

The Homeowner's Guide to Electrical Load Management

Learn how to electrify your home without upgrading your electrical service.

CONSUMER GUIDE



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Introduction

Electrifying your home is an important step in reducing greenhouse gas emissions and improving the overall energy efficiency of a home. A common misconception is that a home's electrical service must also always be upgraded when electrifying but electrical service upgrades may not be necessary. There are many opportunities to achieve an energy efficient home and avoid upgrading your home's electrical service. These can include:

- 1. Reduce your home's electrical consumption through energy-efficient upgrades.**
- 2. Use load management technologies to share or shed electrical loads.**

This consumer guide is an expansion of the Homeowner's Conversational Guide to Electrical Service Upgrades. It provides, in greater detail, key concepts in home electrical load management, such as:

- › **Assessing your home's electrical capacity**
- › **Strategies to reduce or manage overall electrical loads**
- › **Managing complete electrification retrofits**

While this publication focuses on considerations for replacing existing fossil fuel heating with a heat pump, many principles also apply to overall home electrification.

Your Electrical Service Panel

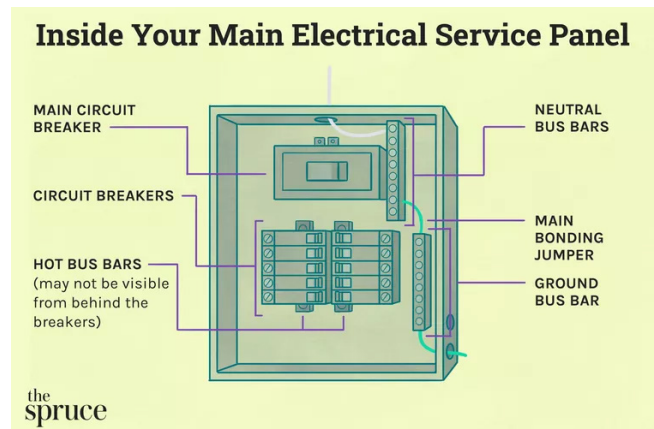
Inside your Electrical Service Panel

An electrical panel box (sometimes called a breaker box) is usually built into the wall, located in an out-of-the-way space such as a basement, garage, or hallway. Inside, you'll find your home's breaker switches. The main service panel is like the switchboard for all the electricity in the home. It receives incoming power from the utility company and distributes it to each of the circuits. These circuits supply electricity to the various lights, outlets, appliances, and other devices throughout your home.

Any device that requires electricity to function (such as heat pumps, furnaces, microwaves, or lighting) consumes a certain amount of electricity to do so. Each of these devices is an **electrical load** on the home. The total (or active) electrical load varies based on how many devices are consuming electricity at the same time. The maximum total electrical load that an electrical service can support at once is a home's **electrical capacity**. In Canada, electrical service in single-family, duplex, and rowhomes generally ranges from 60 to 400 amps.

Some of the key components of your electrical service panel include:

- › **Main breaker.** This is the large switch that controls the overall electricity of the home. In an emergency, switching off the main breaker will instantly shut off all power to the home.
- › **Circuit breakers.** Your breakers are the component most homeowners may be familiar with. Breakers distribute electricity to the circuits that power your home's systems, appliances, and lights.
- › **Branch circuit.** A branch circuit is the wiring between the circuit breaker on the service panel and an end use device, like a lightbulb or heating system.
- › **Empty slots.** Usually an electric service panel will have empty slots where additional breakers may be implemented for future appliances or other electrical needs.
 - **NOTE:** Having empty slots does NOT necessarily mean you have additional electrical capacity on your service panel. Adding additional electrical loads should only be done by an electrician, engineer, electrical designer or electrical professionals (i.e. someone with an understanding of Section 8 of the Canadian Electrical Code.)



Some older homes won't have breakers and instead, have fuses. If your home still uses a fuse box, you might experience insurance difficulties and an upgrade will likely be recommended.



Working with electricity is dangerous and can cause serious harm and/or death. Homeowners should contact a professional electrician for any servicing or maintenance of their electrical panel or equipment, or when adding an additional load to their panel.

What is an Electrical Service Upgrade?

An electrical service upgrade is the term for increasing your home's maximum electrical capacity. Common upgrades include changing from 60 amp to 100 amps or from 100 amps to 200 amps. An electrical service upgrade always requires permits and fees, and costs can add up quickly.

In this section, you will learn about:

- › what's often involved with an electrical service upgrade
- › general cost estimates
- › permitting guidance
- › answers to common questions and misconceptions.

