
THE ABC'S OF ELECTRIFYING YOUR GAS APPLIANCES

A GUIDEBOOK FOR HOUSEHOLDS

This Guidebook was created by a team of community-based organizers, academics, and practitioners who are working together on a grant from the California Energy Commission:

- Active San Gabriel Valley, a community-based organization <https://www.activesgv.org/healthy-home-study.html>
- UCLA – California Center for Sustainable Communities <https://www.ioes.ucla.edu/ccsc/>
- UCLA – Center for Occupational and Environmental Health <https://coeh.ph.ucla.edu/>
- The Energy Coalition, a non-profit organization <http://energycoalition.org/>

If you want copies of this Guidebook, or have questions about something written here, please contact Active San Gabriel Valley (see back cover).

TABLE OF CONTENTS

1. THE BASICS	2
Why should I use this Guidebook?	2
What does it mean to electrify my gas appliances?	2
Why would I want to electrify my gas appliances?	2
How do I know which of my appliances use gas?	2
Why do I need a Guidebook?	3
How should I use this Guidebook?	3
What if I can't afford to make any changes?	3
What if I am a renter?	3
 2. IMPORTANT QUESTIONS TO ASK BEFORE ELECTRIFYING	 4
Q1. How much gas does the appliance use?	4
Q2. What is the up-front cost of purchasing a new electric appliance?	4
Q3. What changes might I need to make to my home before I can install the electric appliance?	5
Q4. What will be the ongoing cost? (How will my utility bill change?)	6
Q5. How much will electrification help to improve air quality and slow climate change?	7
Q6. Will appliance electrification improve my indoor or my outdoor air quality?	7
 3. ELECTRIFICATION BY APPLIANCE TYPE	 8
Cooking	8
Hot Water Heating	9
Space Heating	10
Clothes Drying	11
 MORE INFORMATION	 11

1. THE BASICS

Why should I use this Guidebook?

This guidebook was created to help households like yours start to think about electrifying your gas appliances.

What does it mean to electrify my gas appliances?

When you electrify a gas appliance, you replace it with an appliance that serves the same purpose, but is powered by electricity instead of gas.

Why would I want to electrify my gas appliances?

Gas appliances in your home burn methane. That has a bad effect on air quality, can cause safety hazards, and contributes to climate change.

- **Pollution.** Burning methane gas to power appliances creates pollutants that can cause ear, nose, and throat irritation, make asthma worse, and damage lungs. The use of gas for cooking has been linked to increased asthma in children and a worsening of indoor air quality.
- **Safety.** Electric appliances are safer. Gas is highly flammable and can cause fires or explosions if the appliance or gas pipes get damaged, which can happen during an earthquake. Gas appliances also produce carbon monoxide, which is poisonous¹.
- **Climate Change.** Burning methane gas also creates carbon dioxide, which is a “greenhouse gas” because it traps heat in the atmosphere and causes climate change. Methane itself is also a greenhouse gas, so methane gas leaks² contribute to climate change.
- **Resilience.** If you are able to install solar panels on your roof, you can use the energy you generate to power your electric appliances. With the right equipment, you can even power your home with your solar panels during a grid outage.

Switching to electric appliances will reduce pollutants in and around your home, reduce gas hazards, and slow the progress of climate change.

How do I know which of my appliances use gas?

Household appliances that typically use gas include:

- Stoves and ovens
 - Hot water heaters
 - Wall furnaces and central air furnaces
 - Clothes dryers
-

¹ Never use your stove or oven for heating, and be sure to have a carbon monoxide detector installed in your home. For more information, see:

<https://www.cdc.gov/co/faqs.htm>

² Methane can leak at any point as it is produced, stored, delivered, or used. The Aliso Canyon gas leak in Porter Ranch that started in 2015 and lasted for 4 months is an example of a leak from a methane storage facility.

If you see a flexible hose attached to the appliance (see photo of dryer in Section 3), that is the gas connection. It's also important to know that almost all gas appliances also need some electricity to operate, so they won't work when the power goes out.

Why do I need a Guidebook?

While there are many benefits to electrifying your gas appliances, there are also costs. The costs and benefits are different for each type of appliance.

We wrote this Guidebook as a starting point, to help you begin thinking about these decisions. Many people can't afford to replace all their gas appliances, so this Guidebook can help you prioritize your choices, to make the best decision for you and your family.

Your decision to electrify will depend on what is most important to you, such as improving your indoor air quality, keeping your utility costs low, or helping to slow climate change and improving outdoor air quality.

How should I use this Guidebook?

