Decarb Lunch Series

zebx

B2E
Building to Electrification Coalition

Home Electrification: Avoid Electrical Service Upgrades

TECHNICAL SAFETY BC

Fri Nov 24, 2023,
from 12- 1pm PST
Free Webinar I zebx.org

CITY OF VANCOUVER

BC Hydro
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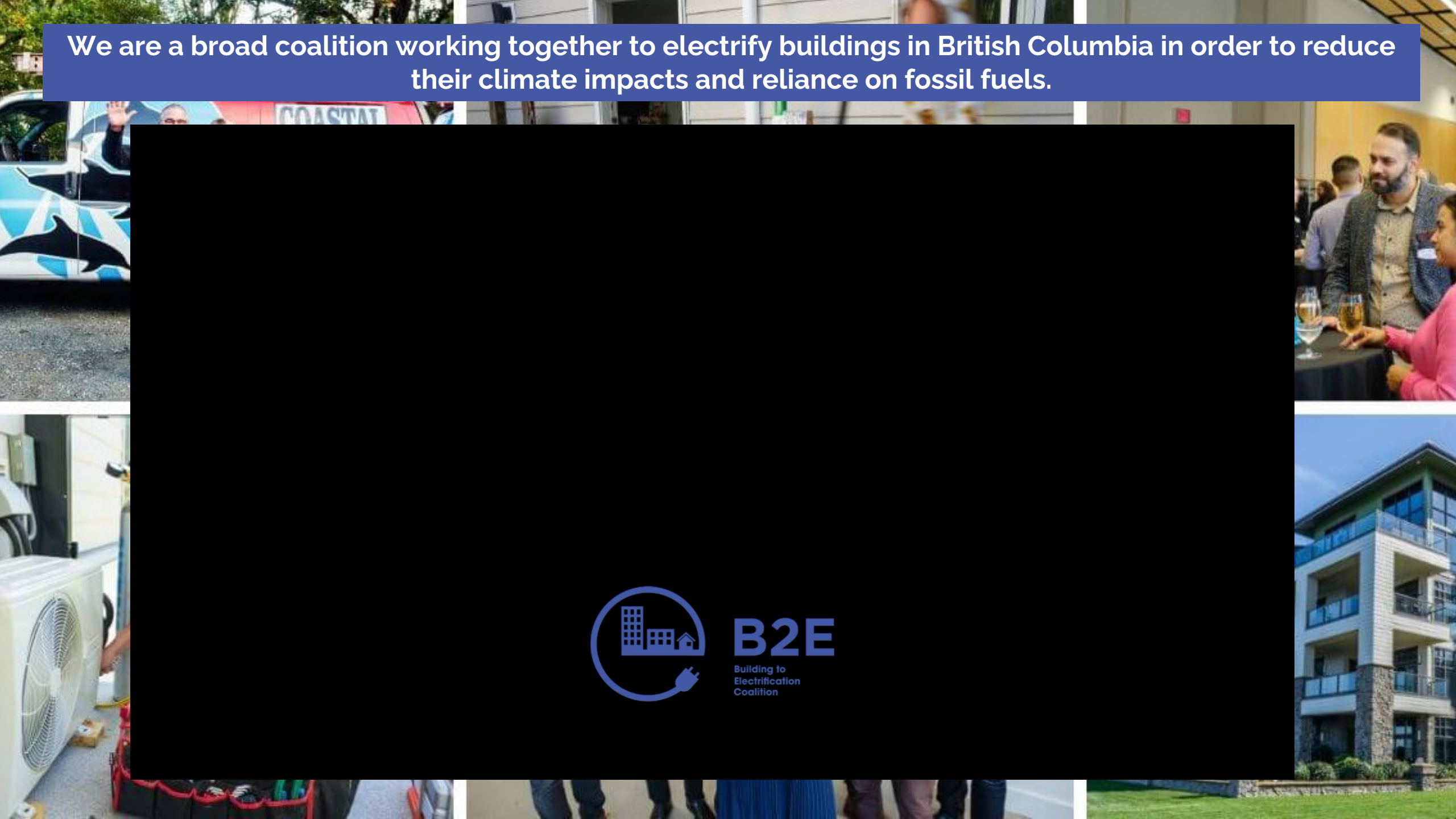
ZERO EMISSIONS INNOVATION CENTRE

MORE SOLUTIONS, LESS CARBON.

We are a broad coalition working together to electrify buildings in British Columbia in order to reduce their climate impacts and reliance on fossil fuels.



Home Electrification: Service Upgrade Not Required!

Mar 2023

Building electrification occurs when a building is disconnected from the fossil fuel distribution network and some to all building system are switched over to run on electricity. In areas where the electricity grid is clean, like in British Columbia, building electrification results in significant greenhouse gas emissions reductions. Some form of energy efficiency improvements, such as air sealing and adding insulation are often necessary prior to electrification to increase comfort and reduce costs.

Optimized Electrification

Optimized Electrification refers to the electrification of a building while maintaining the existing electrical service connection. A grant from the **Alberta Ecotrust Foundation** was obtained by **Passive House Alberta** to investigate equipment to support this. Most existing homes have a 100-amp, 240-volt (24-kW) electrical service connection. This article is based on the work of Redwood Energy in California and their **Watt Diet Calculator**.

In cases where electrifying exceeds the existing electrical panel board capacity, there are direct costs to a homeowner to install a

ZEBX TV

Watch our Latest Videos

Is BC Ready for Electrification? B2E w BC Hydro, Sep 2023

B2E, a program alongside ZEBx and part of the ZEIC family, collaborated with BC Hydro in Sep 2023 to help answer the question 'Is BC Ready for Electrification?'