Why do homes upgrade their electrical service?

There are many situations in which an electrical service may be upgraded. The most common reasons are listed below. See the "When is an Upgrade Unavoidable?" section for additional detail.

- 1) An older home with a smaller electrical service (60 amp) is electrifying;
- 2) Adding a rental or in-law suite; or
- 3) Adding auxiliary electrical equipment like a hot tub, sauna, or pool.

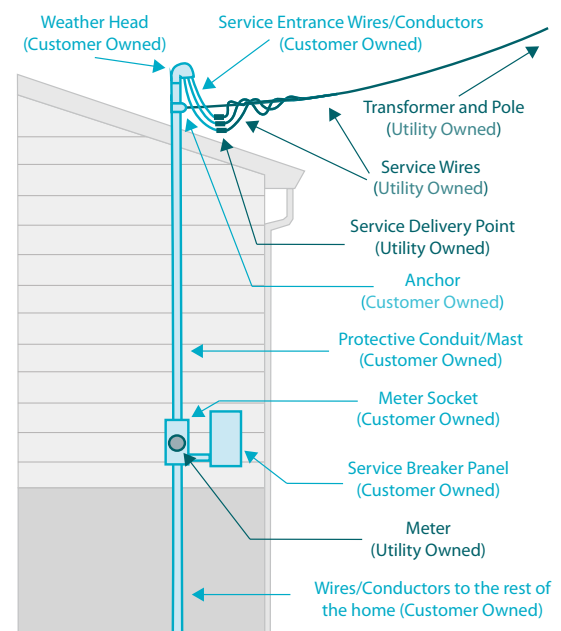
What do electrical service upgrades typically cost?

In an average-sized home, replacing a 100 amp electrical service with a 200 amp service can cost \$3,500 - \$7,000 (as of 2023) plus applicable fees from your electrical utility. These costs can quickly escalate to \$15,000 or more. Common situations that can increase cost include:

- › Your electricity is delivered to your home underground;
- › You need a new electrical pole to address an aerial bypass issue (your electrical line passes over a neighbour's property);
- › The home has wiring that requires remediation.

For example, adding an electrical pole on your property can add \$8,000 to the cost. These costs will vary over time. Seeking quotes will help identify the costs specific to your home. Thankfully, there are multiple options to avoid these costs when electrifying your home.

Customer vs. Utility Owned Electrical Service



Do I need a permit to upgrade my electrical service?

Yes. In British Columbia, you will require a permit for any electrical work involved with your electrical service. These upgrades require hiring an electrician and they will take care of the permit process for you. Most contractors will pull their own permits, so be wary of contractors that ask you pull permits for them. Be sure to check in with your specific municipality to see how they handle permits.

Can I upgrade an electrical service myself?

It is **not recommended** to add electrical loads or upgrade your electrical service yourself. Attempting to complete electrical upgrades without proper training and expertise risks serious injury or death from electrocution or property damage from fire. Upgrades may also cause issues for insurance claims if proper permits are not obtained.

Building Codes in Canada are different in each province and municipality. Check with your local government to confirm regulations before completing an upgrade. See the Appendix for links to relevant permit and building code resources.

Common Misconceptions:

These are some of the common misconceptions that homeowners have regarding electrical service upgrades.

- › **The cost of electrical service upgrades are not expensive or are far too expensive.** The truth is that electrical service upgrade costs vary from home to home, based on factors such as those mentioned above. When receiving quotes, it is important to ask the electrician about load management options and how you can avoid upgrading your electrical service.
- › **You cannot electrify your home without upgrading to at least 200 amps.** Not true! It can be very possible and this guide provides many tips and information for fully electrifying your home with a 100 amp service. Appendix 1 includes examples of what optimized 100 amp panels could look like.
- › **There are no alternatives to upgrading electrical service.** There are many alternatives to an electric service upgrade, including load management devices. These options are discussed in the next section.

Determining Your Home's Electrical Capacity and Load

While it is important to consult professionals before adding electrical loads, you can assess your home's current usage on your own. Start by estimating your home's electrical capacity and load to help you better plan your home's electrical service solutions.

Determine your home's maximum electrical capacity

Check your electric service panel. The main breaker (the biggest switch on your panel) might be inside the panel and should have its capacity on or next to it. This should be used only as an estimate. **Be sure to have this reviewed by a qualified individual.**

Estimate your home's current electrical load

Talk to an electrician to estimate your maximum electrical load. Ask them to reference the [Demand Factors and Use of Rule 8-106 for Single Dwellings](#) bulletin from Technical Safety BC. Your electric utility provider may provide useful information to begin understanding your maximum electrical load. BC Hydro provides hourly tracking of your electrical usage via the HydroHome app and through your online MyHydro account. Other electricity providers, such as FortisBC Electricity, also have online tracking of electricity consumption that you can reference.