You shouldn't wait until your gas appliance stops working before thinking about whether to replace it with an electric one. When an appliance stops working, you probably want to replace it as quickly as possible, so it's better to be ready in advance. Also, many electric appliances require some changes to your home that will take time to schedule. **We encourage you to plan ahead to electrify your appliances.**

This Guidebook doesn't have all the answers, but it gives you the basic knowledge you need before talking with an electrician, your electric utility, or a sales rep at the appliance store. It will help you ask the right questions and decide on your next steps.

Where possible, we have included estimated costs. It is impossible to provide exact cost information for every situation because there are too many possibilities - for example, whether your household is eligible for a low-income utility rate, what gas appliances you already have, what type of electric appliance you plan to buy, and how much you will use that appliance.

We have provided links to more detailed information from trustworthy sources, and this Guidebook will help you to better understand those details.

What if I can't afford to make any changes?

We realize that, especially for older homes, the up-front costs of electrification may be too much. We believe that the utilities (like Southern California Edison) and the State of California should provide more money to help low-income households electrify. We are advocating for this as part of our work. If you want to support this advocacy, please contact Active SGV to get involved.

What if I am a renter?

We know that, as a renter, you may not be able to replace your large appliances. In Section 3, we give examples of how you can reduce your use of gas for cooking. You may also want to talk with your landlord about electrifying in advance, before an appliance needs to be replaced.

2. IMPORTANT QUESTIONS TO ASK BEFORE ELECTRIFYING

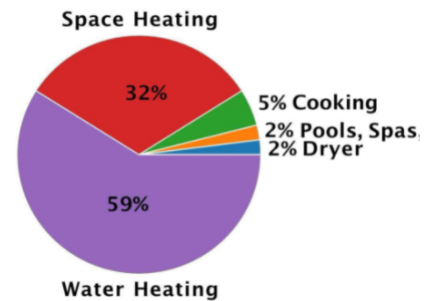
The following questions will help you understand both the benefits and the costs when thinking about each appliance you might want to electrify:

1. How much gas does the appliance use compared to your other gas appliances?
2. What is the up-front cost of purchasing a new electric appliance?
3. What changes to my home might be needed to install the appliance?
4. What will be the ongoing cost? (How will my utility bill change?)
5. How much will electrification help to improve air quality and slow climate change?
6. Will appliance electrification improve my indoor or my outdoor air quality?

Q1. How much gas does the appliance use?

This pie-chart shows the breakdown of how gas is used in a typical household in Southern California -- most is used for water heating (half or more of total use) and space heating (about a third or more of total use).

Electrifying water heating and space heating appliances will cause the biggest changes in most people's gas use.



Q2. What is the up-front cost of purchasing a new electric appliance?

The cost of a new electric appliance includes the purchase price of the appliance itself and the installation cost. (There are other possible costs that we discuss in the next question.)

Purchase Price: The table below shows typical purchase prices for new electric appliances, and whether rebates are offered (as of the time we are writing this). Rebates (cash back) may be provided by Southern California Edison, or other agencies. Federal tax credits may also be available for some appliances - see:

https://www.energystar.gov/about/federal_tax_credits/non_business_energy_property_tax_credits

Category	Appliance Type	Typical costs	Rebates ³
Cooking	Electric resistance range	\$800 - \$1,200	
	Induction range	\$1,400 - \$4,000	
Hot water heater	Heat pump water heater (tank)	\$1,200 - \$3,500	SCE ⁴
	Tankless (on-demand) water heater	\$150 - \$1,500	
Space heating	Electric heat pump split system (ducted, single zone)	\$2,000 - \$5,000	SCAQMD ⁵
	Electric heat pump ductless mini-split	\$3,500 - \$9,000	
Clothes dryer	Electric clothes dryer	\$300 - \$800	

³ Free appliances may be available to income-qualified customers. Apply here: <https://www.sce.com/residential/assistance/energy-saving-program>

⁴ <https://www.sce.com/residential/rebates-savings/rebates>

⁵ <https://www.cleanairfurnacerebate.com/> (until funding is spent)

Installation Cost: You may need to pay additional money to have your new appliance installed.

- Water heaters and space heaters will need professional installation.
- Even for simpler items, like a stove or dryer, a professional can make sure the old gas line is properly closed and capped off. Check if this is a service that the appliance seller can provide, otherwise you can contact SoCal Gas Company for a service appointment (there may be a fee).

Q3. What changes might I need to make to my home before I can install the electric appliance?

You may need changes to your electrical circuits or your electrical panel to accommodate the new electric appliance.