Overview

B2E Resources

Planning for High-Performance Buildings

From ZEBx's Net-Zero Energy-Ready Playbook Series

Overview

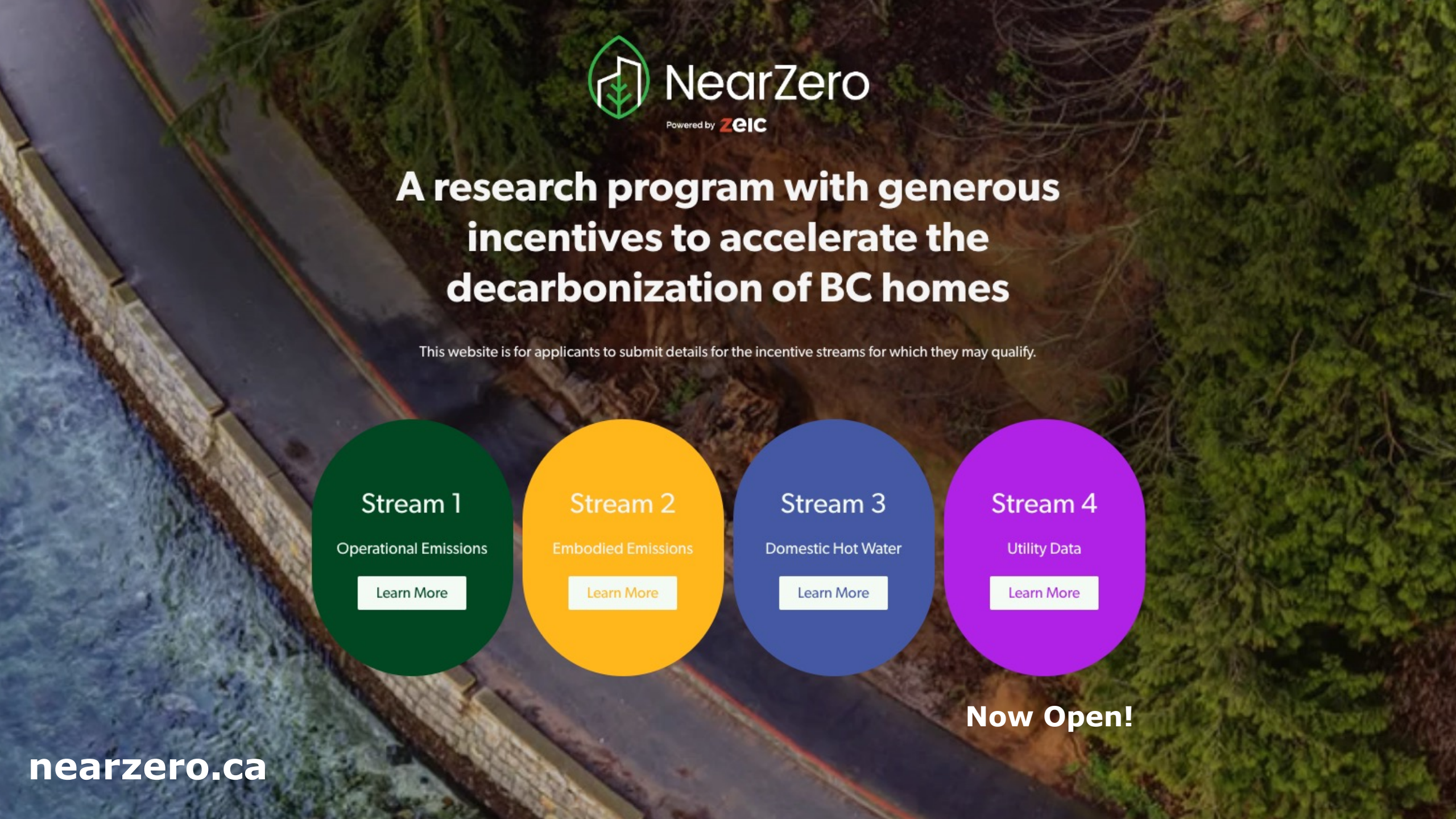
Read This Playbook

Building Industry: Here's how to get to Net-Zero Energy-Ready (NZER) by 2032.

From ZEBx's Net-Zero Energy-Ready Playbook & Winner Series

Overview

Playbooks & Winners


NearZero
Powered by zeic
A research program with generous incentives to accelerate the decarbonization of BC homes
This website is for applicants to submit details for the incentive streams for which they may qualify.
Stream 1
Operational Emissions
Learn More
Stream 2
Embodied Emissions
Learn More
Stream 3
Domestic Hot Water
Learn More
Stream 4
Utility Data
Learn More
Now Open!
nearzero.ca

POLL 1

Tell us about yourself!

Three-part anonymous poll

B2E
Building to Electrification Coalition

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Load Management and Regulatory Requirements

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Who is Technical Safety BC?

We administer the Safety Standards Act throughout British Columbia. We oversee the installation, operation, manufacturing, alteration, maintenance, or selling of equipment across the province with several key exceptions such as municipalities which administer parts of the Safety Standards Act themselves.

The technologies we oversee include the following:

- Electrical equipment and systems.
- Natural gas and propane appliances and systems, including hydrogen.
- Boilers, pressure vessels, and refrigeration systems.
- Elevating devices, such as elevators and escalators.
- Passenger ropeways, such as aerial trams and ski lifts.
- Amusement devices.
- Railways, including commuter rail.

