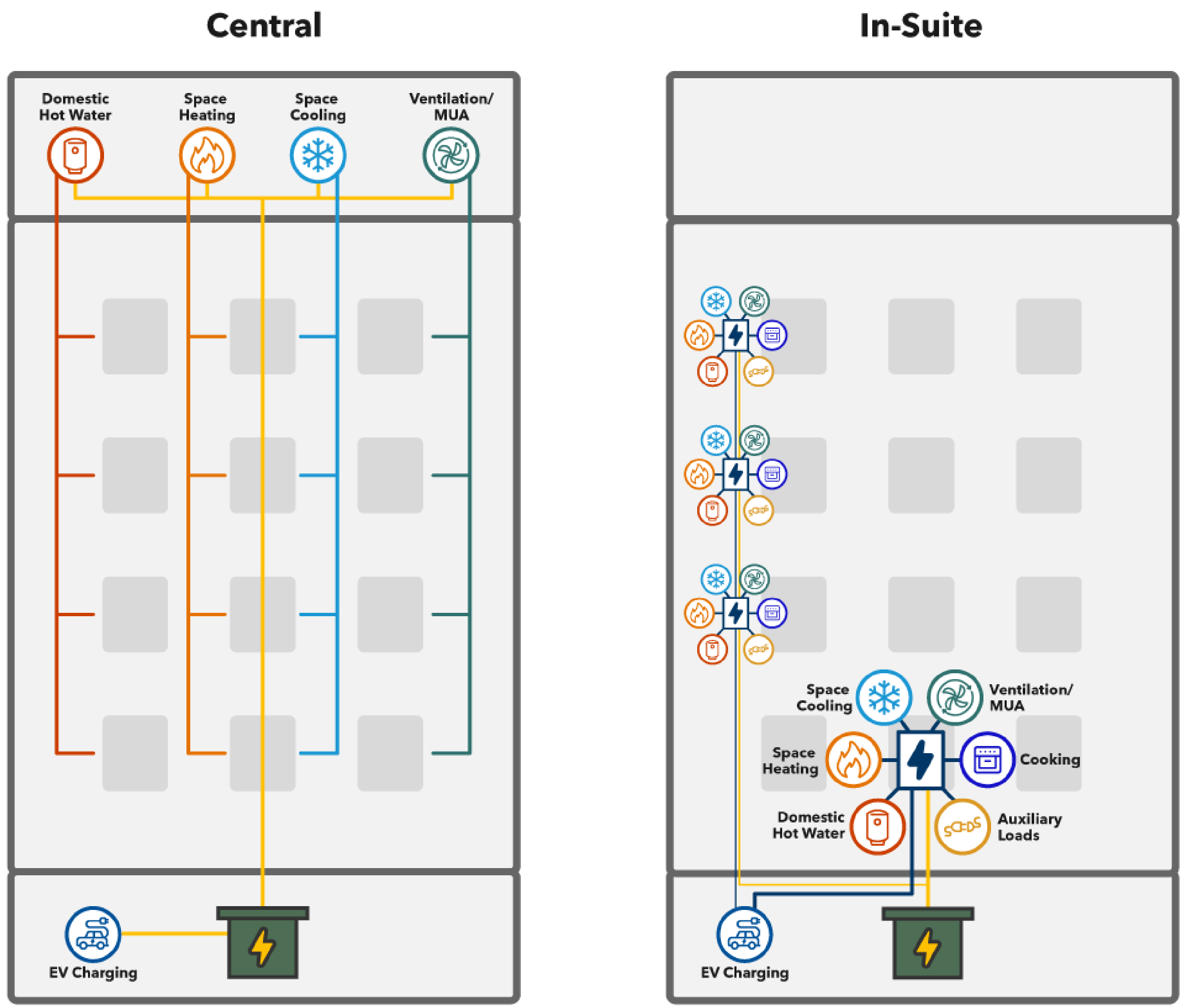

Figure 3: Loads in multifamily buildings - central versus in-suite systems.

Planning for Electrification

Thoughtful planning is key to maximizing the potential for MURB electrification while avoiding or deferring electrical upgrades. As opposed to only evaluating electrification projects independently, consultants and contractors can help condominium and building owner clients understand how to make best use of their limited electrical capacity as building systems are electrified over time.

Typically, electrification will proceed over years or decades, as building systems come up for replacement and/or as occupant demands evolve (e.g. demand for EV charging, heat pumps, or electric cooking). It is important to set buildings up for success by planning today for how to proceed with electrification over time. This includes anticipating that occupants demands, market conditions, and/or policy is likely to evolve to drive greater electrification than residents currently demand.

Careful attention to PED strategies is particularly important in buildings where electrical capacity is limited. Notably, buildings with fossil fuel-based space heating will usually have less spare capacity to accommodate new electrical loads. More advanced PED strategies may be needed to defer or avoid upgrading electrical services in these buildings. Conversely, buildings with existing electrical resistance space heating are more likely to have sufficient capacity to accommodate new loads.

A properly scoped **Electrical Planning Report (EPR)** provides the best opportunity to anticipate and coordinate electrification efforts. Alternately, such a plan can be developed as a precursor to individual electrification projects; for example, as part of an expanded scope of an EV Ready Plan or as part of HVAC or building enclosure upgrade assessments.

BC'S ELECTRICAL PLANNING REPORT REQUIREMENTS

BC's Strata Property Act and Regulation require that multifamily condominiums with five or more units obtain an Electrical Planning Report (EPR). An EPR:

- Describes the current electrical capacity of the buildings service and relevant feeders.
- Lists existing electrical loads and estimates spare capacity.
- Estimates for loads from building electrification and EV charging.
- Identifies opportunities to reduce or manage electrical demand.

An EPR must be completed by a qualified person, such as a professional engineer or other designated electrical professional. Further information about EPRs and guidance on how to complete them is summarized in the *Guidance for the Preparation of Electrical Planning Reports for Strata Corporations in British Columbia* prepared for the Condominium Home Owners Association (updated May 2026).

How To Plan for Electrification & Power Efficiency

CONSIDERATION	CONSULTANTS & CONTRACTORS	CONDOS, BUILDING OWNERS & MANAGERS
COMMIT TO ELECTRIFICATION PLANNING	Advise clients on value of PED and of planning for electrification. Sell electrification planning services.	Decide to invest in a plan to guide electrification. This can take the form of an Electrical Planning Report or as a precursor to an individual project.
ASSESS CAPACITY	Review electrical service ratings, feeders and panel capacity. Use the maximum measured 12 month historical peak demand to establish available (spare) capacity in accordance with CE Code Rule 8 106(8). If major loads were added during the measurement period, the data must be adjusted or supplemented with sub metering.	N/A
EVALUATE STRATEGIES	Identify appropriate strategies to electrify different energy end uses – e.g. space heating and cooling; ventilation; water heating; cooking; clothes drying; EV charging. Determine PED approaches that can accommodate the greatest electrification on the limited capacity of buildings' services and other infrastructure. Right-size loads and then consider energy management strategies to avoid electrical service upsizing. Identify appropriate timing/thresholds for any electrical upgrades that are necessary.	N/A
PRIORITIZE PROJECTS	Coordinate with and advise clients on how to interpret the Watt Budget; whether new loads can be accommodated by existing infrastructure or if prioritization is necessary; and sequencing options.	Determine which electrification projects are priorities, where necessary. E.g. is the near-term priority to ensure all residents can implement heat pumps? Have access to home EV charging?
DOCUMENT	Synthesize options and decisions into an EPR or similar document.	Use plan to guide future work.
IMPLEMENT	Assist with implementation	Use EPR to guide individual projects in coming years. Direct consultants and contractors to following PED strategies and the Watt Budget in the EPR through detailed design and construction.
TRACK	Include recommendations in the EPR/Electrification Plan to track available capacity as loads are added. This can be achieved by using the same historical load calculation methodologies as performed during the EPR/Plan preparation, or via additional sub-metering.	Update historical load calculations or sub-metered information at regular intervals – e.g. when major new electrical loads are being considered; on an annual basis; etc.

PART 2

Overview of Power Efficient Design Strategies

There are four broad categories of PED strategies applicable to MURB electrification retrofits:

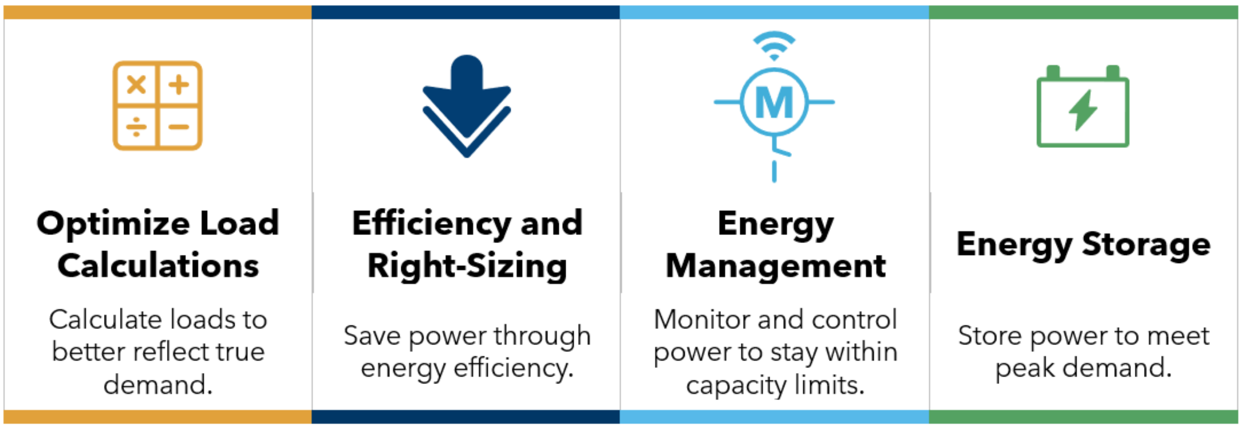

Figure 4: PED Categories

These categories are complementary and are often most effective when applied together as part of an integrated retrofit plan.

The following sections describe these categories in detail. **To navigate these sections, click on the titles following (→I) to sections of interest.**

- →I **STRATEGY 1 - Optimize Load Calculations** explains how CE Code electrical load calculation methodologies, particularly the use of measured historical demand, can be used to identify available electrical capacity and establish an accurate basis for electrification retrofit planning.
- →I **STRATEGY 2 - Efficiency and Right-Sizing** describes how reducing building loads and sizing equipment to match those reduced loads can minimize electrical demand, with system-by-system guidance for both centralized and in-suite applications.
- →I **STRATEGY 3 -Energy Management Systems** describes how controllable loads can be limited using energy management technologies to reduce coincident demand, and how these strategies can be applied under current the CE Code.
- →I **STRATEGY 4 - Onsite Energy Storage Systems** outlines the role of on-site storage technologies (battery and thermal) and their treatment under the current CE Code.

STRATEGY 1

Optimize Load Calculations

Section 8 of the Canadian Electrical (CE) Code includes requirements for load calculations for buildings' electrical services, feeders and branch circuits. Installed equipment must have sufficient capacity to accommodate the calculated load. Likewise, the capacity calculated dictates the electrical service capacity that must be requested from utilities.

CE Code Section 8 includes two methods for determining the electrical capacity available for adding new loads.

1. **Calculate the theoretical electrical load** of the building, as would be performed for new construction, under CE Code Rule 8-202. Appendix A provides a brief overview of the components of a theoretical load calculation.
2. **Use the historical load demand** from the most recent 12-month period and add the sum of the additional loads, per Rule 8-106 8).

Using historical load calculation methodologies typically finds considerably more available electrical capacity than theoretical load calculation methodologies. Calculated maximum demands are inherently higher than measured/actual maximum demands, as they are sufficiently conservative to avoid overloads nationwide. As an illustrative example, Figure 5 shows the spare (remaining) capacity using historical load calculations from an Electrical Planning Report for a small MURB complex at the building service level and at the unit level for two typical dwelling units.

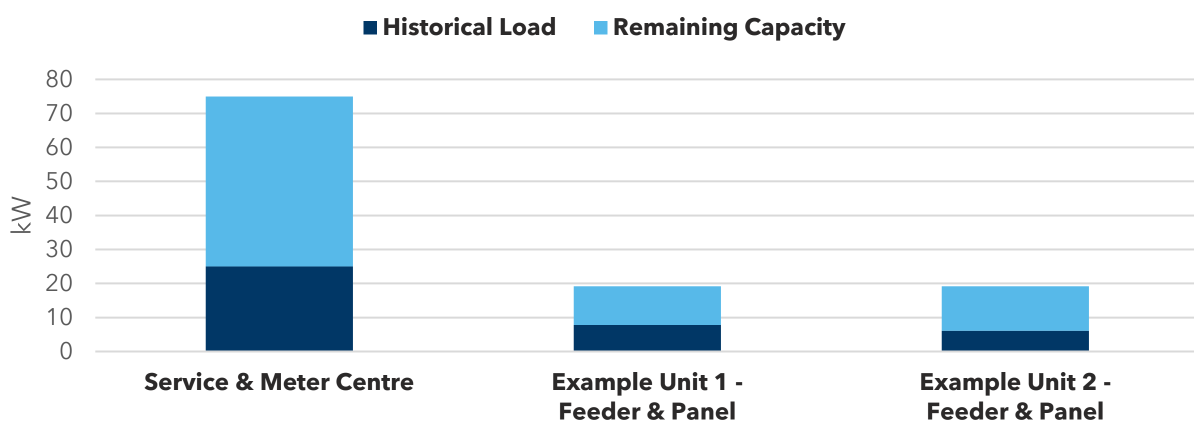

Figure 5: Example historical loads from an 18-unit MURB complex with gas space and water heating.

Accordingly, when planning how to add electrical loads to MURBs, it is good practice to use historical load calculation methodologies. Obtaining historical electrical demand data provides a more accurate understanding of the actual peak demand and available capacity than theoretical calculations alone.

Importantly, aggregated historical data captures the effects of load diversity across multiple dwelling units. In MURBs, individual suite loads (e.g. cooking, heating, appliances) do not all operate at peak simultaneously. This "true diversification" typically results in lower observed peak demand than CE Code calculation methodology outputs.

However, utility-provided historical data typically reflects a prior 12-month period and does not always fully capture changes in building load within that timeframe (e.g. whether new loads were added during a given 12 month period). Submetering or system-level monitoring data, where available, can be used to supplement historical utility data and better reflect the contribution of newer loads.

BC Hydro has processes enabling MURBs (including apartments, townhome complexes, and mixed-use buildings) to request historical, aggregated peak load data for their facilities.[12] In addition to aggregating meter data on a service, it can be used to aggregate data on specific feeders/meter centres. Likewise, when individual suites are adding electrical loads, individual BC Hydro customers could use their own historical data to accommodate the additional load. BC Hydro customers can access their individual unit data through their MyHydro account.

FortisBC customers can access historical electricity consumption through the MyFortisBC online account portal or by requesting data directly from FortisBC customer service. Unlike BC Hydro, FortisBC does not currently provide a dedicated public portal for requesting aggregated peak demand data for MURBs, making such approaches considerably more challenging.

Using historical load calculations in Electrical Planning Reports provides a more accurate picture of available capacity. Likewise, it is good practice to regularly update historical load information to track a building's use as it adds electrical loads over time.

1.1 Energy management strategies to reduce calculated loads

Rule 8-106 of the CE Code enables certain energy management strategies to reduce calculated loads. Rule 8-106 2) enables **circuit switching** strategies, specifying that where two or more loads are installed so that only one can be used at any one time, the one providing the greatest demand shall be used in determining the calculated demand. Under CE Code Rule 8 106 2), two loads may share a branch circuit only if an approved switching device prevents simultaneous operation. This rule applies only to branch circuits – not feeders or services – and AHJs may require mechanical interlocks or certified control devices.

Such strategies can potentially be of use in fitting additional loads on a limited panel size; however, their ability to reduce load calculations for upstream service and feeders service in a MURB is typically minimal.

The CE Code also enables a variety of **EV energy management systems (EVEMS)** to reduce calculated loads:

- Rule 8-106 10) specifies that where EV charger loads are controlled by an EVEMS, EV charger demand will equal the maximum load allowed by the EVEMS. For example, multiple 40A EV chargers can share a branch circuit, but the calculated load will be limited to the maximum output of one charger (typically 32A).
- Rule 8-106 11) specifies that EV charger loads do not need to be included in load calculations if an EVEMS monitors the capacity of a buildings' service, feeders and branch circuits, and controls EV charger loads so as not to exceed their capacity.

[12] BC Hydro, Request peak load data for your building or strata.

- Under CE Code Rules 8 106 10) and 8 106 11), EV loads may be excluded from calculated demand only when controlled by an EVEMS that continuously monitors service or feeder capacity and automatically reduces EV charging to prevent overload. The EVEMS must be fail safe: loss of communication or controller failure must disable EV charging. With such **service monitoring** technologies, EV charger loads can be ignored entirely in load calculations.

CSA Group has issued CSA C22.2 No. 343 Electric vehicle energy management systems; however, to date, most EVEMS are not certified to this standard. Accordingly, electrical authorities having jurisdiction in BC typically require professional assurance of systems performance.