There are many online tools and templates designed to help you estimate your home's electrical load, such as [this one from the City of Vancouver](#). These calculators should be used as an **estimate only** and should not directly replace electrical code calculations conducted by an Electrician.

Once your maximum electrical load is determined, you can compare your home's electrical capacity to your planned upgrades. If the amperage ratings of the device(s) you are planning to add will put you near or over your home's maximum electrical capacity, load management will be required.

There are several strategies that may help you reduce your current load and increase available capacity in your panel to allocate to current and future upgrades. These are discussed in the next section.

Planning Your Solution

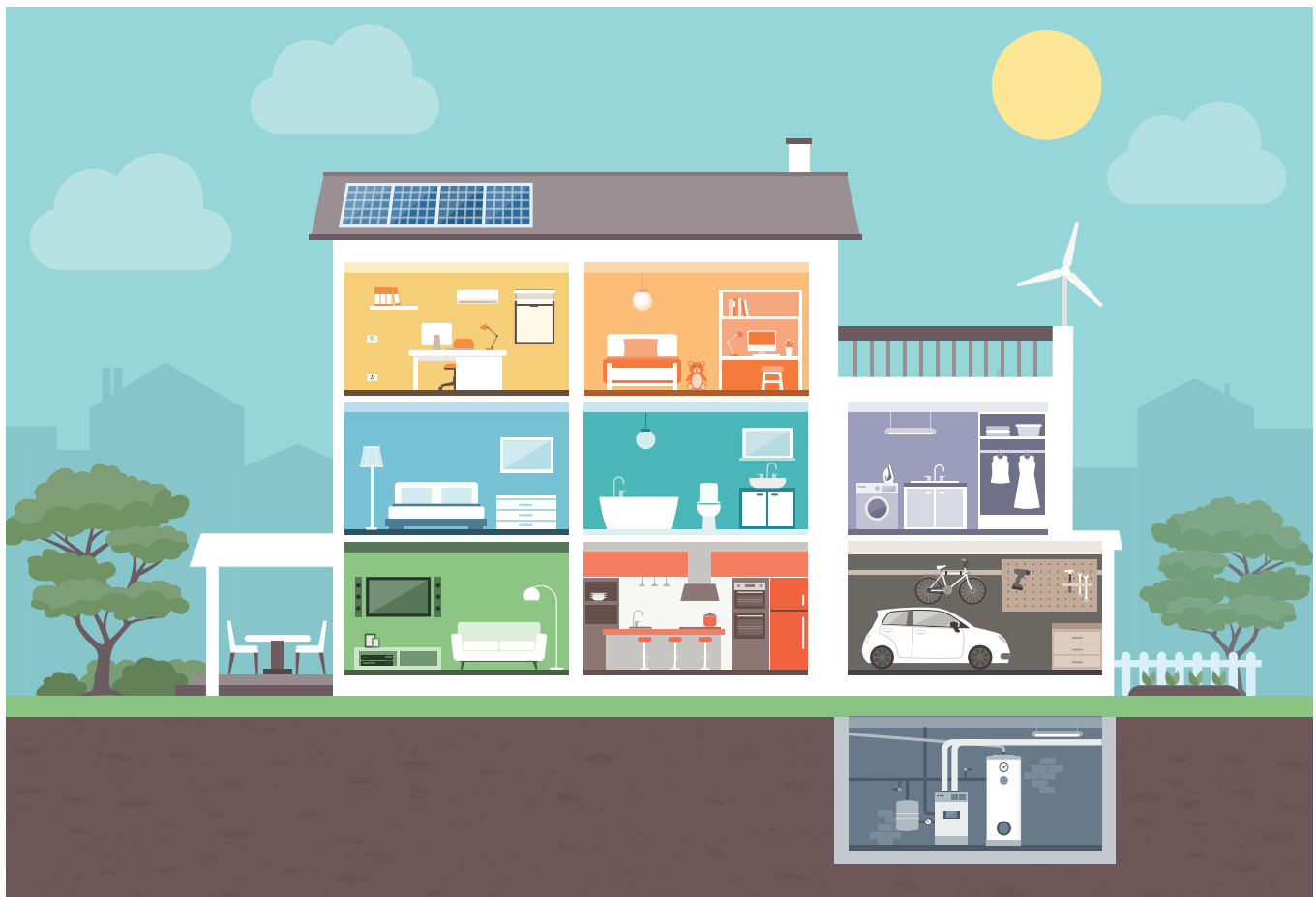
Once electrical capacity and load are determined, options can be considered for electrifying to avoid upgrading your service and panel. This section provides an overview of these options and provides guidance on how those technologies or strategies might be used. It is important to consult a professional electrical contractor before implementing any solutions.