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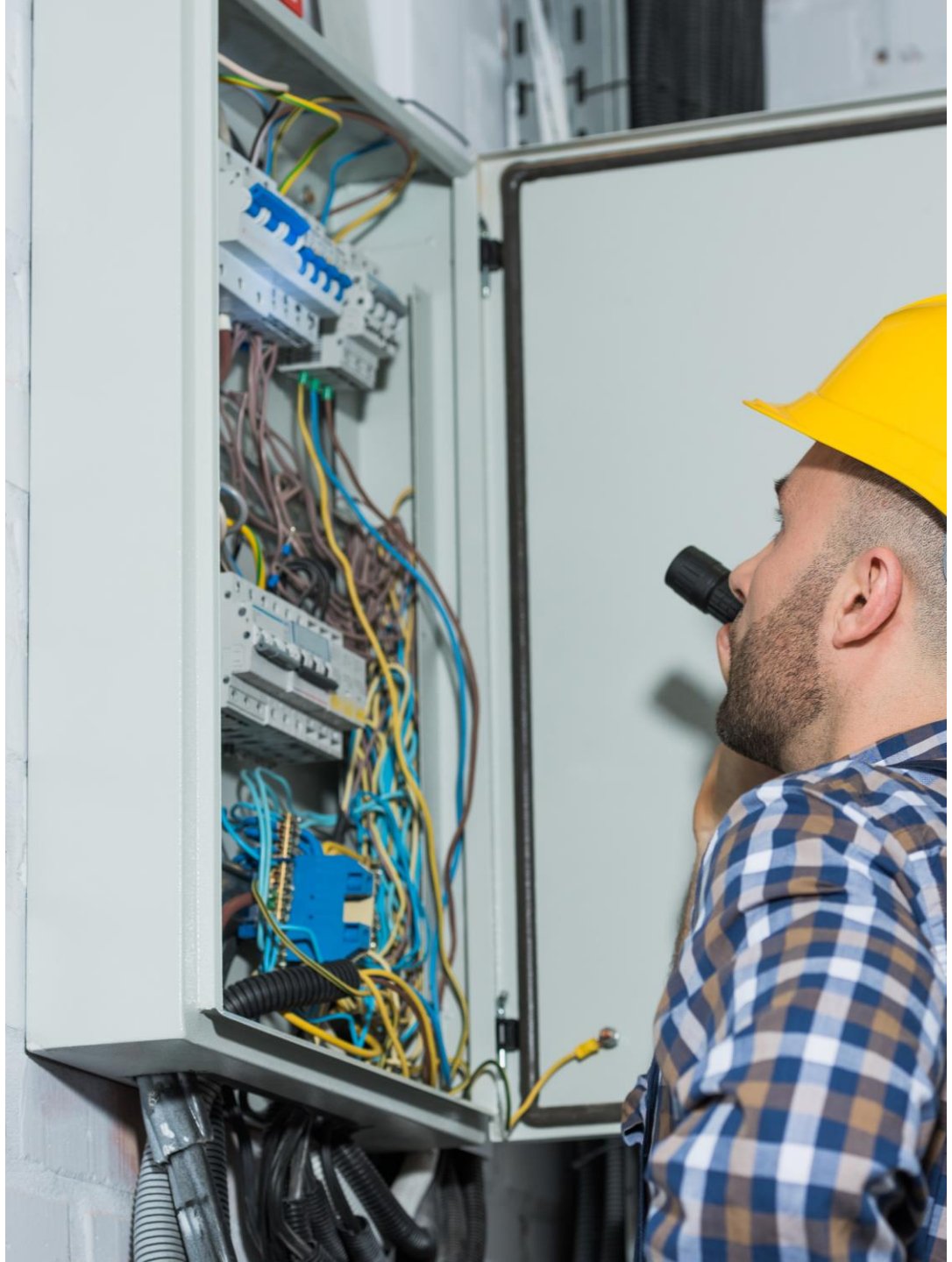

Background

- 2023 – two information bulletins were published by Technical Safety BC on topics related to load management
- February - Demand Factors and Use of Rule 8-106 for Single Dwellings
- June - Electric Vehicle Supply Equipment (EVSE) and Electric Vehicle Energy Management Systems (EVEMS)

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Information Bulletin:

Demand Factors and Use of Rule 8-106 for Single Dwellings

This bulletin provides clarification on Rule 8-106 8), and how additional loads, such as a hot tub or electrical vehicle supply equipment, can be added to the existing service of a single family dwelling.

The code allows for use of a “maximum demand load” as obtained from the local utility, indicting the existing demand over the last 12 (or more) months.

Information Bulletin:

Electric Vehicle Supply Equipment (EVSE) and Electric Vehicle Energy Management Systems (EVEMS)

The bulletin includes four basic sections:

- Definitions
- Installation of EVSE
- EVEMS installations
- Acceptance and Approval (variance process)