Two Technical Safety BC (TSBC) Information Bulletins have been recently issued to address this gap.

- **TSBC Information Bulletin IB-EL 2023-05 Rev.3 (March 2025)**[13] describes variance application requirements for electric vehicle supply equipment (EVSE) and electric vehicle energy management systems (EVEMS) to be considered as acceptable methods to meet BCEC Rule 8-106 10) and 11). EVEMS are recognized as code-compliant control systems that can substitute their managed load limit (set-point) for full connected load (aggregate) when calculating service size or feeder demand under Rule 8-202.
- **Complementary TSBC Information Bulletin on Load Calculations for Row Housing IB-EL 2014-01 Rev.4 (March 2025)** clarifies the distinction between BCEC Rules 8-200 and 8-202 based on service configuration – MURBs with shared service remain under 8-202.[14]

1.2 EMS variances that are not enabled in the CE Code

The 2024 CE Code does not currently recognize non-EV load control (e.g., domestic hot water, space heating, appliances) as a basis for reducing calculated demand. These strategies may be used operationally but require a variance under Rule 2-030 if they are intended to reduce service or feeder sizing. For example, the current version of the CE Code does not recognize the following strategies as means to reduce calculated loads:

- Service/feeder monitoring and control of non-EV charging loads (e.g. turning a hot water heater, dryer, or other loads off or down as electrical limits are approached).
- Battery integrated appliances (e.g. battery integrated oven ranges) that can use lower power circuits (e.g. oven ranges) while still providing high power output to customers.
- Energy storage to reduce buildings' peak demand (integral fail-safe mechanism required for failure or depletion events).

Electrical authorities having jurisdiction may support variances to deploy such solutions.[15]

Later in this guide, we discuss the possibility for energy management systems controlling non-EV loads. Future versions of the CE Code, BC Electrical Code and/or Vancouver Electrical By-Law are anticipated to be amended to enable these solutions to control non-EV loads without such a variance process.

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13 Technical Safety BC, IB-EL 2023-05 rev3, March 2025.
14 Technical Safety BC, IB-EL 2014-01 rev4, March 2025.
15 See the City of Vancouver's Bulletin 2009-004-EL "Special Permission" of the Electrical By-Law No. 5563 Application of Rule 2-030 of the Canadian Electrical Code, Part I "Deviation or Postponement".

STRATEGY 2

Efficiency and Right-Sizing

MURB electrification is not just about replacing fossil fuel systems with electric ones; it is fundamentally about managing peak electrical demand within constrained infrastructure. Efficiency and right-sizing form a coordinated approach to minimize instantaneous electrical demand.

1. **First, reduce the load where possible.** Improve the efficiency of building systems to lower overall energy demand and resulting peak electrical loads.
2. **Then, right-size to meet the reduced load.** Select and size electrical and mechanical equipment based on these reduced loads.

This order of operations is important. Designing systems before reducing loads can lock in unnecessary electrical capacity. Right-sizing after efficiency measure implementation enables the selection of smaller equipment with lower power draw, thereby improving the feasibility of electrification within existing electrical infrastructure capacity limits.

To navigate this section, click on the titles following (→I) to subsections of interest:

→I **2.1 Efficiency Can Lower Power Demand**

Describes how envelope improvements and high-efficiency mechanical systems can lower space heating and domestic hot water demand.

→I **2.2 Centralized Systems Right-Sizing**

Recommended approaches for right-sizing electrified centralized MURB systems and equipment with practical examples.

→I 2.2.1 Centralized Space Heating

→I 2.2.2 Centralized Domestic Hot Water

→I 2.2.3 Centralized Ventilation

→I **2.3 In-Suite Systems Right-Sizing**

Recommended approaches for right-sizing electrified in-suite (distributed) systems and equipment with practical examples.

→I 2.3.1 Space Heating

→I 2.3.2 In-Suite Water Heating

→I 2.3.3 All-In-One Systems

→I 2.3.4 Appliances

2.1 Efficiency Can Lower Power Demand

Improving building efficiency directly reduces the electrical impacts of MURB retrofits. In a PED context, efficiency measures matter not only because they reduce annual energy consumption, but also because they reduce the loads that electrical and mechanical systems must handle, thereby lowering both connected load and peak electrical demand.

2.1.1 Heating Loads

MURB heating demand is largely determined by the thermal effectiveness of the building envelope. Heat loss through opaque assemblies, windows, and uncontrolled air leakage drives the peak loads that ultimately determine heating system capacity and, by extension, electrical infrastructure requirements. In buildings already requiring recladding or major envelope renewal, these measures can be coordinated with planned capital upgrades to minimize electrification costs and occupant disturbance.

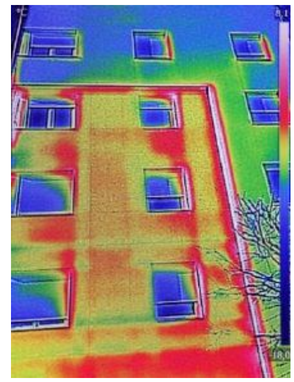


Figure 6: MURB Thermal Imaging

Key envelope-related building performance measures include:

- Improving roof and wall thermal performance (e.g. overcladding, interior insulation retrofitting)
- Upgrading fenestration performance
- Reducing air leakage through enclosure sealing
- Reducing thermal bridging through improved cladding and balcony connections

These measures reduce heating load at the source and can enable lower-capacity electrified space conditioning systems.

If a MURB will be engaging in envelope renewal, envelope measures to reduce space conditioning loads should be considered before right-sizing mechanical systems.

2.1.2 Hot Water Loads

Domestic water heating is one of the largest continuous energy loads in existing MURBs, often accounting for up to 25% of a building's energy use intensity.[16] Reducing hot water demand before sizing electrified DHW systems lowers required heating capacity, storage requirements, and electrical demand.

- **Low-flow plumbing fixtures** reduce consumption while maintaining occupant comfort.
- **Efficient appliances** (e.g. ENERGY STAR®), use less hot water per cycle.
- **Improved hydronic distribution system efficiency**, including better pipe insulation, optimized recirculation controls, and increased hot water storage reduce standby and distribution losses as well as demand peaking.
- **Operational measures**, such as temperature setpoint optimization and occupant awareness initiatives, can reduce consumption by limiting unnecessary heating and use.

These measures reduce hot water demand at the source and enable smaller-capacity electrified DHW systems with lower power draw.

[16] ZEIC B2E, Right-Sizing Matters: Retrofitting Domestic Hot Water in MURBs | B2E, April 2025

2.2 Centralized Systems Right-Sizing

2.2.1 Centralized Space Heating

Many MURBs use centralized heating systems to distribute heat through hydronic piping to fan coils, radiators, or baseboard units located in suites or common areas. In older buildings, the heat source is often a central gas-fired boiler plant. Electrification of these systems typically involves either:

- Replacing the fossil fuel heat source with electric equipment while maintaining the existing hydronic distribution network (solutions discussed in this section); or
- Shifting from centralized fossil-fuel based heating to distributed systems (i.e. in-suite heat pumps that can also provide cooling).

Recommended Approaches for Right-Sizing Centralized Heating

✔ **Size centralized heating systems using measured historical demand** rather than legacy equipment capacity or generic design assumptions. A historical demand–based approach focuses on establishing loads that are representative of real building operation.

- **Use submetered heating data**, where available, to calculate average daily consumption and characterize peak demand periods. Thermal submeters at the plant level or suite level can help characterize consumption and demand trends.
- **Where submetering is unavailable**, historical gas consumption, building automation system trend data, equipment efficiency ratings, efficiency de-rating by equipment age, and other operating data can help calibrate or validate calculated heating loads.
- ✘ **Do not size electrified central heating systems based on existing fossil-fuel capacity.** Legacy gas-fired heating systems tend to be oversized to enable rapid heating. Using installed boiler capacity as a proxy for actual demand will almost certainly lead to significant oversizing of electric heating systems.

✔ **Limit backup electrical resistance heating.** Where electric resistance is used for supplemental or extreme weather backup, they should be sized only for the portion of load that cannot be practically met by the primary heat pump plant under design conditions. Avoiding full capacity resistance backup can materially reduce peak electrical demand.

✔ **Use modular and staged heating plants.** Central electric heating plants can be designed with staged or modular capacity so output can track building load more closely across the heating season. This improves part-load performance and reduces the need to install excessive capacity in a single large increment. It can also reduce the need to accurately estimate historical demand.

✔ **Optimize hydronic system operation through control strategies.** Variable-speed pumping, proper system balancing, and outdoor temperature reset controls can improve heat distribution and reduce both pumping energy and heating plant electrical demand.

✔ **Coordinate heating plant sizing with other PED measures.** Envelope upgrades, ventilation right-sizing, heat recovery, and other system-level improvements can reduce building heating demand and should be reflected in final plant capacity selection. Where electrification retrofits are staged, load-reducing measures can be implemented first and the resulting heating demand measured to inform right-sizing of the electrified heating plant.

PRACTICAL EXAMPLE

▶ RIGHT-SIZING CENTRALIZED SPACE HEATING

Let's compare central heating electrification strategies for a 189-unit MURB with a 2500A, 600Y/347V incoming electrical service. All calculated loads are shown at the 600V building service level. First, let's consider central heating in isolation.

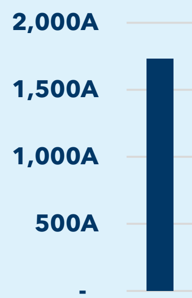
Central Gas-Fired Boiler Plant

2x 2500 MBH Laars MagnaTherm
4,748 MBH total heating output

negligible

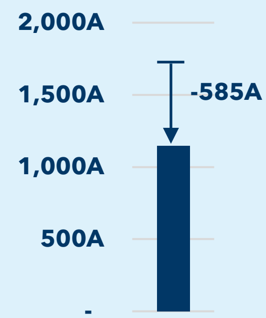
Central Electric Boilers for Hydronic Heating

6x Laars 1431-NH EB-240-600
4,913 MBH heating output



Central ASHP Heating (and Cooling) Plant

2x AERMEC NS-3402
4,952 MBH total heating output

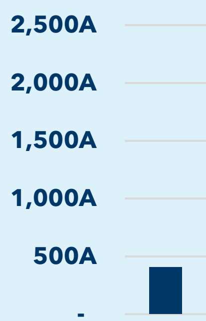


Electrifying existing centralized gas-fired heating adds significant electrical loading at the building service level. The central ASHP configuration results in a substantially lower added electrical load than the electric boiler configuration due to the higher efficiency of heat pump heating. Mechanical room and rooftop space and structural capacity must also be considered in selecting electrification alternatives but are outside of the scope of this document.

Now let's factor in conventional electric chiller loads for the base case design. These are not required for the ASHP case, since the ASHP provides both heating and cooling.

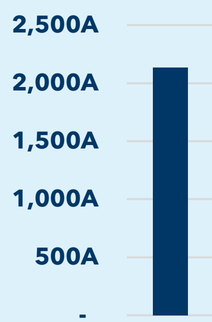
Central Gas-Fired Boiler Plant and Air-Cooled Chiller

2x 2500 MBH Laars MagnaTherm
1x 250 ton Daikin AGZ



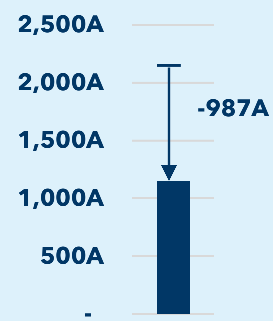
Central Electric Boilers and Air-Cooled Chiller

6x Laars 1431-NH EB-240-600
1x 250 Ton Daikin AGZ



Central ASHP Heating and Cooling

2x AERMEC NS-3402
384 tons cooling



When cooling is considered alongside heating, electrifying central heating still represents a significant addition to building-level electrical loads. However, combining heating and cooling within a central ASHP plant can avoid the need for separate electric chiller capacity and reduce the total connected load relative to an electric boiler plus chiller approach.

2.2.2 Centralized Domestic Hot Water

Most MURBs constructed in BC between the 1960s and 1990s rely on centralized, gas-fired DHW plants, typically served by atmospheric or mid-efficiency boilers.[17] These conventional systems were typically designed with the following characteristics:

- **Oversized heating capacity**, driven by a design priority on rapid (i.e. 1-hour) recovery following peak draw events.
- **Minimal storage volume**, since high boiler capacity allows for fast reheating.
- **Peak-oriented sizing**, with morning and evening weekday peaks driving capacity.

As MURBs electrify, central heat pump water heater (HPWH) systems have emerged as the most common replacement technology for fossil fuel-fired DHW plants. HPWHs use electricity and a refrigerant cycle to extract heat from ambient air and transfer it to domestic water via a heat exchanger. In electrification retrofit applications, HPWH systems can often reuse much of the existing DHW distribution and recirculation piping infrastructure.

Unlike traditional HVAC heat pumps, DHW heat pumps are designed to deliver higher outlet water temperatures, typically up to 70°C (160°F), enabling compatibility with centralized DHW systems.[18]

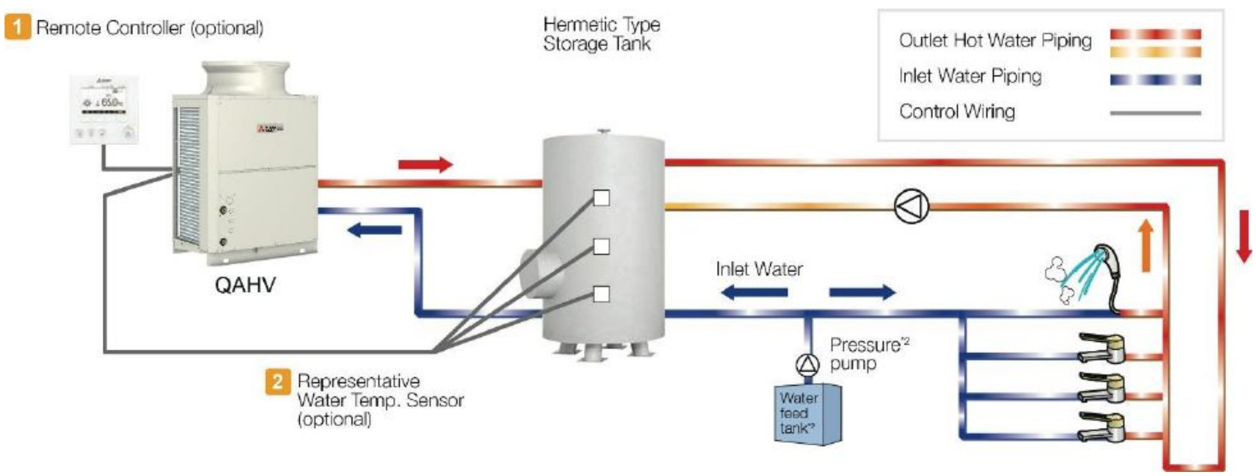


Figure 7: Mitsubishi Electric, Ecodan QAHV Domestic Hot Water CO2 Heat Pump

A defining difference between gas-fired DHW systems and HPWH systems is the **role of thermal storage**. HPWHs generally have: lower instantaneous heating capacity; longer recovery times; and greater reliance on storage tanks.

Rather than attempting to meet peak demand instantaneously, HPWH systems use larger storage volumes to shift heating to off-peak periods. In effect, DHW storage tanks act as a thermal battery, allowing the heat pump to operate more steadily while meeting short-duration morning and evening peaks. **This storage-centric approach enables the selection of smaller HPWH equipment capacity with lower peak electrical demand.**

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[17] BC Housing Homeowner Protection office, Greenhouse Gas Implications of HVAC Upgrades in Multi-Unit Residential Buildings, January 2015.
[18] BC Housing Research Centre, Design Guide for DHW Heat Pumps in New MURBs, September 2024.

Importance of Right-Sizing for HPWH Systems

Oversizing HWHP systems not only increases capital cost but can also reduce system efficiency more significantly than in conventional gas-fired systems.

- HPWHs are typically less tolerant of oversizing, leading to short-cycling and lower COPs.
- Electrical infrastructure impacts scale directly with installed capacity.
- HPWH systems generally have a larger physical footprint than gas boilers, making mechanical room space a common constraint.

A 2019 study commissioned by the City of Vancouver analyzed measured DHW consumption data from a sample of 37 MURBs and found that the daily per capita consumption was approximately 61 L/person/day (16 gal/person/day) lower than ASHRAE consumption assumptions.[19] This finding suggests that **conventional sizing approaches may significantly overestimate actual DHW demand and thus power draw** for DHW heating in multifamily buildings.