Reduce Your Home's Electrical Load

You can free up space on your panel in two main ways:

- › Remove loads that you do not use or will not need after upgrades or reduce loads by replacing appliances with efficient models (**load elimination**).
- › Use technologies to automatically turn certain loads on and off in certain scenarios (**energy management**).

Did you know that a high performance, well-insulated home can be heated or cooled with 1500W of power total – about what a hairdryer uses!



Load elimination and home efficiency

Load elimination involves removing or reducing existing electrical loads to make space for the loads you want to add. A good example of load elimination is **removing some baseboards when adding a heat pump** since the heat pump will now be providing the heat. Also consider eliminating non-essential loads such as electric hot tubs or pool heaters. Below are several examples of load elimination strategies to consider early in planning your electrification upgrades.



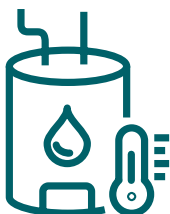
Save energy by replacing your space heating and cooling with an electric heat pump:

When electrifying your home, heat pumps are a no-brainer. Heat pumps are two-in-one systems that can provide heating and cooling year-round. Consider choosing a cold-climate heat pump, particularly when trying to save capacity for your electrical service. Cold-climate systems are highly efficient in all temperatures and often don't need a back-up heating source that would take up additional capacity. [Learn more here.](#)



Reduce your home's heating and cooling needs with building envelope upgrades.

A better insulated and air-tight building envelope lets your home retain more heat inside the home. When electrifying your home, reducing your home's heating load means you might need a smaller heat pump system, which in turn reduces your electrical load. [Learn more here.](#)



Choose a heat pump water heater instead of a standard electric water heater.

Heat pump water heaters use 2-3 times less electricity than a standard electric water heater. If you have a standard electrical water heater, it often requires a 30 amp circuit. Switching to a heat pump water heater model often uses only 15 amps. [Learn more here.](#)



Install a heat pump dryer:

If you currently have a standard electric dryer (usually 30 amps), replace it with a ventless heat pump dryer, condensing dryer, or combo washer/condensing dryer. These are often available in 15 amp versions, freeing up space in your home's overall load. These types of dryers are not vented so you can also seal up any holes in your wall. [Learn more here](#) (p. 47).



Select the right size of electric vehicle charger:

Electricians have reported installing a 240 volt electric vehicle charger as one of the most common reasons for service upgrades. However, there are options available to avoid this upgrade.

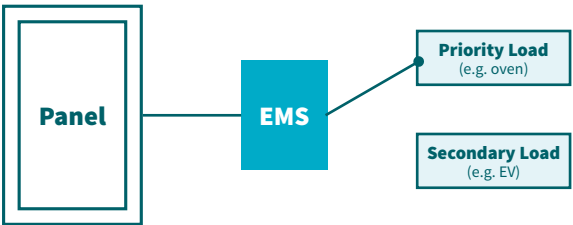
If you commute less than 65 kilometers in a workday, a standard level 1 charger may still be suitable and saves 15 amps on your service. Also, using a load management device can reduce or eliminate your EV charger's contribution to your load calculation. We discuss these technologies in the next section. [Learn more here](#) (p. 52).

Manage Your Home's Electrical Load

If load elimination and home efficiency measures do not reduce electrical load enough, there are options to stay on plan. Various energy management devices (EMS) can help you avoid an electrification upgrade. Energy management technologies generally involve prioritizing the electrical appliances in your home. Non-essential (secondary) loads automatically turn off during times of high electrical load, such as when cooking or doing laundry.