Management of Energy Loads

Power Load Switching

Power Load Shedding

Power Load Sharing

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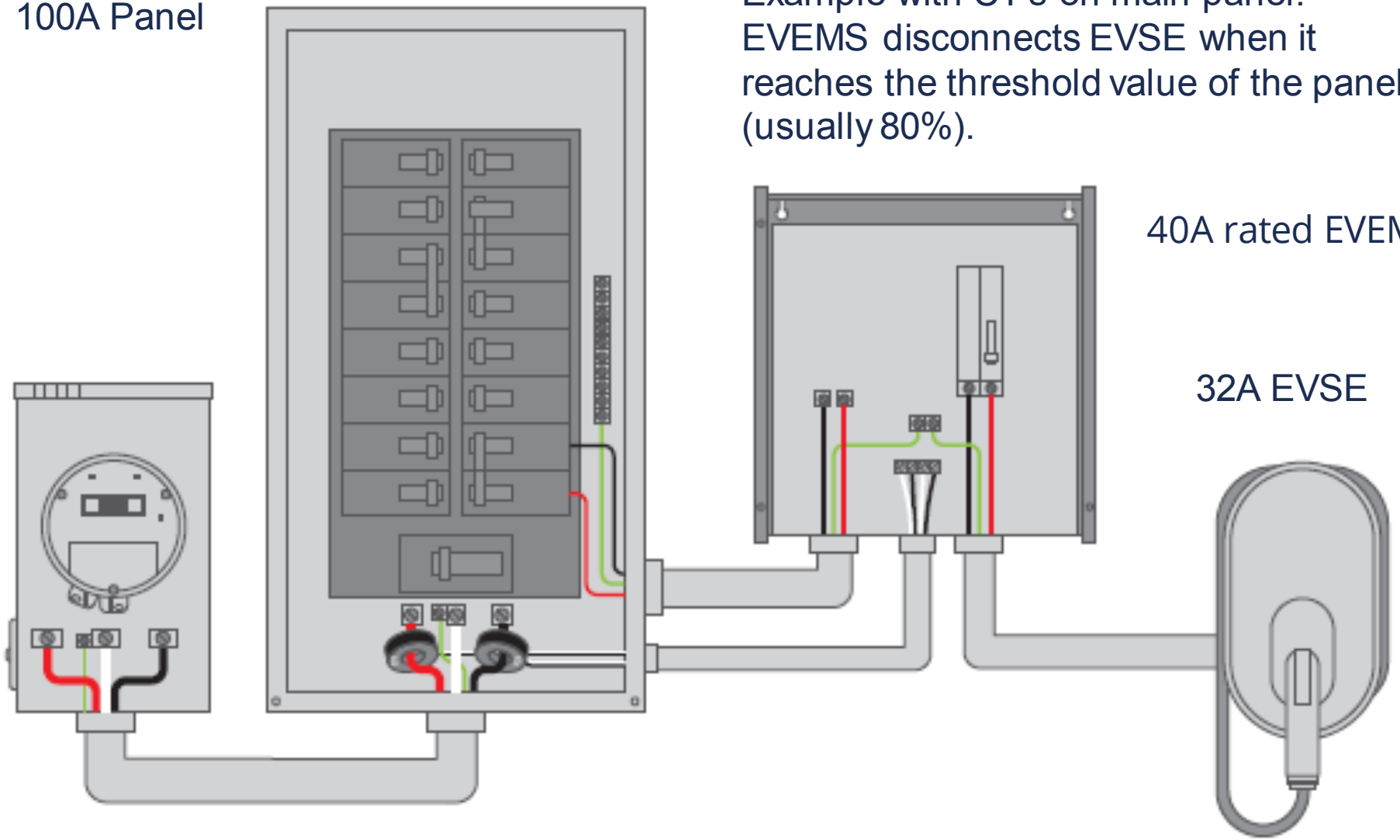
Power Load Switching:
Example with CT's on main panel.
EVEMS disconnects EVSE when it reaches the threshold value of the panel (usually 80%).