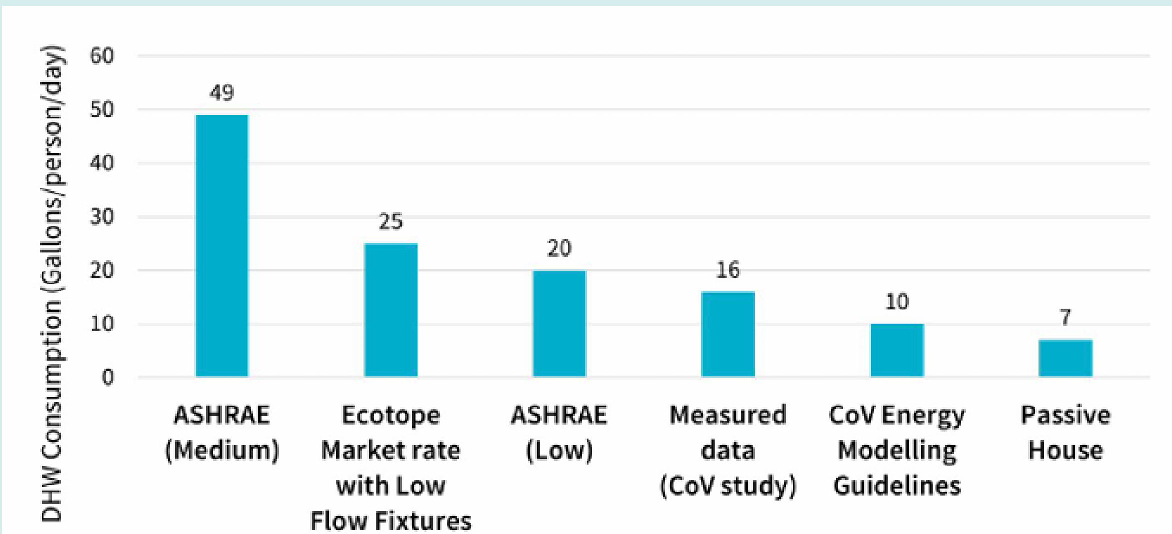

Figure 8: Industry DHW Consumption Assumptions [20]

[19] BC Housing Research Centre, Design Guide for DHW Heat Pumps in New MURBs, September 2024.
[20] 2050 Partners, Water Heater Right-Sizing: ASHRAE Recommendations vs. Actual Hot Water Use, March 2025 (2025 ACEEE Hot Water & Hot Air Forums)

Recommended Approaches for Right-Sizing Centralized Water Heating

✓ **Reduce DHW heating demand before right-sizing centralized equipment.** Several complementary strategies can contribute to lower HPWH power draw.

- **Increase storage tank insulation**: Increasing insulation thickness from 3 inches (ASHRAE baseline) to 6 inches at 60°C stored water temperature can reduce tank heat losses by approximately **30%**.[21]
- **Minimize distribution and recirculation losses** through improved pipe insulation, reduced recirculation flow rates, and optimized control strategies.
- **Reduce DHW demand** using low-flow fixtures, aerators, and efficient appliances.

✓ **Size centralized DHW systems using measured historical demand** rather than legacy equipment capacity or generic design assumptions. A historical demand–based approach focuses on establishing real **average and peak DHW loads.**

- **Use sub-metered DHW data**, where available, to measure daily consumption and characterize peak demand periods. In MURBs, DHW peaks typically occur on weekday mornings and evenings, with lower consumption during mid-day and overnight hours.
- **Where sub-metering is unavailable**, estimate demand by auditing fixture flow rates, unit counts, and typical occupancy levels.
- ✗ **Do not size HPWH systems based on existing fossil-fuel capacity.** Legacy gas-fired DHW systems were almost always oversized to enable rapid recovery. Using installed boiler capacity as a proxy for actual demand will almost certainly lead to significant oversizing of electric systems.

✓ **Use online tool-based DHW sizing methods** in cases where historical demand data are incomplete or unavailable to support optimization of centralized HPWH systems. Tools such as Ecotope's *Ecosizer* [22] are specifically designed to model the interaction between heat pump capacity, storage volume, draw profiles, and recovery performance over time, making them well suited to storage-centric DHW system design.

Tool-based sizing best practices avoid systematic oversizing; these include:

- **Replace default demand assumptions** with audited or locally appropriate values for occupancy, unit counts, and per-capita hot water use, rather than relying on ASHRAE-based defaults.
- **Prioritize thermal storage over heat pump capacity**, testing configurations that meet peak demand through stored hot water rather than instantaneous recovery.
- **Evaluate hourly system performance**, including tank temperature profiles and recovery between peaks, instead of relying solely on summary sizing outputs.
- **Test multiple capacity vs storage combinations** to identify the lowest capacity heat pump configuration that reliably meets service requirements.
- **Cross-check electrical implications**, ensuring that modeled heat pump capacity aligns with available electrical service and broader power efficiency design objectives.

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[21] Lync by Watts, Performance and Operational Benefits of Storage Tanks in Heat Pump Water Heating, 2024.
[22] Ecosizer tool available at https://ecosizer.ecotope.com/sizer/.

Recommended Approaches for Right-Sizing Centralized Water Heating

The Ecosizer tool outputs minimum heating capacity and storage at the design conditions stated, as well as a primary sizing curve based on the DHW heat pump operating for 16 hours on a peak day.[23] The user can adjust the curve to explore configurations that include greater storage with reduced capacity, or conversely, increased capacity and less storage.

Tool-based outputs should be treated as optimization and validation aids, not as prescriptive sizing results. Final system sizing should reflect the fundamental operating characteristics of HPWH systems (steady operation, storage-driven peak management, and minimized electrical demand) rather than legacy design assumptions focused on rapid recovery.

✔ **Use modular and staged plant equipment to serve incremental DHW loads.** Centralized electrified DHW systems can be implemented using modular HPWH skids that integrate heat pumps, storage tanks, pumps, controls, and accessories. This modular approach allows electrified DHW capacity to be added incrementally, enabling designers to quantify how much gas-fired load is displaced by each increment and determine how many modules are actually required.

With staged deployment, projects can gradually increase electric DHW capacity while monitoring real system performance and electrical demand. This approach allows buildings to progressively transition toward full electrification, while also enabling hybrid configurations during interim phases and providing greater flexibility for managing building electrical capacity.

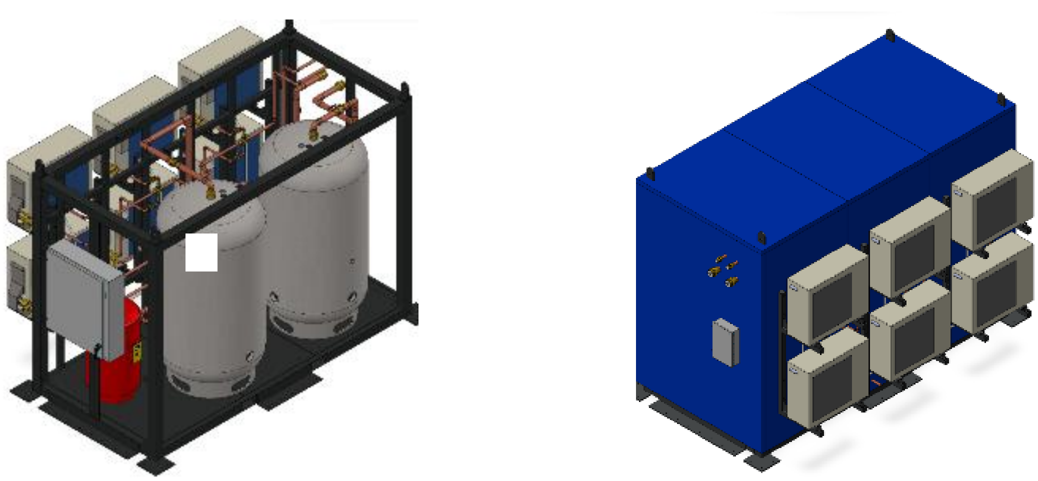


Figure 9: SmallPlanet WaterDrop **Modular Domestic Hot Water Plant**

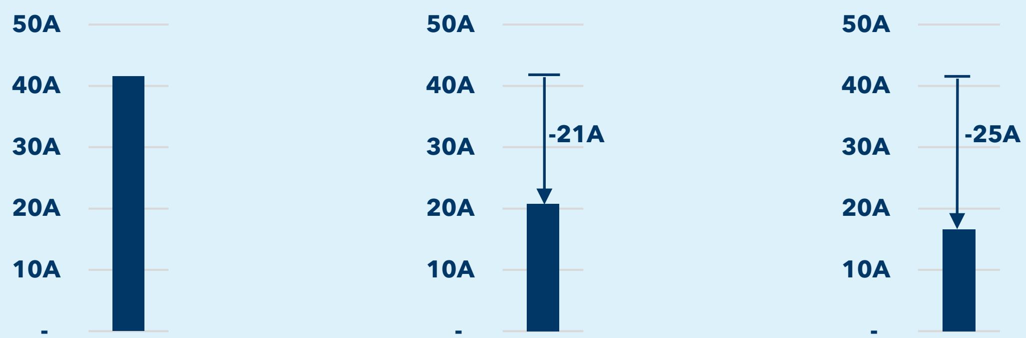
[23] Ecotope, Ecosizer – Central Heat Pump Water Sizing Tool Manual, December 2020.

PRACTICAL EXAMPLE

▶ RIGHT-SIZING CENTRALIZED DOMESTIC WATER HEATING

Let's see how right-sizing DHW HPWH equipment can affect electrical load at the building service level. To do so, we will compare three design approaches for a 30-unit MURB with 60 occupants using the *Ecosizer* tool.

ASHRAE Medium	Ecotope Market Rate	City of Vancouver Study
49 gal/person/day (185L/p/day)	25 gal/person/day (95L/p/day)	16 gal/person/day (60L/p/day)
10x SANCO$_2$ GS5-45HPC HPWH	5x SANCO$_2$ GS5-45HPC HPWH	4x SANCO$_2$ GS5-45HPC HPWH
760 gal (2875L) storage	387 gal (1465L) storage	248 gal (940L) storage



* Nameplate feed for SANCO$_2$ GS5-45HPC HPWH is 208/230V-1Ph-60Hz.

For this example, right-sizing the HPWH plant to suit historical load according to the City of Vancouver study rather than the medium ASHRAE assumption can reduce the peak demand by 20A. Note that a 20A reduction at the building service level, does not typically impact equipment sizing, as there are discrete equipment capacities i.e. 100A, 200A, 400A, 800A, etc.

That said, right-sizing HPWH for DHW heating saves physical space and reduces added structural load requirements in existing MURB mechanical rooms – constraints that frequently determine whether retrofits are feasible.

Centralized Ventilation

Centralized ventilation systems in MURBs operate continuously and have heating loads coincident with winter space heating peaks – making them a significant factor in load sizing, particularly in retrofits where legacy gas-fired outdoor air tempering systems are electrified.

Conventional Centralized Ventilation Systems in Existing MURBs

For most existing BC MURBs constructed between the 1960s and early 2000s, ventilation is provided by centralized systems such as: Indirect gas fired rooftop air handling units; hydronic make-up air units (typically fed from gas fired heating plant); electric resistance heating make-up air units.

Where heating at centralized make-up air units has been conventionally provided by gas heating (indirect-fired or hydronic coil), ventilation's contribution to electrical service sizing was often limited to fan motor power alone. When gas-fired central ventilation is replaced with electric tempering, the ventilation heating and cooling loads become part of the building's electrical demand.

Central Ventilation Electrical Load Drivers

When a gas-fired central ventilation system is replaced with electric tempering, the ventilation heating load becomes part of the building's electrical demand. The following characteristics commonly drive increased continuous and peak electrical loads.

Characteristic	Power Impact Mechanism
Oversized airflow rates	Increased fan power and increased electric heating demand due to greater ventilation air volume.
Constant speed fans	Continuous full-load motor demand with limited turndown, resulting in higher coincident peak and annual energy use.
Electric resistance tempering coils	Large winter peak demand coincident with space heating peaks.
Poor control sequencing	Excess or improper loading contributor; unnecessary simultaneous operation of heating and full airflow, increasing coincident electrical demand.
Lack of heat recovery	Higher thermal input requirement.

Importance of Right-Sizing for Central Ventilation

Fan power scales approximately with the cube of airflow (per the fan affinity laws), meaning modest airflow reductions can yield disproportionately large reductions in electrical demand.

- 10% airflow reduction reduces required fan power by 27%
- 20% airflow reduction reduces required fan power by 49%

Excess airflow also increases heating (and cooling) demand, since more outdoor air must be tempered.

Recommended Approaches for Right-Sizing Centralized Ventilation

✔ **Reduce ventilation airflow and air tempering demands before right-sizing centralized equipment.** Several complementary strategies can contribute to lower centralized air handler power draw.

- **Improve envelope airtightness:** Leaky envelopes increase the airflow required to maintain corridor pressurization. Improving airtightness can lower airflow requirements and reduce both fan power and tempering capacity requirements.
- **Optimize controls and scheduling:** Where applicable, implement airflow turndown, pressure reset, and improved supply–exhaust coordination to reduce continuous and coincident peak demand.

✔ **Right-size airflow before electrification.**
Oversized ventilation airflow increases both continuous fan demand and required electric heating capacity, locking in unnecessary peak demand. Prior to electrifying, ventilation systems should be re-balanced, evaluated against current code-minimum airflow requirements, and assessed for opportunities to reduce corridor pressurization.

✔ **Right-size heating based on airflow and occupant comfort requirements.**
Legacy gas-fired air handlers were often sized conservatively for rapid heating capability. Converting burner nameplate capacity directly into electric coil capacity almost guarantees oversizing. Electric ventilation tempering systems should be sized based on verified airflow rates, required discharge temperatures, and design day conditions.

✔ **Add variable frequency drives (VFDs) to enable turndown on supply fans.**
Where feasible, VFDs should be installed to allow for control strategies that minimize fan speed while maintaining minimum corridor pressurization levels as well as occupant health and comfort (e.g. static pressure reset, time of day scheduling).

✔ **Prioritize heat pump MAUs over electric resistance tempering.**
Where space, budget, and infrastructure allow, air-source heat pump MAUs should be considered to reduce installed electric heating capacity and lower winter peak demand.

✔ **Define and limit supplemental resistance trim heat.**
Properly sequenced resistance trim can avoid unnecessary activation and reduce additional peak electrical demand. Supplemental heat should be limited to clearly defined balance-point conditions and sequenced to prevent simultaneous full capacity compressor and resistance operation.

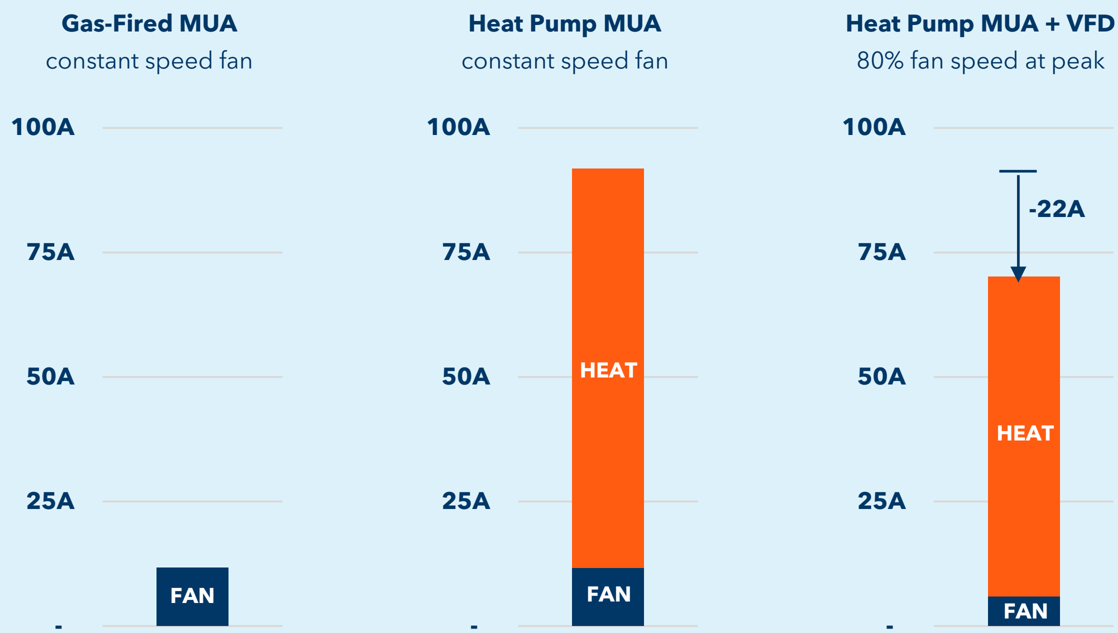
✔ **Integrate heat recovery where feasible.**
Without heat recovery, electric heating systems must provide the full temperature rise from outdoor air to supply air setpoint. Where duct configuration permits, HRV or ERV integration should be evaluated to reduce required heating capacity and lower coincident winter peak demand.

PRACTICAL EXAMPLE

▶ RIGHT-SIZING CENTRALIZED VENTILATION EQUIPMENT

Let's see how right-sizing a central heat pump (HP) make-up air unit (MUA) can affect electrical load at the building distribution panel level.

To do so, we will compare central ventilation design for a 71-unit MURB with two conventional constant-volume (CV) gas-fired make up air units. The results are shown below on a per-MUA basis.



For this example, right-sizing is applied through the use of a variable frequency drive (VFD) on the supply fan, dialed back to 80% speed at peak. Not only does this decrease fan power draw, but also heating power draw as less air is being drawn through the MUA and tempered for delivery to conditioned spaces. If right-sizing in design could implement a 20% capacity reduction, breaker size for each MUA could be decreased from100A-125A to 80A.

This example is based on a case study by RDH Building Science.

