

Home Electrification and Electric Panel Considerations

In August 2022, President Biden signed the Inflation Reduction Act into law, marking the most significant action Congress has taken on clean energy and climate change in the nation's history.

One aspect of the Inflation Reduction Act is providing many incentives to support the transition to all-electric homes. A key consideration when electrifying is fitting it all on the electrical panel capacity. Homeowners need to understand their electrical panel capacity

when considering electrifying. This resource will help individuals gain a deeper understanding of their electric panels and their options to create the easiest path toward electrifying their future.

Common Electrification Upgrade Triggers

Electrification Upgrade	Description	Benefits	Cost
 Electric Vehicle Charger	EV chargers deliver household electricity to an electric vehicle, either at 120 Volts from a regular outlet or at 240 Volts from a dryer outlet or dedicated circuit.	<ul style="list-style-type: none"> • Energy efficiency • Convenience 	\$
 Electric Dryer	Clothes dryers might be one of the easiest appliances to switch to electric. Electric dryers include vented electric resistance dryers, ventless heat pump dryers, ventless condensing dryers, and ventless all-in-one washer dryers.	<ul style="list-style-type: none"> • Energy Efficient • Longer Appliance Lifespan • Gentler on clothes 	\$
 Induction range	Moving from a mixed-fuel residential kitchen to an all-electric kitchen is fully achievable today with induction range tops and electric resistance ovens. Induction technology uses a magnetic field to directly heat pots and pans for cooking, while the kitchen stays cool.	<ul style="list-style-type: none"> • Better Indoor Air Quality • Reduced Asthma Risk • More control over temperature • Boils water faster 	\$\$
 Heat Pump Water Heating	Heat pump water heaters (HPWHs) use electricity to pull heat from the surrounding air and transfer it into a hot water tank.	<ul style="list-style-type: none"> • Energy Efficient • Better Indoor Air Quality 	\$\$
 Heat Pump Space Heating	A heat pump is a single electric appliance that can replace both your traditional air conditioner and home heating system. Heat pumps use electricity to move heat from one place to another. For cooling, a heat pump moves the heat from inside your home to the outside.	<ul style="list-style-type: none"> • Energy Efficient • Better Air Quality • More Control • Heating, Cooling, & Dehumidification all in one 	\$\$\$

The cost estimates in the chart above are based on full-price appliances. There may be federal, state, or local incentives that can help to bring down the cost. See the Re-Wiring America Rebate Finder to find what is available to you.



Electric Meter

An electric meter is typically located outside and is the device that measures the amount of electric energy consumed by a residence. Electric panel size is determined by the current rating of the main breaker and typically ranges between 50-400 Amps.

Understanding Your Electrical Panel and Its Important Parts

An electrical panel is responsible for safely delivering electricity from the utility's power lines to your home. The electric panel controls how much current and power are allowed in and distributes the electricity into different circuits in your home via switches and breakers. The panel capacity determines the maximum amount of power that can be delivered on the circuits powering your lights and appliances can be drawing at any given time.

Circuit Breaker: a combined electrical overload sensor and switch is used in more modern systems. The circuit breaker disconnects power for safety reasons if it senses too much power is flowing.

- **Single Pole Breaker:** a circuit breaker that runs most of your smaller electricity needs as it handles up to 120 amps.
- **Fuse:** found in older systems to provide safety in a way similar to a circuit breaker.
- **Double Pole Breaker:** a circuit breaker that runs your larger appliances, such as your dryer or water heater, as it handles up to 240 amps.

Expansion Slots: an area where a new circuit breaker can go at a later date, such as when adding an addition to your home.

Service Disconnect Breaker: a main breaker or switch like device that allows you to disconnect from the utility and turn off all the power to your home. The main breaker can disconnect if the total of loads in your home drew more power than the main breaker is rated to deliver.



Most Common Types of Electrical Panel

The size of the panel is usually based on when your home was constructed. Two common types of electrical panels are:

Medium-Sized Service Panel: This is at least a 100 amp service panel and is common in many older homes that have not had a major renovation or home addition.