Branch Circuit Switching and **Load Pausing** devices can be great solutions for adding an additional load that cannot be fit with load elimination and efficiency measures alone. Common loads to consider are:

Primary Loads (must run, but run infrequently)	Secondary Loads (can usually be shut down for an hour or so without inconvenience)
Electric Stove/Oven	Electric Vehicle Charger
Electric Dryer	Tanked Electric Water Heater

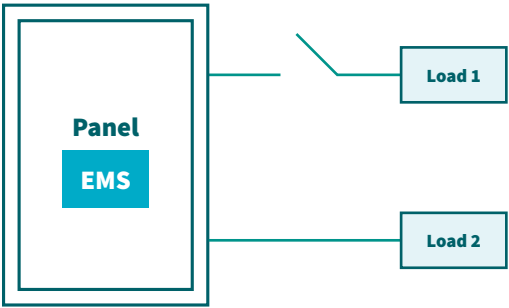


Branch Circuit Switching Devices

Branch circuit switching devices always provide the primary load with electricity when needed. The equipment on the secondary load side only has power when the primary load is off. This allows two large loads to be connected to a single circuit breaker, but only the larger is included in the electrical service capacity calculation. These devices typically start at around \$700 and are often the most applicable load management option for single family home situations.

Load Pausing (Circuit Pauser) Devices

Circuit Pausers work in a similar manner to branch circuit devices. Pausers monitor the electrical demand on your whole electrical panel, as opposed to connecting multiple loads to a single breaker. If the home's total demand goes over a certain threshold, it will pause the power to the connected equipment until the main electrical service demand drops below the threshold for a set amount of time. These are often used for electric vehicle chargers. The connected load is not included in the electrical service capacity calculation when used for an EV charger. Current technology includes DCC-9/DCC-11 and DCC-10/DCC-12 devices, ask your contractor about what's available in your area. Equipment costs typically start around \$850. Contact an electrician for a quote customized your home. Make sure to verify the permitting requirements for use of this technology, as there may be limitations to its application.



When is an Upgrade Unavoidable?

While there are many options to avoid electric service or panel upgrades, here are some signs that may point towards an unavoidable upgrade:

1. **Faulty wiring.** Improper installation leads to inevitable problems; look for mismatched breakers and circuits or two circuits on a single breaker. An electrician or inspector can assess the quality of installation and wiring in your home.
2. **Damage.** Look for water corrosion, rust, broken or frayed service entry cables, etc. All are indications that repair or replacement are required. The service entry cable is the grouping of wires between the panel and the mount. A damaged cable is easy to see and may crackle or spark. Additionally, loose cables and damaged clamps cause major breaker box problems. Call a professional to assess the specific needs.
3. **Sub-par manufacturing.** There is always the possibility that your electric panel is faulty due to manufacturing.
4. **You're using extension cords for permanent solutions.** Power cords are designed to be used for the short-term. If you have too much plugged into them, they can be a fire hazard. If you need more outlets, you'll likely have to upgrade the circuit and the panel. This does not necessarily mean you need to upgrade your service.
5. **Breakers keep tripping.** Circuit breakers are designed to disconnect (i.e. 'break') when there is too much electricity and they're overloading. If you find you are constantly resetting your breakers, you may need to balance your electrical loads or consider an electric service upgrade.
6. **Your home uses fuses instead of circuit breakers.** If your panel is still using a fused-based system, it may be undersized for the modern electrical needs of your home. Fuse boxes can become unsafe if not maintained well over their lifetime. Get your fuse box inspected if you are concerned about its condition.



Important!

Improper installation leads to inevitable problems. Some contractors try to save space by doubling up two circuits on a single breaker. This is not only dangerous, but may be a code violation. Additionally, a fire in a home with non-compliant wiring or improper permitting could void claims on insurance. Electric vehicles must have a dedicated 20 amp plug and wiring for a level 1 charger. It cannot be plugged into a standard household plug, which is only 15 amps. This issue can also impact insurance claims.

Hiring a Professional

When considering changes to your electrical panel or electrical service, it is important to get professional advice. Consider the following tips to help find a quality electrical contractor:

- › Technical Safety BC maintains a **list of licensed electrical contractors**. [Find contractors in your area by clicking here.](#)
- › **Word-of-mouth:** get recommendations from trusted friends or family. This is a great way to find a contractor who cares about their long-term reputation.
- › **Online reviews:** checking company reviews online can help narrow your search for a contractor, but be wary of fake reviews! [Click this link or check out the Better Business Bureau's "How to spot a fake review" article to learn more.](#)
- › **Cheapest is not always best:** Don't always accept the lowest quote without doing due diligence. Ask questions about the contractor's other work, references, and their recommendations for your home. Good contractors will readily provide answers to these questions.
- › **The electrical service for your home is a vital part of its overall systems:** Taking the time to ask questions and receive multiple quotes will ultimately help you make the most informed decisions. Working with a licensed professional means that you benefit from their experience and have a venue for support should you need follow up assistance.