2.3 In-Suite Systems Right-Sizing

2.3.1 Space Heating

The electrification of space heating, which is often coupled with the introduction of space cooling, can significantly increase suite-level and aggregate building electrical demand if systems are not carefully selected and right-sized. From a PED perspective, in-suite space heating systems warrant particular attention because conservative sizing assumptions applied repeatedly across many suites can aggregate to dominate suite panel, feeder, transformer, and service capacity requirements.

In existing BC MURBs, space heating is often provided on a suite-by-suite basis using electric resistance baseboard or hydronic fan coils or baseboards served by a central gas-fired boiler plant.[24] These systems were typically designed using conservative peak load assumptions with limited consideration of suite-to-suite diversity, internal heat gains, or part-loads.

In-Suite Air-Source Heat Pumps

Driven by electrification retrofits alongside growing occupant demand for cooling, in-suite air-source heat pumps (ASHPs) are increasingly used as replacement technologies for existing space heating systems in MURBs. Modern in-suite ASHPs differ fundamentally from electric resistance heating and hydronic fossil fuel-based systems in several ways that directly affect sizing strategy.

- ASHPs deliver variable output and typically operate at part load for the majority of the heating season.
- Peak heating capacity is only required for a small number of extreme cold hours per year if sized to serve full space heating demand.
- Oversized units operate less efficiently and with increased cycling.

Figure 10: Carrier Infinity ductless cold climate mini split ASHP

Importance of Right-Sizing for In-Suite Heat Pumps

Right-sizing in-suite heat pumps involves two different but related design challenges.

Challenge 1 – Fit within Suite Electrical Panel

The first constraint is local: each in-suite heat pump must be able to operate within the capacity and breaker space of the existing suite electrical panel. ASHPs rarely present capacity problems for suite electrical panels in existing MURBs (typically 100A), provided historical data is used in accordance with CE Code Rule 8-106 8).

Challenge 2 – Manage Building-Level Aggregate Demand

The aggregation of space heating capacity across dozens or hundreds of suites can dominate feeder, main distribution, and transformer sizing, even though actual coincident peak loads are typically far lower than the sum of installed nameplate capacities.

[24] RDH Building Engineering, Energy Consumption and Conservation in Mid- and High-Rise Residential Buildings in British Columbia, February 2012

Treatment of Space Heating Loads Under CE Code Rule 8-202

Under CE Code Rule 8-202 methodology, electric space heating loads are treated as fully coincident, meaning that no explicit diversity is applied to the aggregate kVA of in-suite heat pumps, even though real-world operation is highly diversified in MURBs and the sum of individual suite peak capacities is not representative of coincident building-level demand.

Diversity is permitted by Rule 62-118 3) for space heating, but not for cooling (under Rule 8-202 1) a) iv)), effectively eliminating diversity for the ASHPs.

Diversity is permitted by Rule 8-106 5), and can effectively be recovered via Rule 8-106 8), provided ASHPs are progressively installed over many years.

Consequently, aggregate demand calculations based on nameplate or circuit ampacity overstate real peak electrical demand in MURBs with in-suite heat pumps.

Recommended Approaches for Right-Sizing In-Suite Space Heating Equipment

✔ **Estimate suite-level heating demand based on actual building and suite characteristics** rather than generic assumptions. Use building plans, audits, and/or envelope assessments to classify suites based on: exterior vs interior exposure; stack position (height); orientation (solar gains); internal thermal gains (occupancy). This approach typically results in substantially lower and more realistic design heating loads than rule-of-thumb methods.

✘ **Do not size heat pumps based on existing electric baseboard capacity.** Electric resistance heaters are typically oversized relative to actual heating needs. Directly replacing installed wattage with equivalent heat pump capacity will almost always result in oversizing.

✔ **Use simplified modeling and load estimation tools where project complexity warrants** to validate sizing assumptions. These tools can enable retrofit designers to:

- Estimate hourly or temperature-bin heating demand rather than relying on single-point peak values.
- Test sensitivity of aggregate electrical demand to different heat pump capacities.
- Use results to support engineering judgement under CE Code Rule 8-106.

Examples of such tools include:

- **HOT2000, RETScreen, and eQUEST** for whole-building or aggregate load estimation.
- **CSA F280** for suite-level decentralized heating load calculations.

✔ **Prioritize heat pump technologies that reduce peak power draw** rather than relying on oversized capacity to meet extreme conditions:

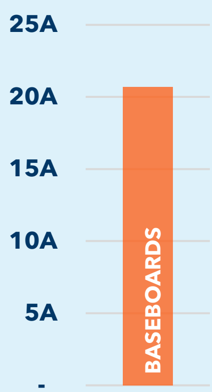
- Cold-climate heat pumps with strong low-temperature performance.
- Inverter-driven systems with wide turndown capability.
- Equipment with lower MCA and breaker requirements where feasible.
- Avoid/minimize electric resistance strip heat back up.

PRACTICAL EXAMPLE

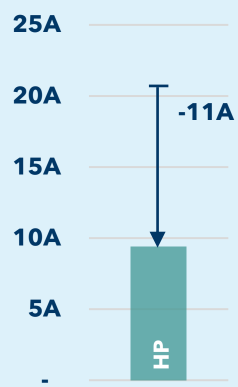
▶ RIGHT-SIZING IN-SUITE SPACE HEATING EQUIPMENT

Let's see how right-sizing heating equipment can affect electrical load at the suite level. To do so, we will compare three design approaches for an 80m² suite in a MURB.

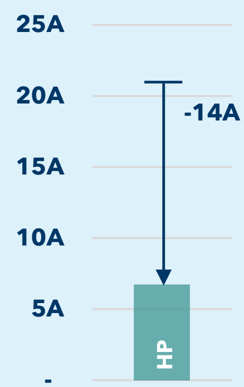
Electric Baseboard Heating
This design represents typical rule-of-thumb sized electric baseboard heating (5W/ft²).



Ductless Mini-Split
Represents replacement of electric baseboard heating with equivalent BTU/h in heat pump heating.

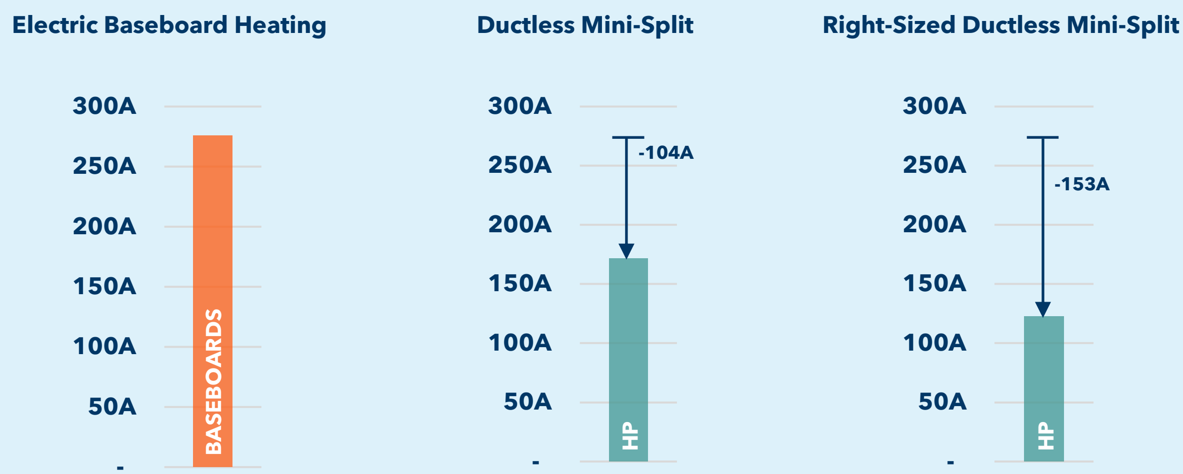


Right-Sized Ductless Mini-Split
This design represents a right-sized heat pump for this suite (12,000 BTU/h).



For this example, right-sizing heat pumps to suit actual suite heating load, rather than assuming a heat pump sized to match the full installed capacity of legacy electric baseboards, reduces the estimated coincident operating current at the suite panel by approximately 3A (from roughly 10A to 7A at 208V, 1Ø). While branch-circuit sizing is ultimately governed by manufacturer nameplate requirements, this reduction in required heating output enables the selection of smaller-capacity heat pump equipment, which in turn typically carries lower MCA and breaker requirements (e.g., 10A rather than 15A-20A). This is particularly important when retrofitting buildings that previously relied on central gas-fired space heating, where any in-suite heat pump represents a new electrical load rather than a replacement. Right-sizing helps minimize added electrical demand.

At the building level, these impacts are amplified. Take the same case for a MURB with 30 of these suites to see the impacts of these electrical loads on the main 208V electrical service, following CE Code Rule 8-202 calculations.



For this example, right-sizing heat pumps to suit actual suite heating load saves 49A at the main service when compared with oversized heat pumps.

2.3.2 In-Suite Water Heating

When electrifying MURBs that previously relied on centralized gas-fired DHW systems, switching to individual in-suite electric water heaters can introduce substantial new electrical loads at both the suite panel and building service level. Because each suite requires its own heating element, the aggregate connected load can become significant when multiplied across many units.

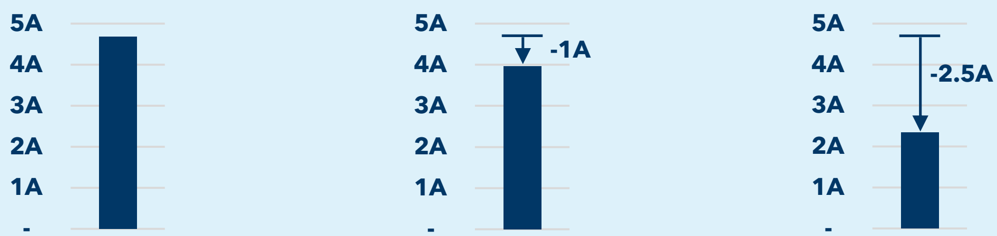
In buildings that already use in-suite electric water heaters, right-sizing DHW equipment capacity can reduce both suite-level electrical demand and aggregate building load. Many installed DHW heaters are sized conservatively relative to actual hot water demand. In smaller suites with fewer occupants, large storage tanks and high wattage heating elements may not be necessary to maintain adequate hot water availability.

PRACTICAL EXAMPLE

▶ RIGHT-SIZING IN-SUITE WATER HEATING EQUIPMENT

Let's see how the different in-suite DHW heaters compare in terms of electrical load.
To do so, we will compare the three (3) design approaches to water heating in a 100 m² (~1,075 ft²) dwelling unit.

Electric Resistance Water Heater	Power Efficient Electric Resistance Water Heater	Hybrid Heat Pump Water Heater
Giant 172STE 60 gal. tank 4,500 W nameplate rating	Giant 172EPS 60 gal. tank **3,800 W** nameplate rating	Rheem XE65T10H22U1 65 gal. tank **2250 W** nameplate rating



* Nameplate feed for water heating equipment is 240V.

Overall, a hybrid HPWH reduces the required electrical capacity by 2.5 A at the dwelling level when compared to an electric resistance water heater.
At the building level, this impact is reduced by the demand factors applied under CE Code Rule 8-202, which accounts for only 25% of the DHW heater's nameplate rating in the load calculation. These values are then further reduced by the diversity factors applied when multiple dwelling units are served by the same feeder or service. For example, in a 50-unit MURB, switching from electric resistance to a hybrid HPWH in each suite would reduce the calculated building service load by approximately 33 A. In a 100-unit MURB, the reduction would be approximately 62 A.

! Smaller 30 or 40 gal. electric resistance water heaters also have smaller 3,000 W nameplate ratings. Thus, ensuring the right equipment size is selected will also have repercussions on the electrical load calculation.

2.3.3 All-In-One Systems

Emerging "all-in-one" in-suite systems integrate multiple functions (typically space heating, cooling, ventilation, and sometimes domestic hot water) into a single packaged heat pump unit. These systems use a shared refrigerant cycle to serve multiple end uses, often distributing conditioned air through short duct runs within the suite and providing ventilation air through an integrated heat recovery ventilator (HRV) or energy recovery ventilator (ERV). Some systems also incorporate small storage tanks for domestic hot water production.

From a PED perspective, integrated systems can offer potential electrical demand reductions because a single heat pump can serve multiple loads rather than installing separate equipment for each end use. This can reduce total installed capacity and improve overall system efficiency through coordinated operation and integrated controls.

These systems are most commonly used in new construction but may also be applicable in deep retrofit projects where multiple building systems are being replaced simultaneously. They typically require more significant building modifications than piecemeal retrofits; installation often involves new ducting, ventilation distribution, and dedicated equipment space within the suite, which can limit feasibility in existing MURBs with constrained layouts.

Figure 11: Nilan Compact P all-in-one system

Table 1: All-In-One HVAC and DHW Units

	Ductless Mini-Split HP	**Hybrid HPWH**	**All-In-One HVAC only**	**All-In-One HVAC + DHW**
Voltage	208-240V 1-Phase AC	208-240V 1-Phase AC	120V or 208-240V 1-Phase AC	208-240V 1-Phase AC
Amps (minimum breaker size)	typ. 10-12 A (typ. 15-20 A)	typ. 18-25 A (typ. 25-30 A)	typ. 10-12 A (typ. 15-20 A)	14.8 A (20 A)
Equipment Examples	multiple	multiple	MINOTAIR PentaCare V12 innova AIO Gen 3	NILAN Compact P

2.3.4 Appliances

Appliance selection affects not only suite-level energy consumption, but also aggregate building electrical demand. When multiplied across dozens or hundreds of suites, small differences in connected load can materially affect feeder sizing, transformer capacity, and the feasibility of electrification retrofits.

Cooking

Cooking ranges are typically electric in BC purpose-built rental and strata MURBs constructed in the 1960s onward; in such instances, cooking load is already included in existing building electrical capacity and historical demand. For MURBs with gas cooking appliances, retrofitting with electric ranges constitutes new electrical demand.

At the building level, Rule 8-202(3) applies demand factors when multiple dwelling units are supplied by the same feeder or service. This introduces diversity across suites; however, that diversity is applied to the 6 kW per unit value, not to the actual lower appliance rating. As a result, reducing the nameplate rating below 12 kW does not reduce calculated service load under the prescriptive method either.

Treatment of Electric Ranges Under CE Code Rule 8-202

Under the 2024 CE Code Rule 8-202, load calculation methodology requires that an electric range shall be: 6 kW for a single range plus 40% of any amount which the rating of the range exceeds 12 kW.

- For ranges rated 12 kW or less, the calculated load per dwelling unit is fixed at 6 kW, regardless of actual nameplate rating.
- Only ranges exceeding 12 kW increase calculated load.
- There is therefore no prescriptive load calculation benefit to selecting a 6 kW or less range instead of a 6–12 kW range.

Commercially available electric ranges typically have nameplate ratings at or below 12 kW on a 208-240V circuit. Accordingly, cooking appliance substitution is not typically a major building-level PED lever under prescriptive load calculations.

Suite-Level Panel and Breaker Considerations

While reducing range nameplate rating below 6 kW does not reduce calculated feeder or service load, it may still provide meaningful benefits at the suite panel level, particularly in older buildings with 60A suite panels, limited breaker spaces, or limited feeder ampacity. Further, the difference can be recaptured through future historical load calculations (i.e. 8-106 8), provided ranges are replaced over multiple years.

Classic 208-240V electric ranges are typically fed from a 40A or 50A two-pole breaker, meaning they occupy two breaker spaces and represent one of the largest branch circuits within a conventional dwelling unit panel.

Figure 12: Summit "WattSipper" 120V induction range

By contrast, recent market developments include compact 120V induction ranges that typically draw 1.5-2.0 kW and operate on a 15A or 20A single-pole breaker. For example, a compact 120V induction range such as the Summit "WattSipper" operates on a 120V, 20A circuit with a maximum draw of approximately 1.8 kW, while still allowing simultaneous oven operation and multiple induction cooking zones.

Compared to a conventional 208-240V 40A or 50A range circuit, this represents a substantial reduction in branch circuit ampacity and panel space requirements. Freed-up breaker space and ampacity can then be used to add other electrified end-uses, such as in-suite heat pumps that are being introduced into panels originally designed around central gas-fired hydronic heating.

Battery Integrated Appliances (BIAs)

Battery-integrated appliances (BIAs) function similarly to conventional appliances but incorporate an internal battery system to power the device during operation. This built-in battery is recharged during periods of inactivity.

While the total energy consumption of the appliance remains the same, the integrated battery system reduces instantaneous demand and distributes the load over a longer period. Instead of drawing high power all at once, the appliance relies on stored energy to supply demand. BIAs allow power-intensive appliances (like electric ranges) to use a smaller 120V circuit, rather than a typical 208-240V circuit. They also offer resilience during power outages.

Currently, two BIA cooking ranges are available in the USA. To the best of our knowledge, none are certified for use in Canada at the time of writing of this document.

Table 2: BIA Cooking Ranges

	Traditional electric range	Battery integrated electric range
Voltage	240V 1-Phase AC	120V 1-Phase AC
Amps (min. breaker size)	typically 40 A (typically 50 A)	12 A (15 A)
Examples of Manufacturers and Models	multiple	COPPER Copper Induction Range impulse Impulse Cooktop

Treatment of BIAs Under CE Code Rule 8-202

BIAs are not explicitly addressed in the CE Code. AHJs may require them to be treated as electric ranges unless a variance is approved. Designers should confirm classification with the authority having jurisdiction. Deviation would be required under Rule 2-030, unless/until the equipment is specifically address by the CE Code.