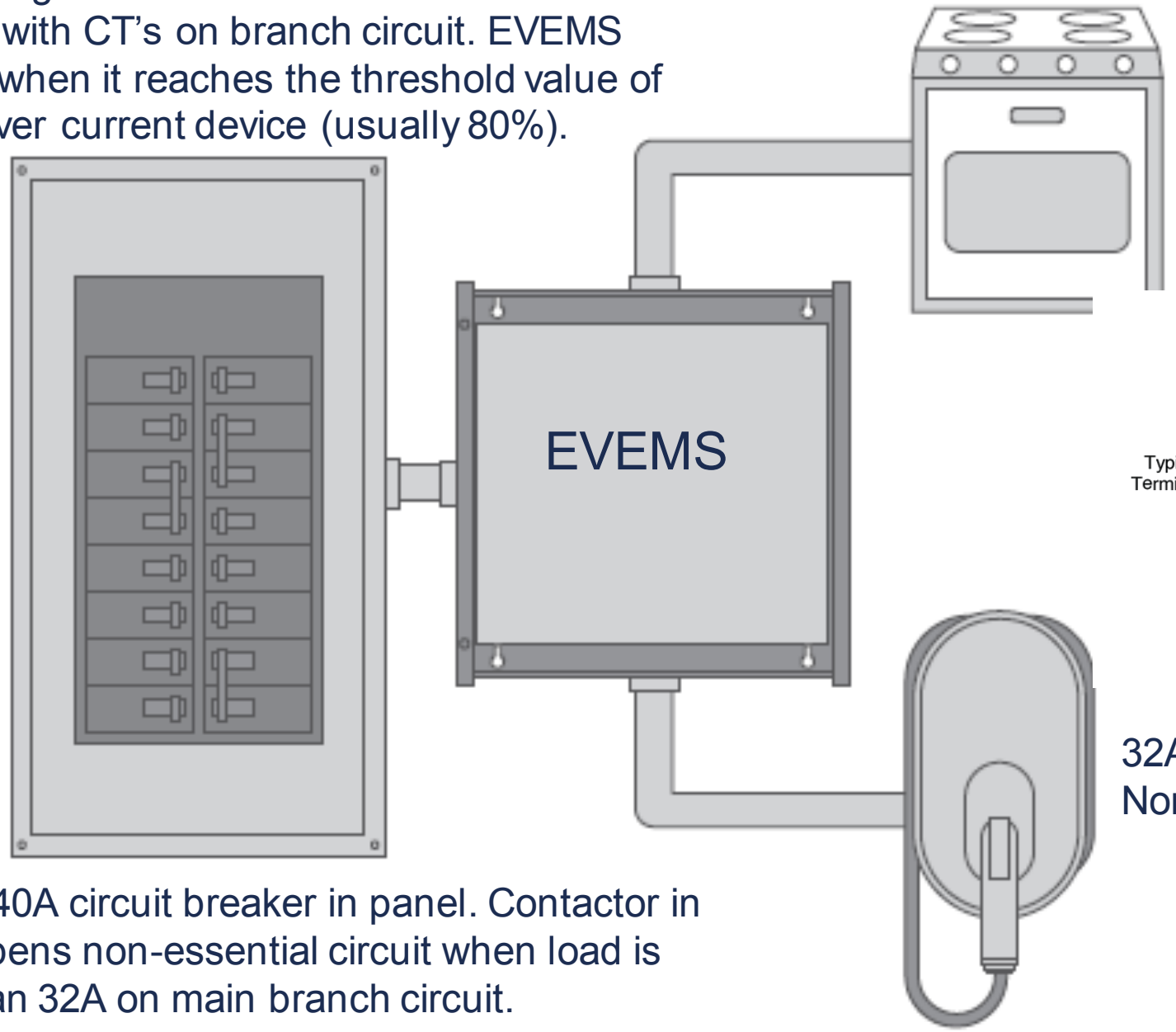
100A Panel



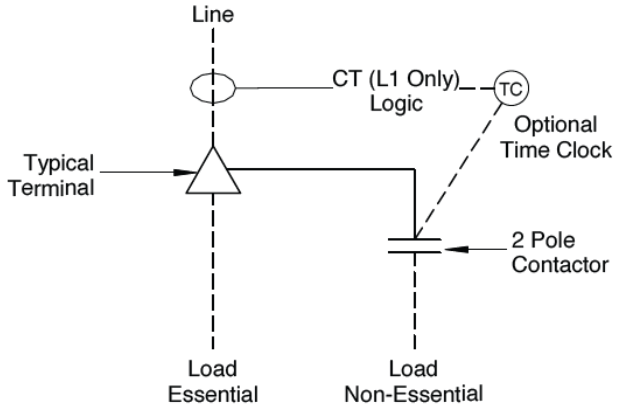
40A rated EVEMS

32A EVSE

Power Load Shedding:
Switching example with CT's on branch circuit. EVEMS disconnects EVSE when it reaches the threshold value of the branch circuit over current device (usually 80%).



Range: Essential load



32A EVSE:
Non-essential load

Example, 40A circuit breaker in panel. Contactor in EVEMS opens non-essential circuit when load is greater than 32A on main branch circuit.

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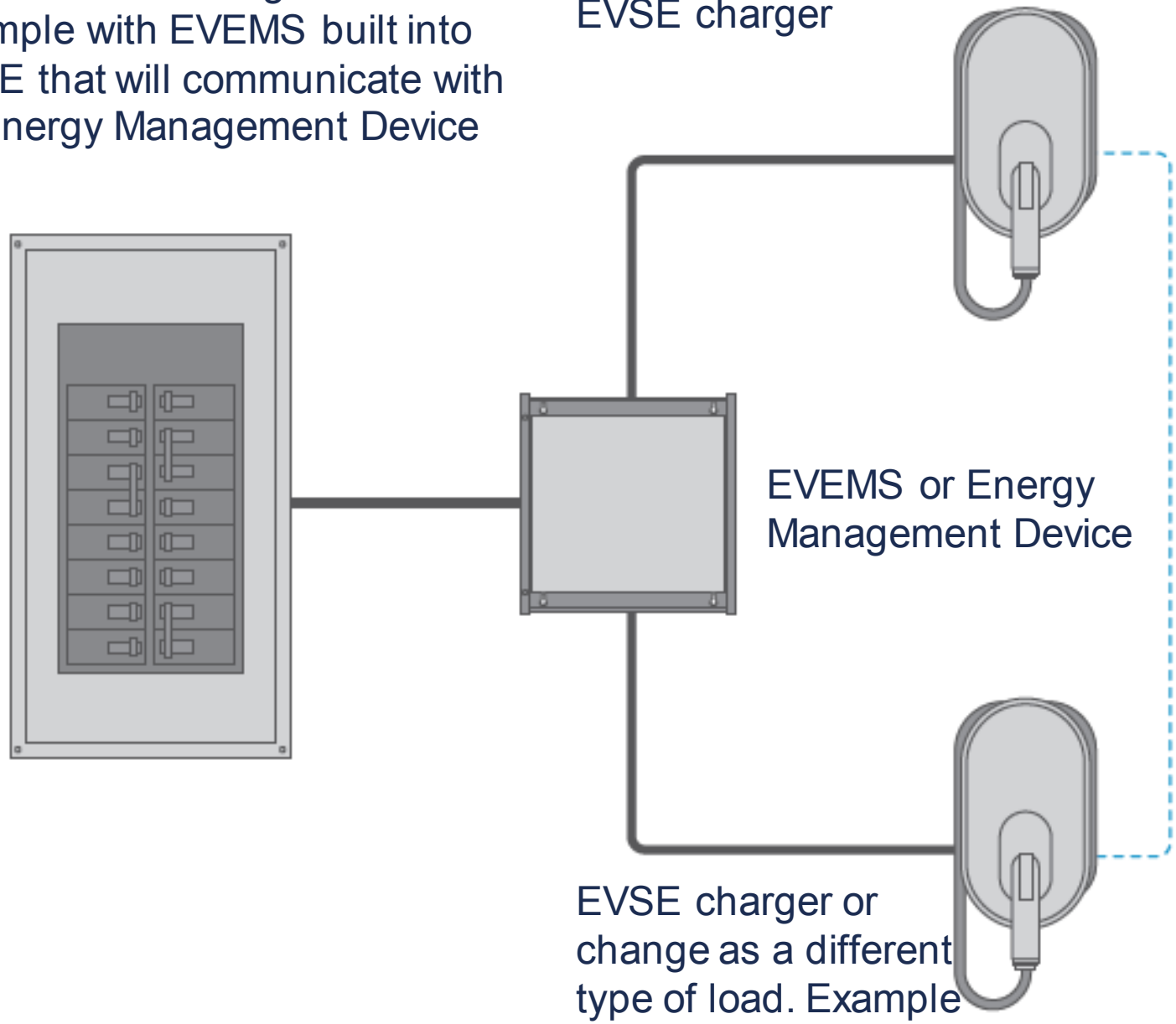
Power Load Sharing
Example with EVEMS built into EVSE that will communicate with an Energy Management Device



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Thank you

Visit us at: technicalsafetybc.ca

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ELECTRIFICATION WITHOUT A SERVICE UPGRADE

ALBERTA ecotrust

PASSIVE HOUSE ALBERTA

What is Building Electrification

- Disconnection from the fossil fuel distribution network and some to all building system are switched over to run on electricity.
- A solar PV system is often added, but not required.
- Main goal is the reduction of greenhouse gas emissions.
- Improvements to the building envelope are recommended.
- An upgrade to the electrical service is often the default route.