Watch out for red flags:

- › All electricians must include their license number anywhere their business name appears, including their website and advertisements. If you do not see this number, they may not be licensed (a license is different than a Red Seal certification).
- › If an electrician asks you to obtain the electrical permit for them, it likely means they are not licensed and can't obtain their own contractor permit.
- › If an electrician asks to be paid in cash **and** is unwilling to provide a receipt, they may not be pulling proper permits. This will leave you without proof of who completed the work if needed later.
- › If your electrician quickly makes a decision on what your home needs after only glancing at your panel, they may not be taking your home's full situation into account. Be sure to ask follow-up questions and get multiple quotes if possible in this situation.



Questions to ask your electrician:

- › Are you licensed?
- › Are you bonded and insured?
- › Will you be the one completing the work?
- › Can I call some references for you?
- › Do I need a permit?
- › Can I make load management work for my home and if not, why?

As homeowners in B.C. look to make energy efficient upgrades to their homes, including their home's electrical service, the planning stages will become more important. Replacing a fossil fuel heating system with a heat pump, or adding an EV charger, can be done without a full service upgrade. Using a combination of load management strategies can negate the need for a service upgrade all together.

Some of the common methods include:

- › Search for opportunities to remove loads you don't need or won't need after upgrades (e.g. baseboards, hot tub etc.)
- › Choosing high-efficiency cold-climate heat pumps that will require fewer amps.
- › Improving your home's building envelope to reduce heating loads may allow you to choose a smaller system.
- › Install two-in-one appliances such as a combo washer-dryer or induction stovetop and oven.
- › Consider EMS devices.

Professionals Recommend:

- › Starting with a load calculation to determine current load and opportunities for reducing or eliminating load.
- › Consider opportunities to use EMS devices early in the planning process (e.g. electrical vehicle charger or water heater as a secondary load with your drier or stove as the primary load).
- › Choose more efficient appliances (e.g. switching to heat pump water heater and heat pump drier can usually free up 30 amps of electrical load)
- › Get a cold-climate heat pump, they will use less electrical load and often don't require adding a back-up that would take up capacity otherwise.
- › Many homeowners with electric vehicles don't need a level-2 charger, consider a level-1 charger that will take fewer amps.

For further reading on some of the key topics and strategies identified in this guide, the *Additional Resources* section below provides links to useful articles, calculators, and more on the topic of electrical service upgrades and load management options when electrifying different aspects of your home.