Large-Capacity Service Panel: This 150- or 200-amp panel is found in many newer homes and some older larger homes.

The difference between breaker box "sizes"

- The amount of electricity the panel can handle
- The number of circuits a panel can handle

Do I Have Room on My Panel or Do I Need to Upsize?

Before making any electrification upgrades, it is important to know the amp capacity of your current electrical panel. Many modern homes have 200 amp panels, but it is not unusual for older homes to have 100 amp panels. You can tell how many amps of service your panel can handle by:

1. Inspecting the utility's meter box for a label with an amperage rating
2. Inspecting your electrical panel for a label with its amperage rating
3. Checking the size of the main breaker on the panel

Physical Space vs. Electrical Capacity Space

There are two types of space to manage in adding electrification to your home. Physical breaker spaces to allow for new circuits to be physically connected to the panel busbars, and electrical capacity space remaining so the main disconnect is not overstressed. Breaker ratings will typically add up to more than the capacity of the panel so you cannot add up the breakers and subtract them from the panel rating to determine electrical space. This is because the appliance load is usually less than the breaker rating, and not everything in the house operates simultaneously. Electricians use the nameplate load for load calculations to calculate the maximum current (or power) an appliance will use. Usually, the actual appliance load is significantly lower than the breaker rating. For example, a 30 Amp EV charger will draw 24 Amps at most.

How to Calculate Electrical Capacity?

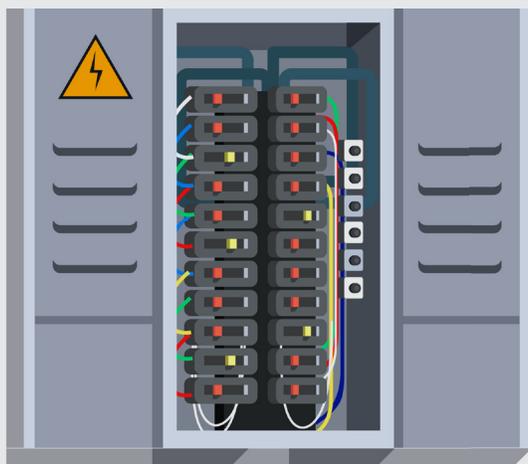
Electrical load capacity is the total amount of instant power delivery capability that your main source of electricity provides for your home. This is available for all of your home's circuits and all outlets, appliances, or lights connected to these circuits. The total capacity of your home's electrical system is measured in Amperage or Amps. Calculating how much power your home needs involves calculating the amperage load of the various appliances and fixtures, then building in a margin of safety. It is important to note, an electrician can be tactical about managing the loads of chosen added appliances to help avoid upsizing a home's panel and help affordably electrify.

Relationship between watts, volts, and amps:

These terms have a mathematical relationship that can be expressed in a couple of ways:

- Voltage (Volts) x Current (Amps) = Power (Watts)
- Watts/Volts = Amps

The National Electric Code provides two different methods for calculating the minimum size of residential electric panels, the Standard Method (NEC 220.40) and the Optional Method (NEC 220.80). This factsheet focuses on the two Optional Methods. Optional Method One, which utilizes the current utility bill is both easier and more accurate than Optional Method Two, which calculates the existing load based on the number and type of appliances and receptacles.



OPTIONAL METHOD ONE

Determining existing loads can be completed by using utility records. Based on the National Electrical Code (NEC 220.87), this code-based method is one of the most accurate ways to calculate the electrical load. The utility record can be used to establish maximum annual demand in kWh in the year's peak hour or peak 15 minutes and be converted to amps.

Example: Maximum demand in kWh/hour from electricity bill X 1000W/kWh X 125%/(240V X 1 hr) = Ampacity reserved for meeting existing load.

Suppose the ampacity of the existing load plus any new potential loads you may want to add is less than the ampacity of your home's electrical panel. In that case, the new loads will fit within the ampacity of the existing panel.

OPTIONAL METHOD TWO

The National Electrical Code (NEC 220.83) describes the steps to determine if an electrical service can safely accommodate new loads.