Figure 13: Copper Home Charlie Battery-Equipped Electric Range

Clothes Drying

Traditional electric dryers use a heating element to generate hot air, which is circulated through the drum to dry clothes. These dryers operate on 208-240V circuits and have power draw between 4,000 and 6,000 W. While they provide quick drying times, power draw is the highest amongst the available technologies.

Condensing dryers work without the need for external ventilation. Instead, they condense the moisture from the air inside the drum into water, which is then collected in a reservoir or drained away. These dryers generally use slightly less power than traditional electric dryers but still have a significant power draw, around 2,000 to 4,000 W.

Heat pump dryers are the most power efficient option. Rather than using resistance heating to evaporate moisture, heat pump dryers operate as closed-loop refrigeration systems that recover and reuse heat during the drying cycle. Although they take longer to dry clothes, this method reduces power draw substantially, with most models operating between 1,000 and 2,500 W on a 120V circuit.

Treatment of Clothes Dryers Under CE Code Rule 8-202

Under the 2024 CE Code Rule 8-202, clothes dryers do not need to be included in dwelling unit load calculations provided that the dryer has a rated power of 1,500 W or less.

Many heat pump dryers fall below this threshold and therefore **do not contribute to calculated electrical demand.**

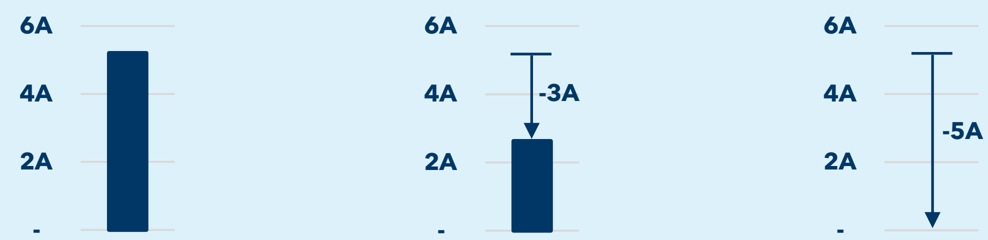
PRACTICAL EXAMPLE

▶ IMPACT OF EFFICIENT APPLIANCES

Let's see how different appliance selections compare in terms of electrical load.

To do so, we will compare the three (3) dryer types in a **100 m² (~1,075 ft²) single dwelling.**

Traditional Electric Dryer	Condensing Dryer	Heat Pump Dryer
Regular appliance with a 5,000 W nameplate rating.	Bosch WTG86403UC with a **2,520 W** nameplate rating	Bosch WQB245AXUC with a **900 W** nameplate rating



The condensing dryer reduces the required electrical capacity by 3 A at the dwelling level.

At the building level, this impact is reduced by the demand factors applied under CE Code Rule 8-202, which accounts for only 25% of the dryer's nameplate rating in the load calculation. These values are then further reduced by the diversity factors applied when multiple dwelling units are served by the same feeder or service. For example, in a 50-unit MURB, switching from a traditional electric dryer to a condensing dryer in each suite would reduce the calculated building service load by approximately 37 A. In a 100-unit MURB, the reduction would be approximately 70 A.

Crucially, **since the heat pump dryer has a nameplate rating under 1,500W, it does not have to be included in the electrical load calculation,** which reduces the required electrical capacity by 5 A at the dwelling level. At the building level, this corresponds to a reduction on the order of 75 A for a 50-unit MURB, and approximately 140 A for a 100-unit MURB.

Central Laundry Rooms

Many MURBs, particularly older and rental apartment buildings, use centralized laundry rooms rather than in-suite appliances. These spaces typically contain multiple commercial dryers serving occupants and may represent a significant installed load when electric resistance dryers are used.

In buildings with gas service, central laundry rooms have historically used gas dryers, which rely on gas for heating and require only a small electrical connection for motors and controls. Electrification of these systems can therefore introduce new electrical loads that were not previously present in the building electrical infrastructure. In these cases, selecting heat pump dryers with nameplate power ratings under 1,500 W can enable electrification retrofits within existing service capacities.

Figure 14: Bosch Heat Pump Dryers

Central laundry rooms with electric dryers also represent an opportunity for load management in MURBs. Because laundry use is intermittent and not critical to occupant comfort or safety, limiting the number of dryers operating simultaneously can cap peak electrical demand while maintaining overall laundry availability. This type of control can be particularly useful during winter peak demand periods, such as morning and evening hours on cold design days. That said, the increased drying time of heat pump dryers continues to be a barrier to adoption for this technology in central/shared laundry rooms.

STRATEGY 3

Energy Management Systems

Energy management systems (EMS) monitor and control electrical loads so as not to exceed power thresholds, enabling deeper electrification while avoiding or deferring electrical system upsizing. Moreover, EMS can be used to control loads for other purposes, such as avoiding utility demand charges (typically applied as part of General Service utility rates applied to common area loads, such as EV charging, in apartments); responding to time varying electrical rate price signals; and utility demand response.

Energy Management Terminology

- **Energy management systems (EMS)** is a broad term typically used to describe systems that monitor and manage building energy use.
- **Power control systems (PCS)** generally refer to systems that actively control electrical loads to limit demand on services, feeders, or branch circuits. PCS are used mainly for overload control.
- **Electrical energy regulating equipment (EERE)** is the term proposed in the 2027 CE Code, Part I, defined as a means used to monitor and control loads through the process of connecting, disconnecting, increasing or decreasing electric power to the loads.
- **Electric vehicle energy management systems (EVEMS)** are EV-only energy management systems and are recognized by the 2024 CE Code as load reduction means.
- **Smart Panel** is a marketing term for electrical panels that can incorporate monitoring and control capabilities. Depending on their functionality and certification, smart panels may or may not operate as an EMS, PCS, EVEMS, or other form of EERE.

3.1 Energy Management System Control Schemes

There are a variety of different EMS control schemes and associated electrical configurations. These are summarized below.

3.1.1 Circuit Switching

A **circuit switching** device (Figure 15) deactivates a "secondary load" on a branch circuit when a "priority load" is turned on, thereby staying within the capacity limits of the circuit. Most circuit switching devices allow the secondary load to operate only when the power drawn by the priority load falls below a specified threshold. The priority load typically remains powered to ensure user-controlled features, such as clocks and custom settings, are not disrupted.

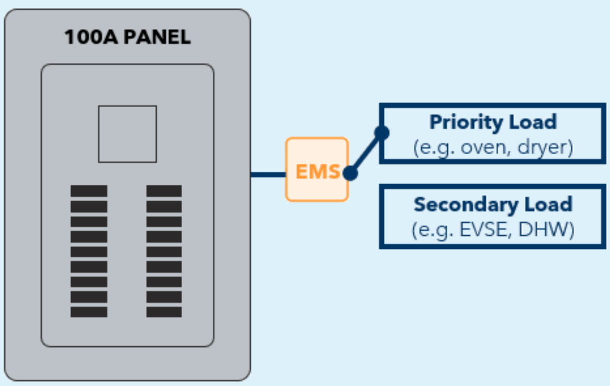


Figure 15: Branch circuit switching device.

When circuit switching devices are used, only the highest load is considered in demand load calculations, per sub-rule 8-106 2) of the CE Code, Part I CSA 22.1:24. This can effectively reduce demand loads for both a single suite's feeder and panel. However, it is important to note that **such devices impact load calculations, but resultant actual/metered demand is uncertain**. Accordingly, while they may be useful in certain circumstances to add new loads to constrained suite panels, they **will generally not address constraints on upstream services or feeders** for multiple dwellings without additional service/feeder monitoring controls.

There are **two typical configurations** for circuit switching devices:

- **Hard-wired devices** require installation by an electrician, which offer a more permanent and seamless integration.
- **Plug-in devices** connect directly to an existing power outlet (typically for appliances like an oven or dryer), eliminating the need for an electrician. This relative simplicity makes them particularly suitable for electrification projects in existing buildings.

Table 3: Branch Circuit Switching Devices

	Hard-wired devices		Plug-in devices	
Voltage	240V 1-phase AC		240V 1-phase AC	
Max circuit amps	up to 60 A		up to 50 A	
Examples of Manufacturers and Models	DANDY	LOADMISER	NeoCharge	Smart Splitter
	simpleSwitch CANADA	simpleSwitch	BSA	Electric Range Buddy
	LOADSHARE TECHNOLOGIES	DIVVEE	SPLITVOLT	Splitter Switches

Branch circuit switching could theoretically interact with multiple different devices. However, **many devices are not appropriate to switch on/off regularly** (i.e. be the secondary load). For example, switching heat pumps on/off can interrupt compressor cycles and lead to inefficiencies. Product warranties may be void if a branch circuit switching device is used.

Figure 16: simpleSwitch

Figure 17: NeoCharge Smart Splitter

3.1.2 Dynamic Energy Management Systems

"Dynamic" EMS involve electrical equipment (e.g. an EV charger, or potentially some other load) that can incrementally adjust power consumption up and down to stay within the electrical capacity of a circuit, as opposed to simply switching circuits on or off. An example of such dynamic load sharing is when two or more networked EV chargers are installed on the same 40A branch circuit. If only one EV is plugged in and charging, it can be allocated the full capacity of the circuit; however, if another EV is plugged in while the first is still charging, then the EMS communicates to reallocate capacity between the chargers, ensuring circuit capacity limits are not exceeded.

Using such a dynamic control scheme may require "smart" end use equipment that are capable of wireless (e.g., Wi-Fi, cellular) or wired (e.g., ethernet cable) communications to receive and/or send messages and control power consumption of the equipment. The EMS is programmed to ensure that equipment collectively do not exceed the capacity of the circuit.

Several electrical configurations are possible using dynamic EMS, including:

- **Branch circuit sharing** where multiple flexible loads controlled by an EMS sharing one branch circuit (Figure 18).
- **Panel sharing** where flexible loads are controlled so as not to exceed some quota that combined with any uncontrolled loads will not exceed the capacity of the panel (Figure 19).
- **Higher- & multi-tier sharing** where loads are controlled to not exceed some quota established for a consumer's service, feeder(s), or other parts of electrical systems.

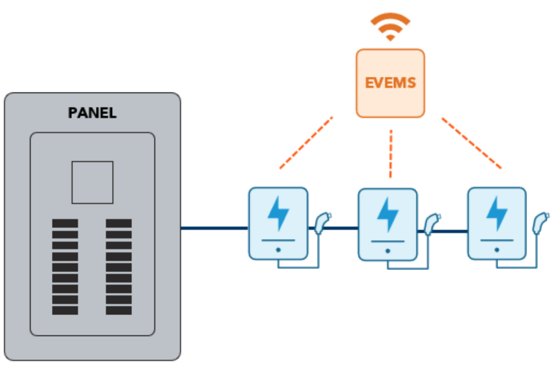


Figure 18: Branch Circuit Sharing

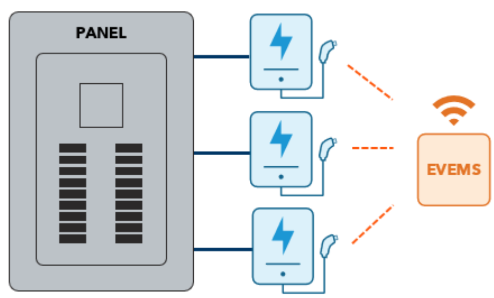


Figure 19: Sharing at the Panel Level

3.1.3 Service and/or Feeder Monitoring

A monitoring EMS control scheme involves implementing equipment – e.g., current transformers (CTs) – that monitor the real-time capacity of circuits services or feeders, and control electrical loads depending on whether there is sufficient capacity. Controls may switch loads on/off at a breaker; alternately, dynamic EMS may be used to communicate with networked devices, allowing them to incrementally adjust power up or down depending on the available capacity. See Figure 20 for an example architecture of such a system.

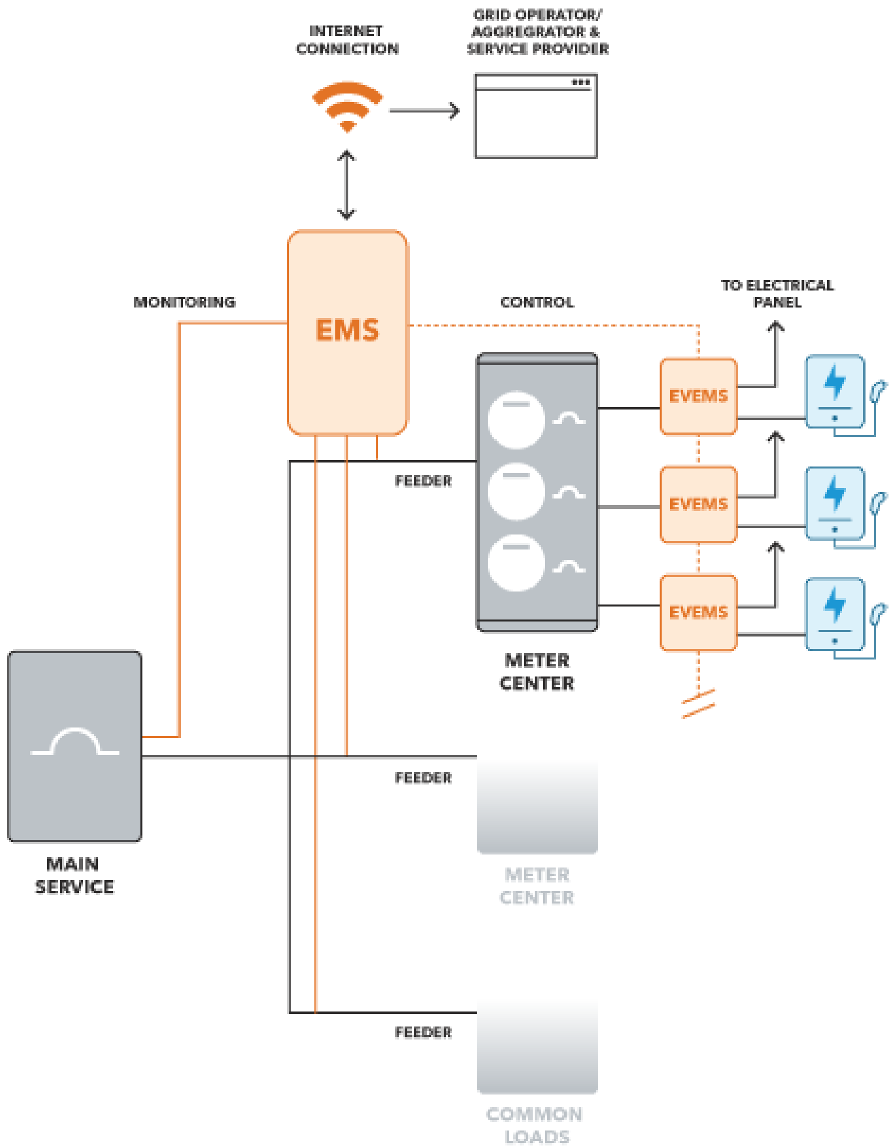


Figure 20: Example of an EMS monitoring the main service, feeder to the residential meter center, and feeders to individual units. If capacity limits of monitored circuits are exceeded, circuits to EVSE are automatically reduced.

Service/feeder monitoring is a potent PED strategy for MURB electrification. It can enable controllable electrical end use equipment to be added without increasing buildings' calculated loads. Likewise, it can be leveraged to enable more energy on a service/feeder to be devoted to EV charging or other controllable loads that can occur during off-peak times (e.g. DHW pre-heating), by monitoring available capacity and controlling loads accordingly (see Figure 21).

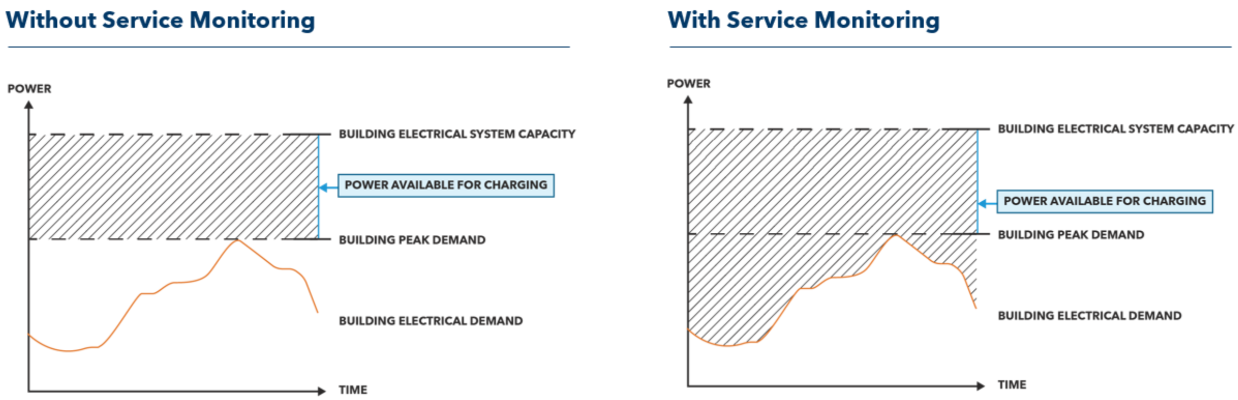


Figure 21: Additional electricity available for loads controlled by service/feeder monitoring.