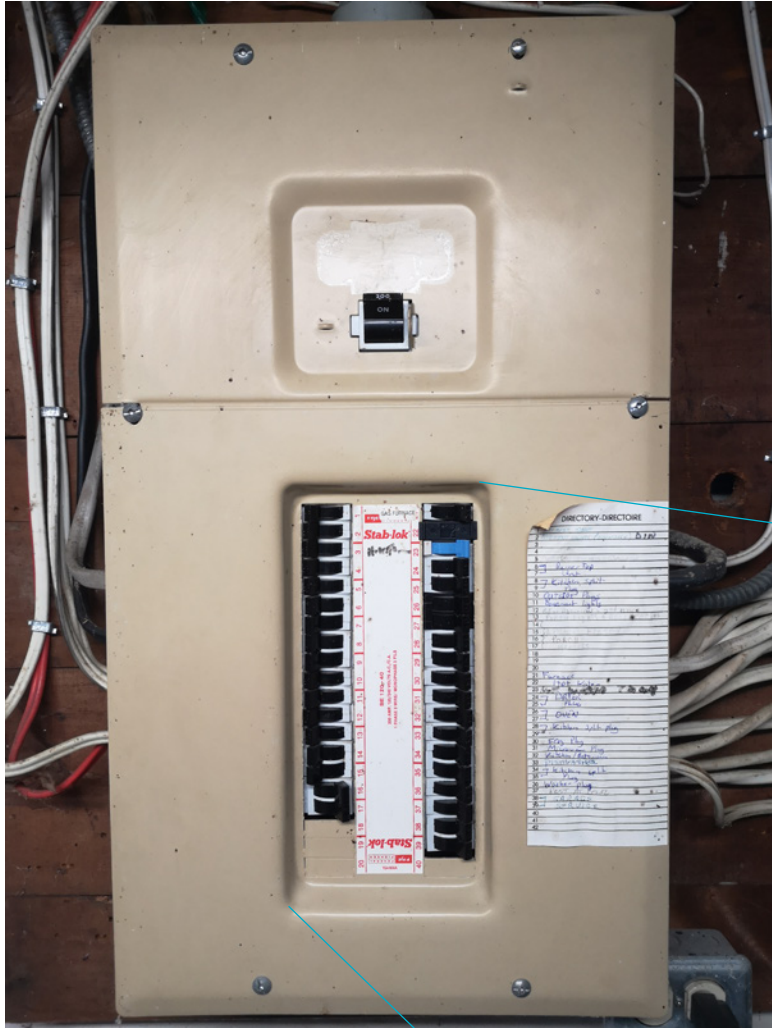
Additional Resources

- › [A Zero Emissions All-Electric Single-Family Construction Guide](#)
 - A guide for homeowners, builders, contractors and policy makers to realize the benefits of building all-electric homes.
- › [A Pocket Guide to All-Electric Retrofits of Single-Family Homes](#)
 - This booklet is a simple “how-to” guide to help homeowners, home renters, and utilities and policy makers who want to replace existing gas appliances with efficient electric alternatives.
- › [Electrify Everything in your Home](#)
 - A guide to replacing all of your fossil-fueled appliances with modern electric ones.
 - Check out the [Homeowner and Landlord Checklist](#) that will help you *Electrify Everything* in your home.
- › [Watt Diet Calculator](#)
 - A guide to electrifying your home without upsizing your electric service.
- › [The Spruce: Calculating Electrical Load Capacity for a Home](#)
 - Understanding electrical capacity and how to calculate your home's electrical load.
- › [Efficiency First California: Do You Really Need to Upgrade Your Service Panel to Electrify Your Home?](#)
 - Learn how efficiency plays a role in reducing the electrical loads in the home.
- › [Home Electrification: Service Upgrade Not Required!](#)
 - Provides links to different load management devices available for single family dwellings.
- › **Electrical Service Load Calculators (estimates):**
 - [City of Vancouver DIY home electrical load calculator](#)
 - A DIY form to fill in and calculate your home's current electrical load.
 - The [Electrical Service Load Calculator for Single Dwellings in Canada](#) can be used as an estimate.
- › **Permit Requirements in British Columbia:**

• TSBC	• City of West Vancouver
• Surrey	• City of Burnaby
• Vancouver	• City of Surrey
• Victoria	• City of Victoria
• City of North Vancouver	• City of Maple Ridge
• District of North Vancouver	

Appendix 1: Example Electrical Panels

Pre-Upgrade Electrical Panel - FPE Stab-lok panel



The Homeowner's Guide to Electrical Load Management

Optimized 100Amp Electrical Panel for a 2,000 Square Foot Home includes:

- › Heat Pump Space Heating
- › Heat Pump Dryer
- › Heat Pump Water Heater
- › EV Charger
- › Spare circuit

All Electric 100 Amp Home (2,000 square feet)

Ducted heat pump, medium power heat pump water heater, hybrid heat pump dryer

Device Volts	Device Amps	100 Amp Panel		Device Amps	Device Volts
120	8	Lights/Plug 15	15	Lights/Plug 15	8
120	8	Lights/Plug 15	15	Lights/Plug 15	8
120	8	Lights/Plug 15	15	Lights/Plug 15	8
120	10	Garbage Disposal 20	20	Kitchen Outlets 13	120
120	7	Refrigerator 20	20	Kitchen Outlets 13	120
120	0	Spare 20	20	Dishwasher 12	120
120	8	Furnace (removed) 15	20	Clothes Washer 13	120
240	20	Heat Pump Centrally Ducted 30	20	Hybrid Heat Pump Dryer 14	240
240	20	EV Charger 25	50	Range (cooktop & oven) 40	240
240	16	Solar Input 20	20	Heat Pump Water Heater 12	204



House Square Footage = 2000

Total Counted Panel Amps = 96.7

Additional House Information

- 4 occupants
- EV charging up to 19 miles/hr
- Located in California climate zone 3 (SF Peninsula)
- Some insulation
- 38,000 BTU heating and cooling

- 60-80 gallon heat pump water heater
- 4-burner induction or standard electric range
- 7.4 cu. foot hybrid heat pump dryer
- A 20-amp circuit will support a 3.8 kW inverter.
(Many 3.8 kW inverters can support up to a 5.8 kW solar array depending on inverter load ratio)

Load calculations per the National Electrical Code Section 220.82(B) and 220.83(B)