Downside of Electrical Service Upgrade

- Minimum cost to individual is around $5,000-$7,000
- Upgrade costs can easily run over $20,000
- Additional societal costs:
  - Electrical Utilities need to increase distribution network size
  - Costs are passed on to consumers via increased "fixed transmission fees”
  - Electricity becomes more expensive, negating any cost savings

How to Avoid an Electrical Service Upgrade

- Go on a Watt Diet
- Use Load Share Devices
- Use a Smart Electrical Panel
- "Split" the Electricity to connect a large solar PV array

Watt Diet or Energy Diet

- Refer to the work of Redwood Energy www.redwoodenergy.net/watt-diet-calculator
- Used to reduce the Peak Load or Amperes the home will draw from the grid
- The Peak Load is calculated according to the current Canadian Electrical Code

General Watt Diet Steps: Appliance Swapping

- Remove Fossil fuel appliances and install electric appliances.
- Electric resistance dryer to all-in-one washer and condensing dryer, 24-amp, 240-volt plug to a 15-amp, 120 volt plug.
- Electric Induction range instead of separate induction cooktop and electric wall oven two, 40-amp, 240-volt plugs to one, 40-amp, 240-volt plug.
- Heat Pump Hot Water Tank, 15-amp, 240-volt version better then 30-amp version use larger tank size and set to “heat pump only setting” .

General Watt Diet Steps: Building Envelope

- Perform a Deep Energy Retrofit or EnerPHIt such that the peak heating load is under 8kW and will fit on a 30-40-amp 240-volt circuit

- Rough Targets for cold climates:
  - Below 1 ACH
  - If 2x4 walls add 6” of insulation or R24 effective
  - If 2x6 walls add 4” of insulation or R16 effective
  - New triple pane window units with a U value < 1 W/m^2K
  - Insulate to at least 1 ft below grade, down to footings better, but only slightly
  - Insulate vented attic to R80 effective

Load Share Devices

- A load share device allows the connection of additional appliances (loads) to an existing electrical panelboard without increasing the peak load calculation.

- Two main types of Load Share Devices:
  - Primary and Secondary Load Share Devises, or Power Switcher
  - Circuit Pausers, or Power Shedder

Primary and Secondary Load Share Devices

Examples:

- **Load Miser by AC Dandy** : D-LM — AC Dandy Products Ltd.
- **NeoCharge Smart Splitter**: NeoCharge (getneocharge.com)
- **DIVVEE by LoadShare Technologies Inc :** (loadsharetechnologies.com)
- **Simple Switch 240:** Simple Switch Canada (simple-switch.ca)

- Equipment costs range from $850 to $1,300
- 2-3 hr to install by an electrician

Circuit Pausers

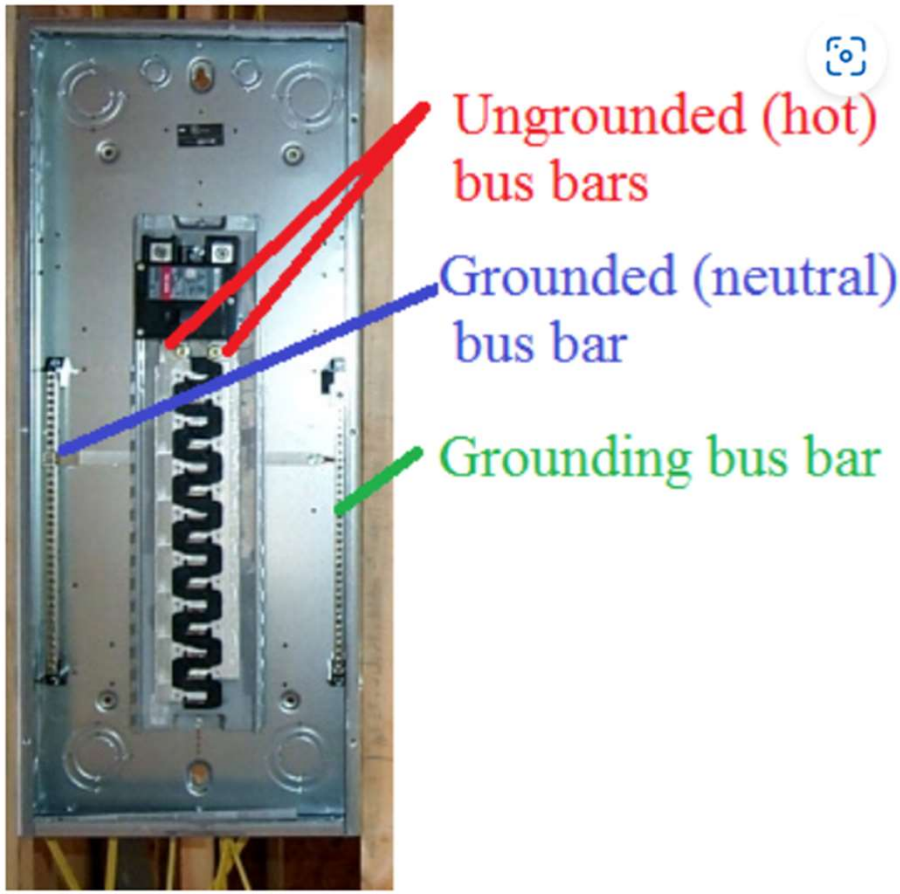
Examples:

- **DCC Electric**: DCC-10 (dccelectric.com)
- **The Blackbox Energy Manager**: (blackbox-in.com)
- **Simple Switch 240M:** Simple Switch Canada (simple-switch.ca)

- Equipment costs range from $850 to $1,300
- 2-3 hr to install by an electrician

Smart Electric Panels

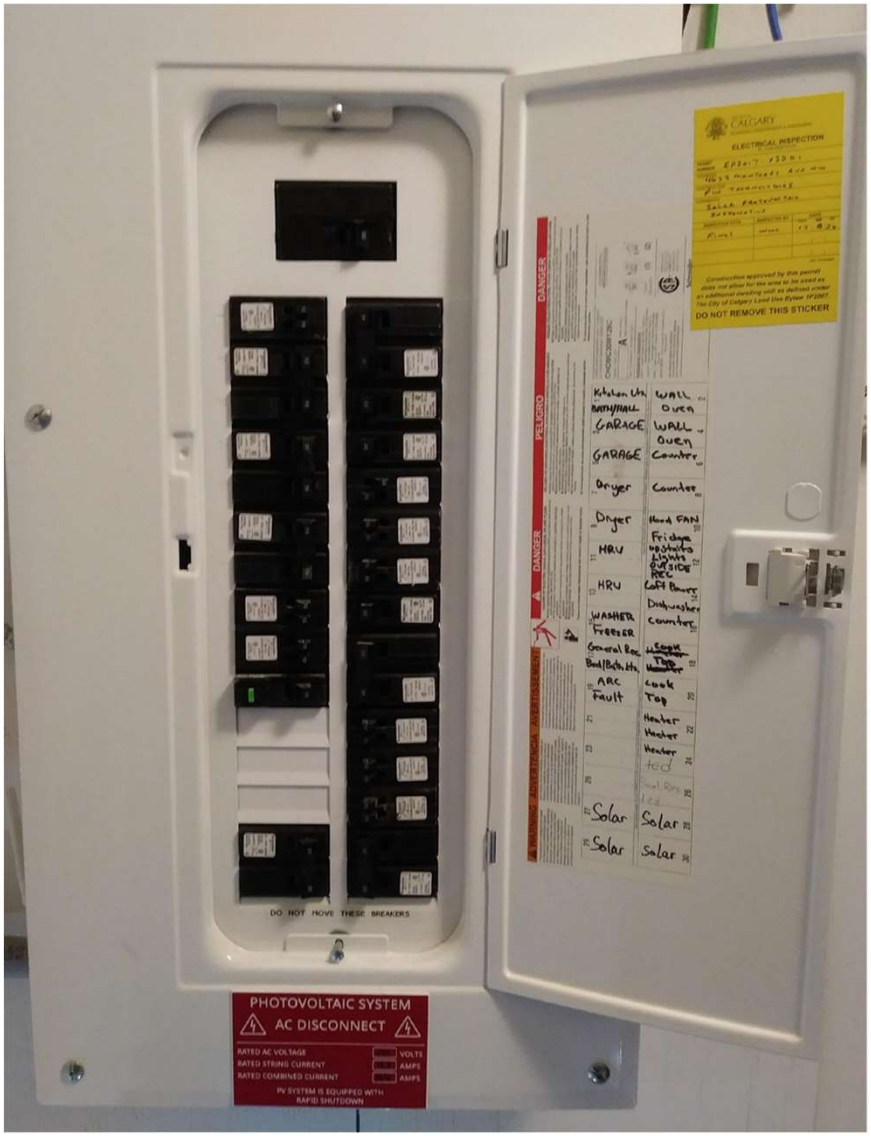
- Good option for new builds or if more than 1 load share device is needed to stay under the 100-amp, 240-volt panelboard calculation.
- Replaces or adds on to the existing electrical panelboard.
- Each individual circuit is monitored, controlled and prioritized so total load does not exceed a selectable watt value.



What is a bus bar in an electrical switch board? - Home Improvement Stack Exchange

Large Solar PV Systems

- Solar PV is generation, not consumption.
- Does not affect the panelboard load calculation.
- Solar PV can increase the electrical current flowing in the busbars.
- Busbars carry and distribute the electricity within the panelboard.



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Large Solar PV Systems

- Large Solar PV systems should be connected at the bottom of the panel.
- Solar PV systems that generates over 4.8kW will likely overload a 100-amp busbar.
- A 4.8kW system is likely not sufficient for a fully electric Net zero on site energy home.

ALBERTA ecotrust

Options for Larger Busbars and Solar PV Systems

- Use a 200-amp rated panel, so it has a 200-amp bus bar and 200-amp rated cable from the meter to panelboard, but only install a 100-amp main circuit breaker.
- Only a $375 increase from a typical 60-amp to 100-amp service upgrade.
- Use a Smart Electrical panel with a 200-amp or larger busbar, then program a max current draw of 100-amps. Koben Genius has a 400-amp bus bar.
- “Split” the electricity into two connection points at the meter, using one of several options acceptable to your local code official.