3.2 Managing EV Loads

EVs are often the highest-power new electrical load in MURBs and thus have a **major impact on buildings' total loads.** Right-sizing electrical infrastructure for EV charging is typically the most impactful demand mitigation measure that can be implemented, and most important component of efforts to avoid major electrical system upgrades.

Fortunately, **EVs are also usually the most flexible and controllable loads in MURBs**. When implementing EV charging at meaningful scale in MURBs (i.e. more than EVSE available in a small percentage of parking to spaces to serve a few early adopters), it is often necessary to substantially manage loads using EVEMS.

3.2.1 Different approaches to implementing EV charging in MURBs

EV charging in MURBs is typically added in one of two ways:

1. 100% "EV Ready" retrofits.
2. Installing a few EV chargers at a time.

100% EV Ready retrofits

This approach involves comprehensive futureproofing, anticipating that residents' vehicles will ultimately be EVs. Electrical systems are planned and upgraded so that most, or all, resident parking stalls can support EV charging over time. This involves:

- A single, coordinated project to implement the shared electrical systems in buildings to support EV charging at each parking space. A 100% EV Ready retrofit tends to implement electrical systems terminating at an electrical outlet adjacent to each parking space.[25] Usually, in shared MURB parkades, these branch circuits are on shared branch circuits, reducing the number of branch circuits and their associated costs.
- Individual chargers are added at stalls as residents adopt EVs.

Installing a few EV chargers at a time

In a piecemeal approach, EV chargers are added a few at a time, as residents request them, without an overall futureproofing plan:

- A building contacts an electrical contractor to install a small number of chargers.
- The contractor finds a way to connect the new chargers to existing electrical equipment, with limited consideration of how additional chargers will be added in future.
- Chargers may be installed:
  - In individual assigned stalls (often paid for by the unit owner in a condominium), or
  - In shared locations like common or visitor parking, where chargers are used on a first-come, first-served basis (paid by everyone through a strata motion)

While **installing a few chargers** at a time can be a quick way to serve the first few EV drivers, it **has important limitations**:

- Electrical capacity may be used inefficiently. This can increase costs of adding additional EV chargers or other electrical loads (e.g. heat pumps) in the future.
- Not all residents may be able to access EV charging over time.
- Early design choices may need to be reworked or replaced in a future larger-scale project, leading to stranded assets, redundancy for stratas, and wasted resources.

A **comprehensive EV charging infrastructure futureproofing** approach, such as a 100% EV Ready retrofit, **is often the best approach in MURBs**. The following table compares these EV charger installation approaches, summarizing some of the considerations and trade-offs between them.

[25] Other futureproofing approaches, sometimes called "EV Capable" retrofits, involve implementing electrical branch panels or feeder service monitoring systems with sufficient capacity to serve all parking spaces. This EV Capable approach can defer the cost of branch circuit wiring. However, branch circuits are often implemented as dedicated circuits to each parking space, as opposed to shared branch circuits. In BC, due to the nature of the CleanBC EV Ready Rebate program, most comprehensive futureproofing has followed a 100% EV Ready approach with wired branch circuits implemented during futureproofing. See the report *Futureproofing Multifamily Buildings for EV Charging* for further discussion of EV Ready versus EV Capable futureproofing approaches.

Table 4: Comparing 100% EV Ready retrofits and implementing a few EV chargers at a time.

	100% EV Ready retrofits	Installing a few EV chargers at a time
Where EVs are charged	• Drivers charge in their regular assigned parking spaces.	• Chargers are often installed in common parking (e.g., visitor stalls) or in a few assigned stalls for early adopters.
Total life-cycle cost	• Typically, lower cost per stall over the life of the building. • EV Ready projects in the CleanBC EV Ready Rebate Program have averaged $1,400 per EV Ready parking space, with savings driven by economies of scale and electrical load sharing. 26 Unit owners will then pay the cost of EVSE installed in their parking space (average costs of $1,500-$2,000 per EV charger).	• Typically, higher cost per stall. • Recent case-by-case installations have averaged around $5,500 per parking space ($3,500 for electrical and $2,000 for charger), reflecting repeated small projects and less efficient use of electrical capacity.
Upfront cost	• Higher one-time project cost, with most infrastructure installed at once.	• Lower cost for each individual project, but significantly more expensive in total as more chargers are added over time.
Futureproofing	• Designed from the outset for widespread EV adoption. • Minimizes risk of "stranded" equipment and makes later charger additions straightforward.	• Early installations may not be designed for later expansion, increasing the risk that wiring, panels or chargers need to be replaced or reworked when more EVs arrive, or other electrification projects occur.
Project management	• One coordinated project with a clear plan and schedule.	• Ongoing series of smaller projects, requiring repeated approvals, procurement and coordination, costs to owners.

[26] Cost estimates are derived from BC Hydro program statistics

3.2.2 Design strategies for 100% EV Ready Retrofits

A variety of different electrical configurations could be implemented as part of such a comprehensive futureproofing approach. Most EV Ready retrofits that aim to serve all or nearly all resident stalls rely on an **EVEMS** to control EV chargers so that, together, they do not exceed the limits of the building's electrical system. This is usually essential to make "100% EV Ready" parking technically feasible and keep costs within a reasonable range.

Broadly, there are three main EVEMS strategies used in MURBs:

Figure 22: SWTCH Charging Station

1. **Branch circuit sharing with networked EV chargers** (see Figure 23).

- Each charger is "networked" and can communicate with an EVEMS, which is offered as part of charging service providers' charging station management systems (CSMS).
- In shared parkades, this approach usually makes use of branch circuit sharing (e.g. 4-share+ on 40A circuits). The EVEMS adjusts the power going to each charger so that many stalls can share limited electrical capacity on a circuit. Service monitoring can be integrated, if necessary, to further reduce peak loads beyond what can be achieved through branch circuit sharing.
- The following are typical costs, before any applicable incentives:
  - EV Ready futureproofing electrical works (i.e. all electrical retrofits terminating in an outlet adjacent to the parking space) are often in the range of $800–$2,000 per stall before incentives.
  - Each resident later installs a networked charger, often around $1,300–$2,000+ per charger, plus ongoing service fees (commonly about $10–$30 per month per charger or driver).

2. **Switching controls supplied by common power source** (see Figure 24).

- In shared parkades, "smart" panels are deployed to serve tranches of parking spaces.
- Each parking space served by a panel will ultimately feature a dedicated branch circuit.
- Branch circuit wiring may be deployed at the outset, though usually is deferred until EV adoption.
- Non-networked EVSE typically deployed.
- The following are typical costs:
  - $2000-$3000+ per parking space for the branch panel.
  - $4000-$6000 for branch circuit and EV charger.

3. **Switching controls fed from individual units' feeder/panel** (see Figure 21).

- A dedicated circuit from a unit's panel, or split from the unit's feeder, runs to its assigned parking spot.
- An EVEMS monitors load on a panel, feeder and/or services and switches charger circuits on and off to stay within safe limits.

- This approach is viable in some low-rise buildings where suite meters are located near the parkade Figure 20, or with "smart panel" systems designed for this purpose (see Figure 24)
- The following are typical costs:
    - Electrical works to make stalls EV Ready often in the range of roughly $3,000–$5,000+ per stall.
    - Later, residents can install lower cost, non-networked chargers with lower equipment cost and no ongoing network/service fees.

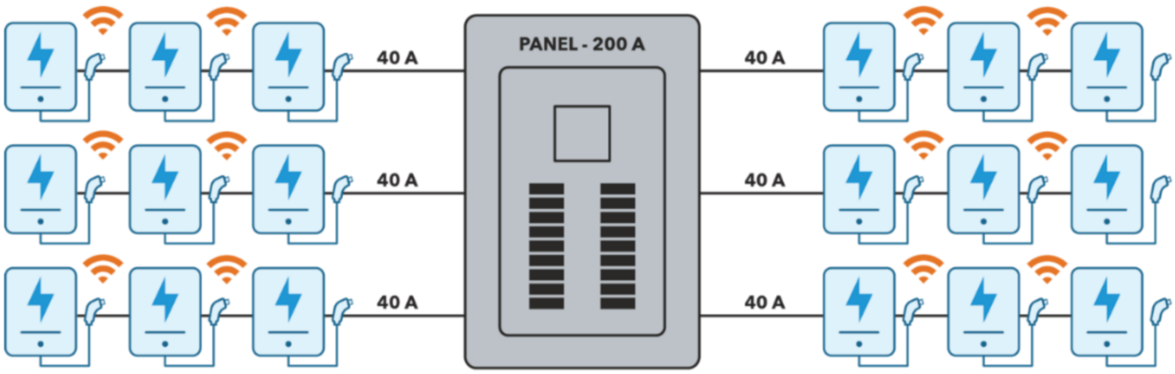


Figure 23: Branch circuit sharing. The diagram shows 3-share on 40A circuits. Other sharing strategies are possible - e.g. 4-share on 40A, 6-share+ on 40A, 10-share on 80A, etc.

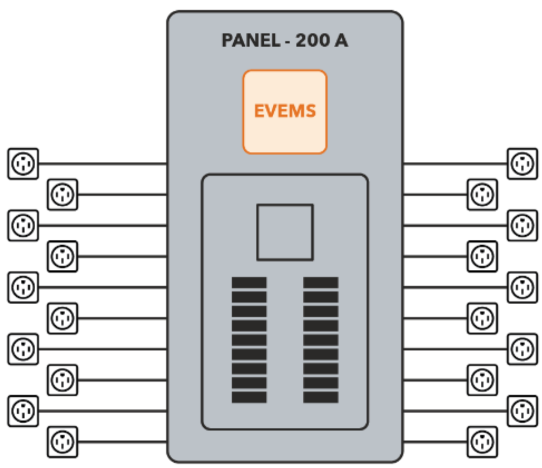


Figure 24: "Smart" panel with switching controls.

3.2.3 Load savings from EV energy management systems in 100% EV-ready futureproofing

Figure 25 shows the incremental power demands of different 100% EV Ready retrofit design solutions, including:

- Dedicated unmanaged 40A 208V outlets.
- Dedicated unmanaged 20A 208V outlets.
- Four outlets sharing a 40A branch circuit ("4-share on 40A"), which happens to be the most common design for newly constructed MURBs in BC.
- Seven outlets sharing a 40A branch circuit ("7-share on 40A"), with charging performance calculations indicating adequate charging provision given the building's location and nature of occupancy.
- Service monitoring use in addition to 4-share on 40A branch circuit sharing.

This example is illustrative of what is true for most MURBs in BC – Most MURBs can accommodate 100% EV-ready futureproofing when designing for significant load sharing using EVEMS. Conversely, they will be limited by capacity when using unmanaged approaches (dedicated 40A or 20A branch circuits), particularly when there is a need to accommodate other electrification retrofits.

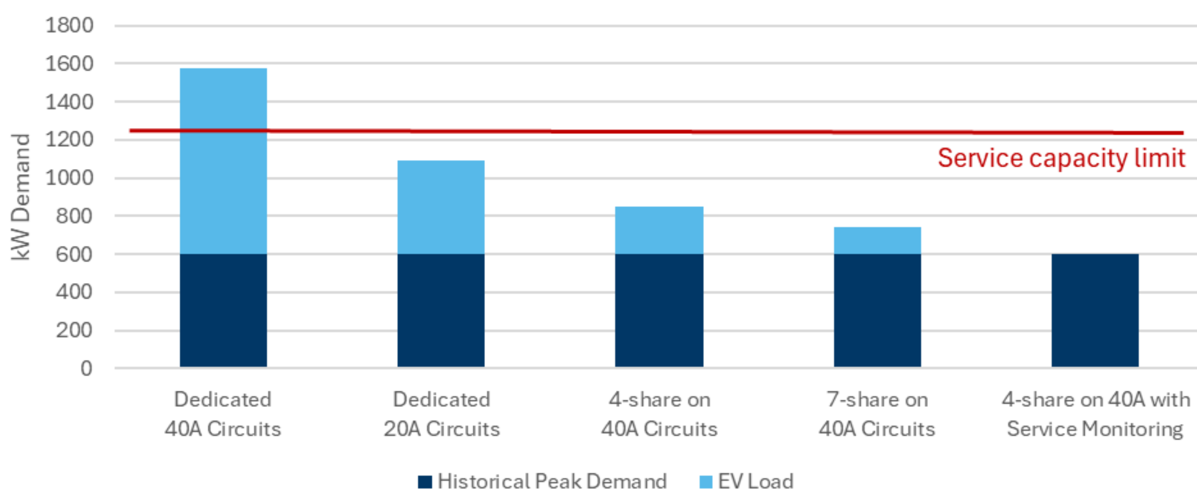


Figure 25: Power demands of different designs for a 100% EV Ready 150-unit apartment.

3.3 Controlling Non-EV Loads

While energy management strategies are well established for EV charging, similar approaches can also be applied to other controllable electrical loads in MURBs. These energy management systems (EMS/PCS[27]) monitor and manage non-EV loads such as water heating and appliances to reduce coincident peak demand.

Treatment of EMS Under the CE Code

The 2024 CE Code does **not recognize EMS loads other than EVs** as a means to reduce calculated demand for services and feeders. Unlike EV energy management systems (EVEMS), which are addressed under Rule 8-106, most non-EV load control strategies cannot currently be used to reduce calculated loads without a variance from the authority having jurisdiction.

However, **CE Code amendment proposals may be adopted in the 2026 version of the CE Code to enable "electrical energy regulating equipment"[28] (EERE) to monitor and control loads that are added to existing premises** (e.g. new electrical loads added to existing MURBs) and **thereby exclude them from load calculations**. Similarly, the province of Ontario has amended its electrical code to allow EMS to be used to control all sorts of types of loads (not just EVs) and thereby exclude these loads from load calculations, even in new construction. As of this writing EMS for non-EV load control will typically require some form of variance under 2-030 of CE Code to be implemented.

The landscape of equipment and systems that can perform this function of monitor real-time power on services, feeders and branch circuits and adjust loads accordingly is evolving rapidly. Several equipment and systems are commercially available in British Columbia to perform this function. This sector is relatively new, and it is understood that similar offerings from larger electrical equipment manufacturers may be made available as these strategies are enabled in electrical codes across North America.

Figure 26: FUTURi smart panel

Figure 27: Evectrix Harmony EVHP Smart Panel

Figure 28: VT Engineering TH-R Townhouse EVEMS

Figure 29: RVE HUB

Figure 30: Span Panel

[28] The terminology and standards for such systems are in flux. In the USA's 2026 National Electrical Code, such systems are now termed "power control systems"; the UL 3141 standards is in development as of this writing to certify such equipment. CSA Group is in the process of developing a standard CSA 22.2 No. 358 *Electrical energy regulating equipment,* to certify equipment that can perform similar functions.

Recommended Load Control Prioritization Effective design requires prioritizing loads based on their flexibility, importance, and impact on peak demand. In MURB applications, the following general hierarchy is typical (in descending order of flexibility and thus prioritization).	
1	**EV Charging (highest flexibility)** EV charging is usually the first and most effective load to control. Charging can be deferred or modulated with minimal impact on occupants, making it the primary target for peak demand management.
2	**Domestic Hot Water (thermal storage-based flexibility)** Domestic water heating systems with storage can be controlled to shift heating to off-peak periods (e.g., pre-heating overnight). However, control strategies must ensure that sufficient hot water is available to meet occupant needs (e.g. hot water during peak demand times) and to ensure safe water temperatures.
3	**Space Heating (some flexibility)** Space heating loads can be modulated through thermostat setpoint adjustments, load shedding, or direct control of heat pump operation. Occupant comfort and equipment performance constraints limit the extent to which these loads can be curtailed. There has been very limited deployment of this strategy to date. However, experience from early deployments (e.g. Chestnut Street – see case study below) suggest that it can be effective. Residents may not notice any change in comfort if their space heating or cooling is suspended for a brief period of time (e.g. 15 minutes) in response to other loads peaking (e.g. when multiple residents cooking at relatively high power levels, temporarily increasing power draws).
4	**Other appliances (some flexibility)** Certain appliances, such as electric dryers or cooking equipment, may be candidates for control in specific applications (e.g., shared laundry rooms). However, these loads are typically more sensitive to occupant expectations, limiting their suitability for broad-based control strategies.

Case Study - Chestnut Street Six-Plex Electrification Retrofit Project by BC Hydro

The Chestnut Street project, designed to support the transition from single-family homes to multiplexes, utilized the Evectrix Intelligent Load Management System (ILMS) to effectively transform a conventional breaker panel into a PCS that manages energy use in real time.