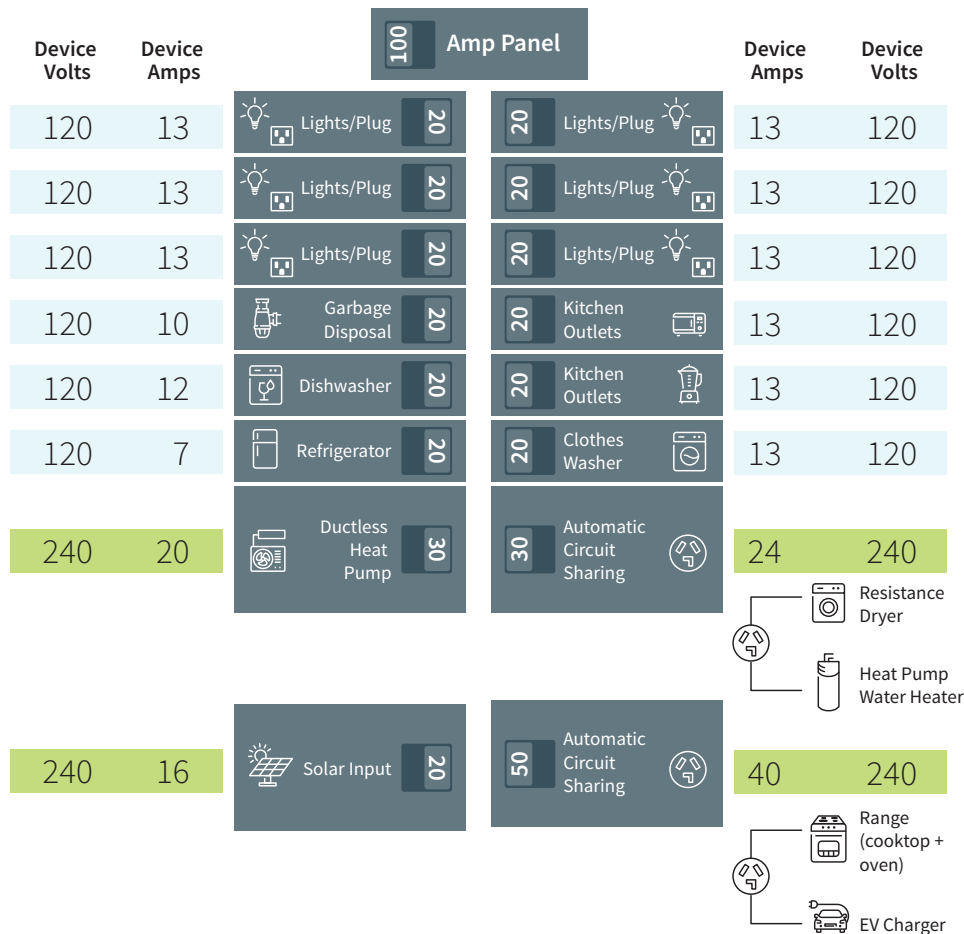
The Homeowner's Guide to Electrical Load Management

Optimized 100Amp Electrical Panel for a 3,000 Square Foot Home includes:

- › Heat Pump Space Heating
- › Heat Pump Dryer + Heat Pump Water Heater Branch Circuit Sharing
- › EV Charger + Induction Stove Branch Circuit Sharing

All Electric 100 Amp Home (3,000 square feet)

Two “automatic sharing” circuits, ductless mini split heat pump, resistance dryer high power heat pump water heater



House Square Footage = **3000**

Total Counted Panel Amps = **97.2**

Additional House Information

- 4-6 occupants
- EV charging up to 38 miles/hr
- Located in California climate zone 3 (SF Peninsula)
- Some insulation
- 48,000 BTU heating and cooling

- 40-80 gallon heat pump water heater
 - 4-burner induction or standard electric range
 - 7.4 cu. foot standard resistance dryer
 - A 20-amp circuit will support a 3.8 kW inverter.
- (Many 3.8 kW inverters can support up to a 5.8 kW solar array depending on inverter load ratio)

Load calculations per the National Electrical Code Section 220.82(B) and 220.83(B)

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Supported by:



Prepared by:



Disclaimer

This guide does not apply to multi-family or strata-titled properties in BC. Strata corporations in BC with 5 units or more must have an electrical planning report completed. It is recommended to complete this report before making electrical upgrades, conversions, or additions to ensure sufficient electrical capacity for the community. Electrical services in strata corporations may be common property and require the consent of the strata corporation before proceeding with upgrades such as the installation of EV charging stations or heat pumps.

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