Alberta Examples of Deep Energy Retrofits and Electrification without a service upgrade

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Single Family Home, Built Prior to 1970

- Typical single-family home with an existing 100-amp 240-volt panel board
- Fossil Fuel furnace, hot water tank and clothes dryer
- Electric Range
- 2x4 walls
- Vented attic
- 134GJ of energy use per year

DER and Electrification details

- Energy use reduced to 43GJ before solar PV
- 100-amp electrical service retained
- All-in-one washer and condensing dryer
- 8” of insulation to walls, 4” below grade, 14” to attic
- Triple pane windows
- 5.8 ACH to 1.2 ACH
- Air source Heat pump
- HPHWT
- ERV added for ventilation
- Cut fossil fuel line
- Cost $130,000-$180,000

Recently Built (2010) Single Family Home

- Existing 125-amp panel, with a 100-amp circuit breaker
- Code min building envelope still had lots of service life remaining
- Fossil Fuel furnace and hot water tank, nearing end of service life
- Electric Range
- Vented Attic
- 2x6 walls
- 143GJ of Energy use.

Ecosynergy: WindHaven Project

DER Details

- Energy use reduced to 62GJ
- Ground source heat pump air handler replaced the furnace
- Aerobarrier improved air tightness to 1.2 ACH
- Circuit Pauser to control an EV charger
- Condensing dryer
- Cut Fossil fuel line
- Cost < $100,000

Ecosynergy: WindHaven Project

Electrification Details

- Net zero via 10kW Solar PV system
- Load Calculation came to 104-amps, so the service had to be increased to 125-amps, but the existing 125-amp panelboard could be maintained.
- Local authority would not accept any of the “splitter” options to connect the PV system, so a new 200-amp panelboard had to be installed.
- Confirm acceptable “Splitter” options with your local authority early.

Ecosynergy: WindHaven Project

Conclusion

- All electrification myths that say it cannot be done are false, even in cold climates, even easier in warmer climates

- For individual and societal benefits, Electrifying without a service upgrade is an achievable goal with minimal costs associated with it.

Service Upgrade Avoidance Trials

Nov 2023

Tim Mosley

Innovation and Delivery

BC Hydro

Nov 2023

BC Hydro
Power smart

The problem

- How do we help customers electrify while avoiding the need for a costly service upgrade ?
  - Utility charge
  - Civil works
  - Electrical works
  - New panel

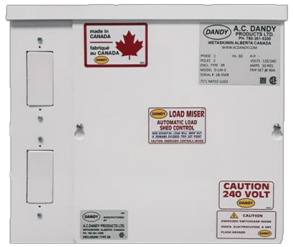
Product Archetypes We Are Testing

Monitoring devices
With on/off control
(Load Shed)

A

Branch Circuit
Switching Devices
(Load Switch)

B



Communicating Devices
Controls across
multiple circuits

A & B

Testing/Trials

Monitoring devices
With on/off control

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Branch Circuit
Switching Devices

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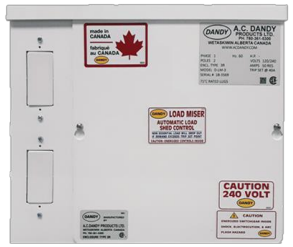


- Initial 20 Homes Type A & B
- Expand to 150 Homes Type B only

Testing/Trials

- Space
- Looks/Location
- Wiring (sub panels)
- Drywall/Asbestos

Testing/Trials

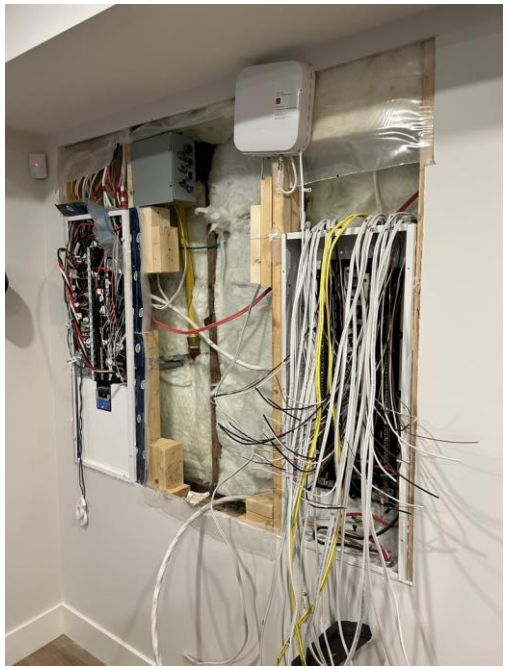
Communicating Devices
Controls across
multiple circuits

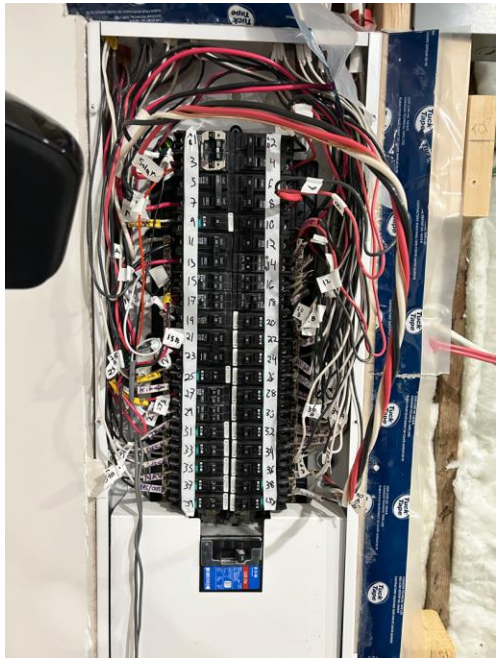
A & B

- Installs in 9 Homes
- Put the home on an “Energy Diet”
  - 3 of each archetype
  - Different levels of vendor product roadmap development

Testing/Trials

- Installation complexity
- Retro fit vs New build
- Pros and Cons of each type





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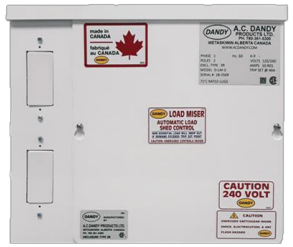

Communicating Devices
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