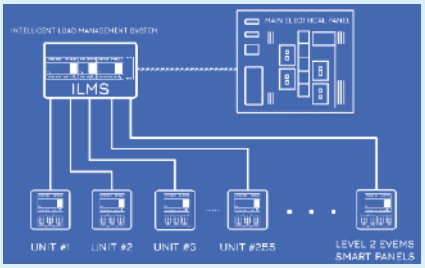


Figure 31: Evectrix NEXX-ILMS System Architecture

Figure 32: Evectrix NEXX-ILMS Panel

The Evectrix ILMS was used in this case to:

- manage multiple non-EV electrical loads (water heating, clothes drying, cooking).
- prioritize load management to take advantage of flexible loads and establish a hierarchal control scheme.
- work concert with smart thermostat setpoints for greater suite-level peak demand control.

Special permission was given from the City of Vancouver for this pilot project. PCS use (and recognition in electrical load calculations) in this case eliminated the need to upgrade from a 200A service to a 400A for this electrified six-plex conversion. The system has further been tested to adhere to lower artificial load limits, to test user experience from more frequent reductions in loads; positive results are reported anecdotally thus far.

STRATEGY 4

Onsite Energy Storage Systems

Energy storage refers to technologies that enable the storage of energy for later use, typically in the form of electricity (e.g. batteries) or heat or cold (e.g. water, heated rocks, bricks) for the purposes of later water heating, space heating or cooling. Theoretically, buildings could be designed to use electrical or thermal storage to meet peak loads while staying within electrical service limits. The electrical or thermal storage would be filled while building demand is low, then would serve space heating and/or hot water needs during periods of high building demand. This could, in certain circumstances, avoid the need for a larger electrical service or feeder.

- **Current regulatory landscape:** The CE Code currently does not enable the use of energy storage systems to reduce calculated loads and service sizes. While this could be a potential option under special permissions or in future iterations of the Code, it should not be regarded as a standard practice at this time. It is noted here for completeness only.
- While Behind-The-Meter (BTM) Battery Energy Storage Systems (BESS) and Thermal Energy Storage (TES) are increasingly used for grid resiliency and utility demand response programs, they are presently treated as additional loads (when charging) rather than capacity-saving generation assets in design. Consequently, a building owner cannot currently use a battery to "prove" to a safety inspector that their peak demand will be lowered enough to avoid a service upgrade.
- **Further proposed amendments:** Updating the CE Code to enable energy management systems (as noted in the previous section) presents an opportunity to include energy storage systems as means of controlling calculated loads and avoiding system thresholds.
- **On the use of EVs for BTM BESS:** Bidirectional charging enables EVs to not only draw power from the grid to charge their batteries but also send stored energy back to a building (V2B) or home (V2H). This emerging technology allows EVs to function as mobile energy storage. However, this application presents a unique challenge: unlike stationary batteries, EVs are mobile assets and may not always be available when the building requires energy storage support. As a result, the use of V2H/V2B for power efficiency may not be feasible, even as technology and policy evolve.

Illustrative Examples

This section includes illustrative examples of how PED can be used to avoid electrical service upgrades in MURB retrofits. They include CE Code compliant strategies from the previous sections including:

- Use of measured historical loads for establishing available electrical service capacity.
- Implementation of partial/phased electrification retrofit strategies.
- Use of power efficient, right-sized equipment.
- Use of EVEMS to remove EV charging from peak demand loading.

Example 1 – High-Rise MURB

EXISTING MURB CHARACTERISTICS	
Building Type	High-Rise MURB
Storeys	Approx 25
Number of Suites	Approx 200
Space Heating Type	Central Gas Boilers Feeding Four-Pipe Fan Coils
Space Cooling Type	Central Chiller (Electric)
Corridor HVAC	Central Gas-Fired Make-Up Air Units
Water Heating	Central Gas Boilers
Cooking Range Type	Gas Stovetop, Electric Oven
EV Charging	Energized Outlets for 25% of Residential Parking Stalls
Incoming Service	2500A, 600Y/347V (3-phase)
Typical Suite Panel	100A, 120/240V

RETROFIT MEASURES			
ASHP for hydronic heating ASHP for make-up air	electric or heat pump DHW heating	electric or induction for both stovetop and oven	L2 EV charging

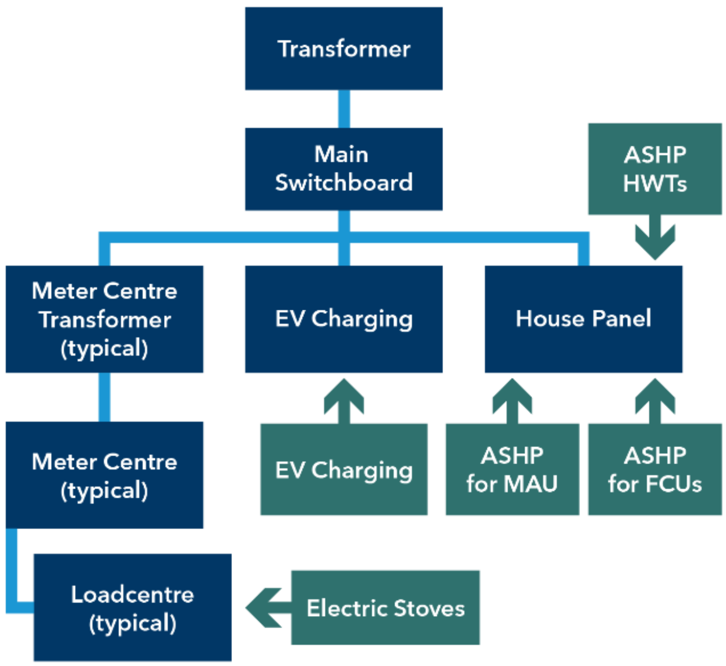


Figure 33: Example 1 Load Connections

PRACTICAL EXAMPLE

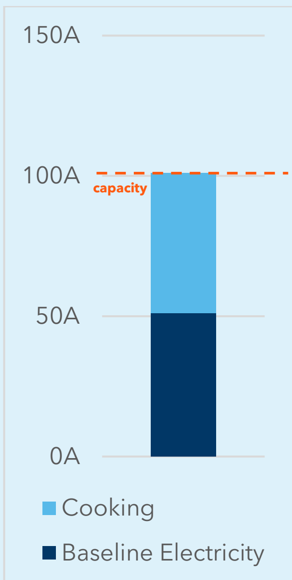
Example 1 is a high-rise MURB with central mechanical and electrical systems. Planned electrification measures include:

- conversion of fossil-fuel based heating to all-electric (space heating, incoming fresh air tempering), adding electrical demand at common/house panels;
- conversion of fossil-fuel based water heating to electric, adding electrical demand at common/house panels;
- a shift to all-electric cooking appliances, adding electrical demand at suite panels;
- EV charging provisions for all residents, adding electrical demand at dedicated EV panels.

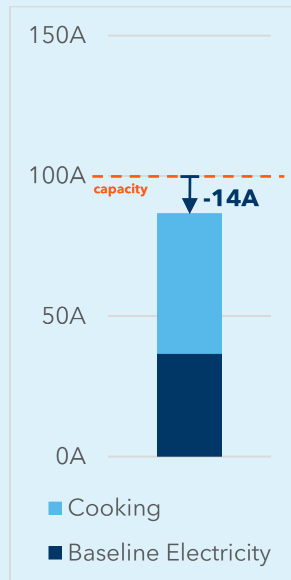
Let's examine cooking electrification feasibility at the typical suite panel level.

CE Code Rule 8-202 standard calculation results show total panel capacity just meeting demand requirements.

Using measured (metered) historical demand as the baseline rather than CE Code Rule 8-202 assumptions reveals that suite panel capacity can accommodate full cooking electrification with room to spare.



CE Code Rule 8-202



Measured Historical Demand

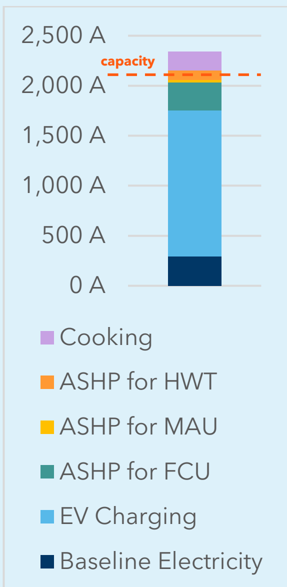
At the suite panel level, cooking electrification retrofits feasibility may be questionable according to standard assumptions as put forth in the CE Code under Rule 8-202. For this case, the PED strategy of using historical demand for load calculations shows electrification feasibility.

Now let's examine electrification retrofit feasibility at the shared incoming service (600Y/347 V switchboard) level.

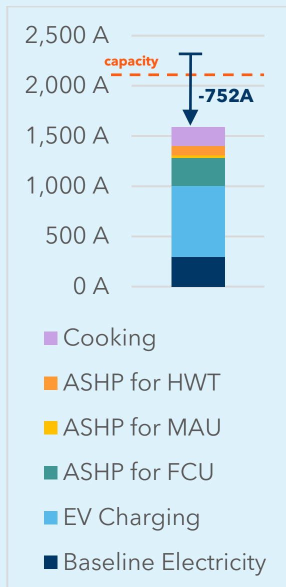
Even using measured (metered) historical demand in load calculations, electrification retrofit demand requirements exceed transformer capacity when standalone 40 A EV charging is provided for all residents.

If lower-amperage (20 A) EV charging is provided for instead, electrification demand is approximately 752 A less and no longer exceeds capacity.

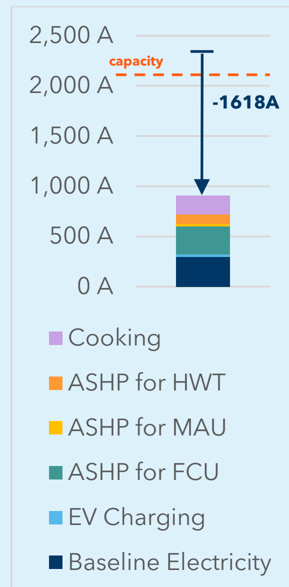
If an EVEMS is used to control EV charging, there is an additional 866 A demand reduction at the building service level.



40 A EV Charging



20 A EV Charging



EVEMS

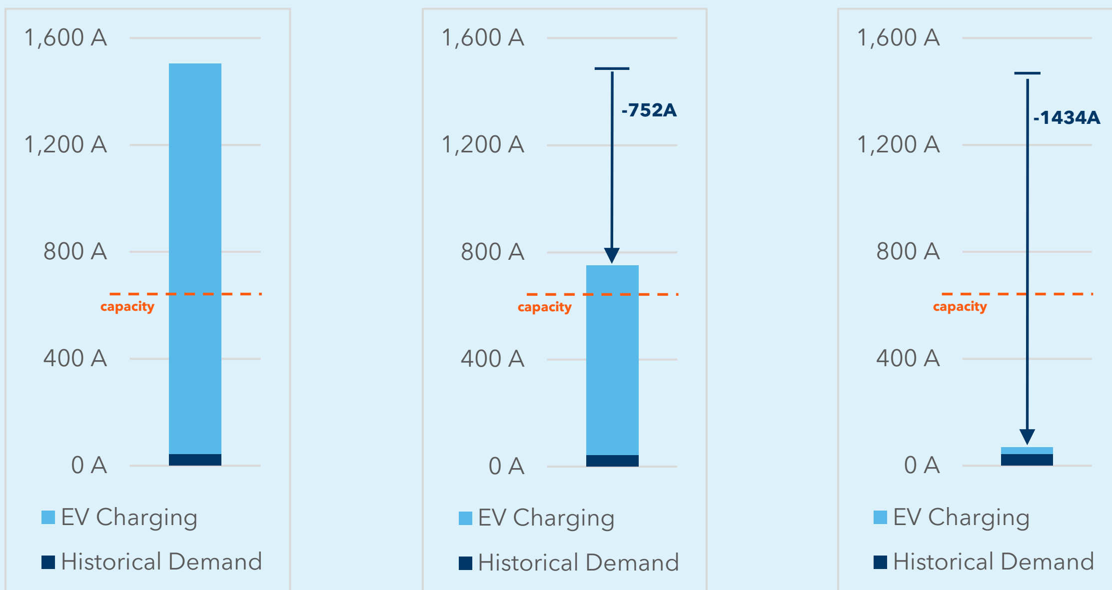
When assessed at the building service/main switchboard level, lower amperage EV charging and EVEMS both enable the provision of EV charging for all residents. However, the EV charging additions must also fit within existing EV charging panel limits.

Now let's examine the feasibility of providing EV charging to all residents within existing dedicated EV feeder capacity.

Standalone 40 A EV charging provision for all residents exceeds capacity.

Low-amperage (20 A) EV charging provision for all residents also exceeds capacity at the dedicated EV panels, despite falling below overall building service capacity (shown above).

If an EVEMS is used to control EV charging, EV charging can be provided for all residents.



40 A EV Charging | **20 A EV Charging** | **EVEMS**

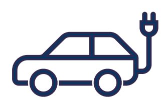
In this example, the electrification of space heating, make-up air heating, and domestic water heating are feasible withing existing capacity. However, cooking electrification and the provision of EV charging capability for all residents are enabled through PED.

This illustrative example puts forth the following observations:

- The use of measured (metered) historical demand in load calculations may reveal more capacity than standard CE Code Rule 8-202 assumptions.
- Implementation of EVEMS is critical in restricting EV charging demand and thereby removing this load as an electrification constraint.
- For larger MURBs with centralized mechanical and electrical systems, capacity constraints may show up at dedicated end-use house/common panels rather than the main incoming electrical service.

Example 2 – Townhouse Complex MURB

EXISTING MURB CHARACTERISTICS	
Building Type	Townhome Complex
Number of Suites	Approx. 60
Space Heating Type	Gas-Fired Furnaces & Fireplaces
Water Heating	In-Unit Gas-Fired Water Tanks
Cooking Range Type	Electric
Incoming Service	4x 50kVA Pad-Mounted Transformers, 120/240 V, 1-phase
Suite Panels	100A, 120/240V, 1-phase

RETROFIT MEASURES		
 ASHP heating & cooling	 electric DHW heating	 L2 EV charging

PRACTICAL EXAMPLE

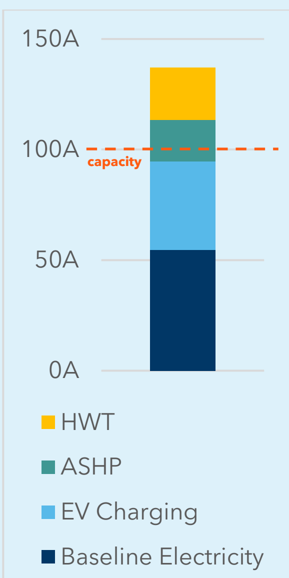
Illustrative example 2 is a townhome complex with shared electrical services, individual townhome electrical panels, and distributed mechanical equipment. Planned electrification measures include:

- the conversion of fossil-fuel based heating to air source heat pump (ASHP) heating and cooling
- the conversion of fossil-fuel based water heating to electric
- the addition of EV charging.
- These additional loads would be served from the townhome (suite) panel level.

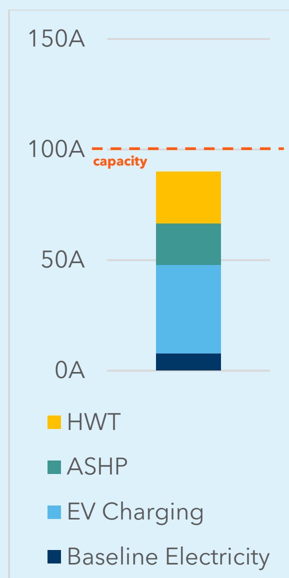
Let's examine electrification retrofit feasibility at the typical townhome (suite) panel level.

CE Code Rule 8-202 standard calculation results show total new demand exceeding panel capacity. From a retrofit planning perspective, this may eliminate the feasibility of either (1) adding EV charging, or (2) electrifying HVAC and domestic water heating. To remain within townhome panel capacity, a choice would have to be made between these two options.

Using measured (metered) historical demand as the baseline rather than CE Code Rule 8-202 assumptions reveals that townhome panel capacity can accommodate all planned electrification retrofits.



CE Code Rule 8-202

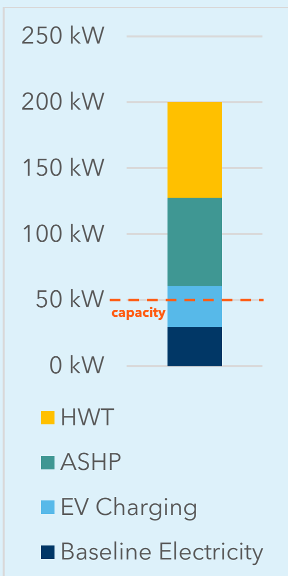


Measured Historical Demand

At the suite (townhouse) panel level, these electrification retrofits would not be feasible according to standard assumptions as put forth in the CE Code under Rule 8-202. For this case, the PED strategy of using historical demand for load calculations shows electrification feasibility.

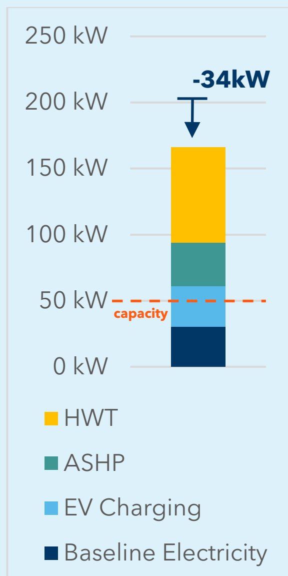
Now let's examine electrification retrofit feasibility at the shared incoming service (transformer) level. The example below corresponds to the highest loaded transformer on the property, which serves 15 townhomes.