Calculation to determine the appropriate size for your electrical service:

1. Start by identifying the square footage of the home to determine the estimated lighting and receptacle loads:	3 VA/ft x _____ = (house finished square footage)	1																																														
2. 20A small appliance and laundry branch circuits	1500 VA x _____ = (20A small appliance and laundry branch circuits (minimum 3))	2																																														
3. Add in all permanent appliances— Code states 1500 VA per 2-wire 20A small appliance branch circuit and laundry branch circuit, and nameplate rating of all appliances fastened in place:	<table border="0"> <tr><td>Oven</td><td>_____</td><td>_____</td></tr> <tr><td>Cooktop</td><td>_____</td><td>_____</td></tr> <tr><td>Fixed Microwave</td><td>_____</td><td>_____</td></tr> <tr><td>Dishwasher</td><td>_____</td><td>_____</td></tr> <tr><td>Disposal</td><td>_____</td><td>_____</td></tr> <tr><td>Electric Clothes Dryer</td><td>_____</td><td>_____</td></tr> <tr><td>Electric Clothes Washer</td><td>_____</td><td>_____</td></tr> <tr><td>Well Pump</td><td>_____</td><td>_____</td></tr> <tr><td>Sump Pump</td><td>_____</td><td>_____</td></tr> <tr><td>Garage Door Opener</td><td>_____</td><td>_____</td></tr> <tr><td>Hot Tub</td><td>_____</td><td>_____</td></tr> <tr><td>Other</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>TOTAL:</td><td>_____</td><td>_____</td></tr> </table>	Oven	_____	_____	Cooktop	_____	_____	Fixed Microwave	_____	_____	Dishwasher	_____	_____	Disposal	_____	_____	Electric Clothes Dryer	_____	_____	Electric Clothes Washer	_____	_____	Well Pump	_____	_____	Sump Pump	_____	_____	Garage Door Opener	_____	_____	Hot Tub	_____	_____	Other	_____	_____	_____	_____	_____	_____	_____	_____	TOTAL:	_____	_____	3	
Oven	_____	_____																																														
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TOTAL:	_____	_____																																														
4. Adjust appliance loads:	a. Sum all above loads	4a																																														
	b. Take the first 8000 VA at 100%	4b																																														
	c. Take the remainder at 40%	4c																																														
	d. Add 4b and 4c to get the general load	4d																																														
5. Add the wattage of your AC or heating appliances (furnace + space heaters), whichever is greater—Don't add both	a. Cooling Load Outdoor Unit _____ Air Handler _____ TOTAL COOLING: _____	5a																																														
	b. Heating Load Heat Pump Outdoor Unit _____ Air Handler _____ Backup Electric Heat _____ Electric Baseboard/Space Heaters _____ TOTAL HEATING: _____	5b																																														
6. Add load and divide by 240V (add 4d + 5a or 5b (whichever is greater))	_____ ÷ 240V = (load total)	6	suggested amperage needed to power your home																																													

Other Options Besides Electrical Panel Upgrades When Considering Electrifying

1

Panel Optimization

Choose power-efficient appliances and circuit-sharing devices.

2

Technology

(smart panels or smart circuit breakers)

Smart Panels, Circuit Splitters, or Circuit Pausers that control individual circuits to regulate a home's peak electricity demand.

Additional Sources

1. [Efficiency First CA](#)
2. [Rewiring America](#)
3. [Rewiring America Inflation Reduction Act Calculator](#)
4. [Redwood Energy Watt Diet Calculator: Electrifying the home without upsizing the electric panel](#)
5. [Pecan Steet](#)
6. [Yes, it's possible to electrify a home on just 100 amps](#)

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New Buildings Institute (NBI) is a nonprofit organization working to advance energy efficiency and decarbonization in the built environment. Our efforts are imperative to keeping energy costs affordable, cutting emissions that are fueling climate change, and to deliver on improved health, safety, and resiliency for everyone. Throughout its 25-year history, NBI has become a trusted and independent resource helping to create buildings that are better for people, communities, and the planet. Learn more at newbuildings.org.

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