Even using measured (metered) historical demand in load calculations, electrification retrofit demand requirements exceed transformer capacity.



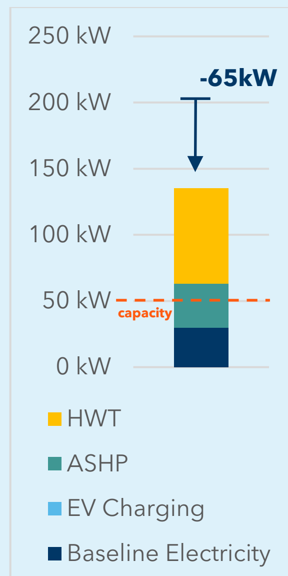
Measured Historical Demand

If ASHP were sized to cover 50% of heating demand at peak and existing gas-fired furnaces remained as supplemental heating, 34 kW of capacity is saved at the transformer.



ASHP 50% Capacity

If, in addition, an EVEMS is used to control EV charging and remove this load from peak, 65 kW of capacity is saved at the transformer.



EVEMS

In this example, incoming service capacity requirements have been significantly reduced through reductions in electrified space heating and the use of intelligent EV charging control. Still, the planned electrification retrofits will result in service upgrade requirements. That said, the required transformer size has been reduced from 200-250 kW to 150 kW. Use of EMS/PCS could be deployed in this instance to further reduce or altogether avoid the transformer upgrade further if a variance to CE Code calculation methodologies is pursued with the Authority Having Jurisdiction.

This illustrative example puts forth the following observations:

- Electrification feasibility at the suite panel does not indicate feasibility at the building service level.
- The use of measured (metered) historical demand in load calculations reveals more capacity than standard CE Code Rule 8-202 assumptions.
- Right-sizing or downsizing HVAC loads has impact not only at the suite level but also at the shared incoming service level, even if those HVAC loads are distributed (decentralized).
- Implementation of EVEMS is critical in restricting EV charging demand and thereby mitigating peak demand at the shared incoming service level. Inclusion of monitoring at the incoming service level further enhances ability to mitigate demand.

Appendices

Appendix A: Electrical Planning Requirements

BC Electrical Planning Requirements

In British Columbia, strata corporations with five or more lots are now legally required under the Strata Property Act to obtain an Electrical Planning Report (EPR) "to assess their available capacity and plan for future electrification demands".[29] The deadlines to obtain the EPR are as follows:[30]

- Existing strata corporations in the Metro Vancouver Regional District, Fraser Valley and Capital Regional District: December 31, 2026.
- Existing strata corporations in the rest of BC: December 31, 2028.
- New strata corporations: Five years after submitting their strata plan.

EPRs are intended to help strata corporations understand and manage their electrical systems' capacity and provide information for preliminary electrical planning. They help avoid brownouts (e.g., momentary power dips during peak load demand episodes) and expensive, unplanned electrical upgrades.

As per the Strata Property Act Part 5.2, Division 2, Section 5.11, an EPR must include the following information:

- **Existing electrical system details:** A description of electrical system, a list of existing demands (including EV charging infrastructure, heating, cooling, ventilation and lighting systems), as well as current capacity, peak demand and spare capacity.
- **Additional electric loads:** The estimated capacity required for electrification (of existing, non-electric heating, cooling and ventilation systems), and anticipated future electrical demands (future heating, cooling, ventilation and/or EV charging infrastructure).
- **Recommendations:** A list of electrical load reduction strategies, as well as recommendations for electrical upgrades.

For Part 3 buildings, EPRs must be prepared by a designated professional (e.g., professional electrical engineer, professional licensee engineering, applied science technologist, certified technician). Journey person electricians are permitted to prepare EPRs for Part 9 buildings.

City of Vancouver New Electrical Load Installation (NELI) Overview

The City of Vancouver requires a New Electrical Load Installation (NELI) form to be submitted as part of the electrical permitting process for MURBs with five or more units in the following conditions:[31]

- Electrification of existing fuel combustion space heating and domestic hot water systems.
- Addition of new electric HVAC systems.
- Addition of new EV charging systems.

[29] Dunsky Energy + Climate Advisors. (2025). *City of Vancouver multiplex electrical process guide.*
[30] Government of British Columbia. (2025). Strata electrical planning report.
[31] City of Vancouver. (2026). Addition of New Loads for Strata Buildings.

- Installation or new or modification of other electrical loads in excess of 3000W within unit.

For electrical permitting, single line diagram(s) and load calculations must be provided with the NELI form. NELI explicitly recognizes **Energy Management Systems (EMS)** as a strategy for managing and mitigating additional electrical load within existing capacity constraints. Applicants must explain how the EMS will manage loads and what the fail-safes are.

NELI functions as a project-level complement to broader planning tools such as Electrical Planning Reports (EPRs). While EPRs provide a long-term, system-wide assessment of capacity and electrification pathways, NELI ensures that each electrical load addition is properly assessed and that it fits within the building's existing electrical capacity.

NELI notes that advance approval from BC Hydro must be obtained for cases where:

- Planned electrical load increase is more than 15kW or 20% of the building's existing calculated electrical load (calculated or established by historical demand measurement pe the CE Code), whichever is greater.
- The total load exceeds 80% of the rated capacity of the building's main switch.

Either of these conditions may trigger an electrical service upgrade, subject to the utility's assessment of available capacity.

NELI submissions generally need to be prepared by a qualified electrical professional (professional engineer or licensed journeyperson electrician, depending on project complexity).

Appendix B: Electrical Safety Regulation

This section provides a brief overview of the regulations, codes and standards that dictate the **calculation of electrical loads** in multifamily buildings.

About the Canadian Electric Code, the BC Electrical Safety Regulation and the Vancouver Electrical By-Law

The Canadian Electrical Code, Part 1 (CSA Group Standard 22.1, the "CE Code") is a model code published by CSA Group (formerly the Canadian Standards Association). Canadian provinces and some cities including the City of Vancouver base their electrical codes on the CE Code, sometimes with amendments. The CE Code applies to all electrical work and electrical equipment in buildings, structures and premises on the consumer's side of a utility's electric service connection. The CE Code's objective is to reduce risks of electric shock, fires, and other electrical hazards.

BC's *Electrical Safety Regulation* under the *Safety Standards Act* adopts the CE Code as the BC Electrical Code. Likewise, under the *Vancouver Charter* and the *Safety Standards Act*, the City of Vancouver has delegated authority from the Province of BC to regulate electrical works in the City. The Vancouver Electrical By-Law (VEBL No. 5563) adopts the CE Code and currently includes minor amendments that generally do not pertain to existing MURBs.

BC and the City of Vancouver adopted the 26th Edition of the CE Code (CSA C22.1-24) in March 2025. The next Edition the CE Code (CSA C22.1-27) is expected to be finalized in mid-2026. It is expected that the province and City of Vancouver will adopt the 27th Edition of the CE Code sometime in 2027 or later, as the BC Electrical Code or VEBL, respectively. It is possible that the BC Electrical Code and/or VEBL will include amendments.

Electrical Permitting and Compliance

Per the *Safety Authority Act*, Technical Safety BC (TSBC) administers the *Safety Standards Act*, including interpreting the BC Electrical Code, establishing licensing requirements for electrical contractors, issuing permits and conducting inspections and risk-based oversight of electrical work. However, eight BC local governments have been delegated authority to issue electrical permits and conduct electrical safety inspections:

- City of Burnaby
- City of Maple Ridge
- City of North Vancouver
- District of West Vancouver
- District of North Vancouver
- City of Surrey
- City of Vancouver
- City of Victoria

Notifying BC Hydro of New Loads

BC Hydro's Electric Tariff specifies that buildings must notify BC Hydro when adding electrical load to an existing building exceeding 15kW or 20% of the load to confirm sufficient upstream capacity.

Building owners or designers must notify BC Hydro when adding electrical load to an existing building. Under BC Hydro's Electric Tariff, new or increased loads may require a utility review to confirm available system capacity. For large projects such as apartment buildings, this review typically occurs through the BC Hydro Design Connections process. If the requested load requires upgrades to the distribution system, project costs are governed by BC Hydro's Distribution Extension Policy (updated 2025), which determines how infrastructure upgrade costs are allocated between BC Hydro and the customer.

There are four cost components to the Distribution Extension Policy:

1. The extension of BC Hydro's system to a customer site.
2. System upgrades (system improvements) to accommodate a customer's load request.
3. BC Hydro maximum contribution.
4. Service Connection and Metering to allow BC Hydro to deliver electricity to the customer.

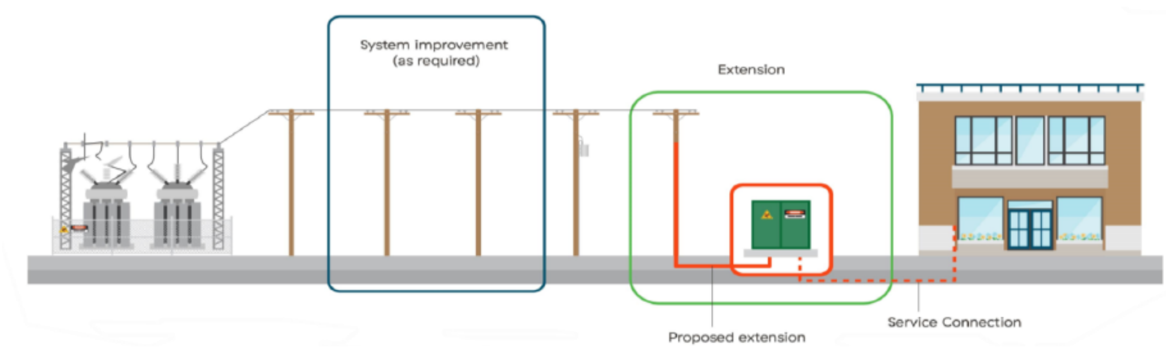


Figure 34: BC Hydro Distribution Extension Policy Cost Components Schematic [32]

Historically, customers requesting new or larger electrical connections were often required to pay the full cost of distribution upgrades triggered by their project. These costs could vary widely, from thousands to millions of dollars depending on the extent of system reinforcement required.[33]

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[32] BC Hydro, Distribution Extension Policy Update, May 2025.
[33] Urban Development Institute, Provincial - BC Hydro/BC Utilities Commission (BCUC) Distribution Extension Policy, July 2025.

2025 Updates to the Distribution Extension Policy

In July 2025, BC Hydro's Distribution Extension Policy was updated with the following key changes to reduce connection costs, improve cost predictability, and support housing development and electrification projects:

- Removal of system improvement costs for most new customers, reducing investment uncertainty and providing a simpler cost model for customer connections (Table 5).
- Increase to BC Hydro's maximum contribution toward connection infrastructure costs.
- Updated standard service connection charges.
- New extension fee refund process that improves equity for the "first customer" that pays for the initial connection that allows other customers to connect subsequently.
- Expansion of financial assistance for both single-phase and three-phase extensions.

System improvement costs are typically the largest potential service upgrade cost for MURBs. Under the previous extension policy (pre-2025), a mixed-use development with 2.5 MVA new electrical load would have paid $2.4 million to connect to the grid. Under the 20225 updated extension policy, the connection cost for the same new electrical load is $30,000.

Table 5: BC Hydro System Improvement Investment (2025 Update)

Customer Connection Size	BE Hydro System Improvement Investment
< 1 MVA	up to $1 million
> 1 MVA	$1 million per MVA pro-rated up to a maximum of $10 million
If the system improvement cost exceeds BC Hydro's maximum investment of $1 million per MVA, up to a maximum of $10 million, the customer will pay for the balance of the system improvement cost.	

Implications for MURB Electrification

Despite the 2025 updates to BC Hydro's Distribution Extension Policy, minimizing electrical service upgrades remains an important objective for MURB retrofit projects. While the updated policy reduces the portion of distribution infrastructure costs borne directly by customers, electrical service upgrades can still represent a substantial capital expense and introduce additional project complexity.

Even when upstream system improvement costs are partially or fully funded by BC Hydro, building owners may still be responsible for a range of project-specific costs. These can include upgrades to building electrical services, transformers, switchgear, distribution panels, and other on-site electrical infrastructure. Engineering studies, utility coordination, and construction work associated with service upgrades can also extend project timelines and increase overall project risk.

Appendix C: Theoretical Load Calculation Methodology in Section 8 of CE Code

This appendix provides a brief overview of what loads are considered in the theoretical load calculations used to size electrical systems in new MURB construction, and that can be used in retrofit applications as an alternative to a historical load calculation. Rules 8-200 and 8-202 of the CE Code specify load calculation methodologies for single dwellings (i.e. a detached, semi-detached, duplex, triplex, quadraplex, or row-housing unit) and apartments, respectively. A load calculation must be performed for both individual dwelling units, as well as for a building's utility service and feeders supplying multiple units. Below, we describe in general terms the factors considered in load calculations.

Load calculations for individual dwelling units

Under Rules 8-200 and 8-202, load calculations for individual dwelling units' services or feeders involve:

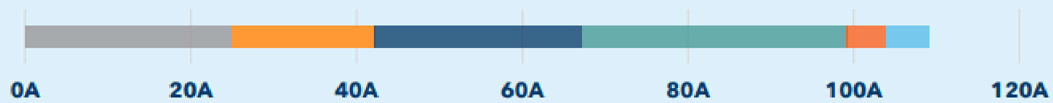
- A "basic load" for **lighting and receptacle circuits loads**. For example, in a unit considered an apartment in the CE Code, the basic load under Rule 8-202 is calculated as 3500W for the first 45m^2 of living area, 1500W for next 45m^2, and 1000W for each additional 90m^2.
- Electrical loads associated with **space heating and air conditioning equipment**.
- **Electric range loads** for cooking, calculated as 6000W for a single range plus 40% of any amount by which its rating exceeds 12kW.
- The load for **electric water heaters**.
- The load for **EV chargers**, if supplied off the panel or feeder to an individual dwelling unit – This is often the EV charging strategy in townhomes where garages are accessible from individual suites, and can also be the case in small apartments where a meter centre is located in the basement allowing a circuit split from a unit's feeder.
- **Other loads**. If the unit includes an electric range, loads greater than 1500W loads are derated to 25% of their electrical capacity (i.e. the load calculation includes only 25% of that electrical load, recognizing it is unlikely to be at full capacity at the same time other loads are at full capacity). If there is no electric range, other loads are added at 100% up to 6000W, and additional loads greater than 1500W are derated to 25% (thereby reserving 600W for an electric range).

These loads are summed together. Services, feeders and panel serving individual dwelling units are based on the larger of these calculated loads or other minimum sizes:

- For buildings subject to Rule 8-200, 24,000W (100A on 120V/240V service) for single dwellings with floor area of 80m^2 or more, or 14,400W (60A on 120V/240V service) for single dwellings with floor area less than 80m^2.
- 60A for an apartment dwelling unit subject to Rule 8-202.

What end-uses make up the CE Code electrical load calculation in a fully electrified dwelling, without accounting for PED

The figure below shows the **load breakdown in a fully electric 100 m² (~1,075 ft²) single dwelling** part of a six-plex building.



An initial **baseload** proportional to the size of the living area is first allocated to account for lighting and the various equipment that will use the electrical outlets. While this load is significant at the dwelling level, its impact on the service size in a multiplex is diminished by a load diversity that increases with the number of units. (per 8-202 a) i) to iii) and 8-202 3) a))

Space heating and air-conditioning loads based on the installed equipment capacity. This is a significant load at the dwelling level and the service level as very little diversity can be accounted for (per 8-202 a) iv) and Section 62).

Electric range load based on the range capacity– 6000W at a minimum – with some diversity for anything above (per 8-202 a) v)).

EVSE load installed on the dwelling's electrical panel, considering a 40 A Level 2 charger (per 8-202 a) vii)).

Hot water heating load, 25% of the equipment rating (per 8-202 a) viii)).

Electric dryer load, 25% of the equipment rating (per 8-202 a) viii)).

Figure 35: CE Code Electrical Load Calculation – Typical Dwelling Unit Makeup

Load calculations for services & feeders supplying two or more units

Load calculations for a building's utility service or feeders supplying two or more units involve summing the following:

- **Unit loads** (as calculated above), excluding EV charging, space heat and air conditioning. The combined unit loads for a whole building are calculated as the sum of 100% of the largest load, 65% of the next two largest unit loads, 40% of the next two largest unit loads, 25% of the next 15 largest unit loads, and 10% of the loads of the remaining units. The CE Code derates the loads from additional units in recognition of the **diversity** of households' electricity use – It is very unlikely that all households will have all these loads on at the same time, allowing for derating of subsequent loads.

- Electric **space heating** and **air conditioning loads** for all units summed with limited derating, recognizing that these loads are often continuous (i.e. operating uninterrupted for long periods of time) and can be synchronous.
- **EV charging loads** again without substantial derating unless controlled by an EV energy management system (EVEMS - see below), in recognition of their continuous nature.
- **Common area loads** such as for example elevators, parking areas, outdoors, stairwells and hallways.

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