Electric Circuits: Let's first think about how your current gas appliances are connected to your electric system. Almost all gas appliances use some electricity for start-up, control, or running fans.

- For some gas appliances like stoves, only a small amount of electricity is needed, which can be supplied through a standard 120V (volt) outlet - these are the typical outlets you have around the house. Your stove may also share an electric circuit with lights or other electrical devices.
- For other appliances, like a central furnace, gas is burned to create heat, but electricity is used to run the fan to blow hot air through your home. Because they require larger amounts of electricity, these types of appliances are connected to 240V outlets and are usually on a "dedicated" circuit (not shared with anything else).

Almost all new electric appliances (for space and water heaters, clothes dryers, and cooking ranges) will require 240 volts. So, if the gas appliance you are electrifying doesn't already connect to a 240V outlet, you will need an electrician to install a new dedicated 240V circuit. This can cost around \$300 to \$1,000, depending on your existing electrical panel.

Electrical Panel: You may also need to change your electrical main service panel to accommodate this new circuit - this is called a "panel upgrade." The panels on many older homes can only deliver <50 amps of electricity. Electrifying different appliances within your home could require 100-200 amps of electricity. If your panel cannot provide enough electricity to power these new appliances, an electrician will have to upgrade it. This can cost between \$1,300 to \$3,000⁶.

There can be additional benefits to a panel upgrade, because older panels contain parts that may have rusted or degraded over time, making them less safe. A panel upgrade may improve the safety of your home, whether or not you are electrifying your appliances.

Ways to Avoid These Changes: There are ways that you might be able to avoid making these changes to your home. Options for electric appliances that can operate on 120V circuits are becoming more available. There are also devices called "smart circuit splitters" that can help you avoid overloading your electrical panel without upgrading it - but for safety, we strongly recommend that you consult a licensed electrician before using these.

⁶<https://www.fixr.com/costs/install-electrical-circuit-panel-upgrade>

Q4. What will be the ongoing cost? (How will my utility bill change?)

It's important to think about how appliance electrification will affect both your gas and electricity bills. Once you electrify an appliance, your total utility bill may decrease, remain about the same, or increase, depending on:

- How much gas your existing appliance uses
- How efficient the new electric appliance is
- When you use the appliance during the day
- If you can make your own electricity using solar panels

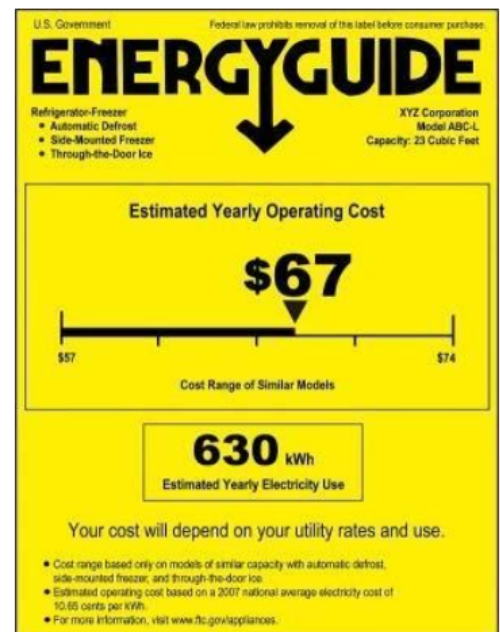
How Much Gas: We talked above in Q1 about which appliances in your home use the most gas. If you are changing your stove or dryer, there probably won't be much change in your total utility bill because these appliances are only a small amount of a typical household gas use. But if you are changing your water or space heater, the other three factors are important to think about.

Appliance Efficiency

The energy efficiency of appliances affects both the upfront cost and operational costs. Typically, more efficient units are more expensive to purchase. But they have a lower operating cost that can pay back the higher purchase costs over a few years.

Appliances that use heat pumps for water and space heating are extremely efficient. They will usually pay back the higher up-front cost through lower energy bills.

A good reference for understanding an appliance's efficiency and estimated operating costs is Energy Star. Energy Star appliances are energy efficient and have lower operating costs compared to other models. Look for the yellow Energy Star tag (see photo) when shopping for appliances. These tags have information about the model's efficiency and estimated operating costs, so you can compare.



When You Use the Appliance: Let's first think about gas: The price of gas is the same at all times of the day, so to manage your gas bill you only need to think about how much you use your gas appliances, not when you use them.

Now let's think about electricity: Most households in California are now billed for electricity according to a time-of-use (TOU) rate – this means the price of electricity depends on when you use it. For example, using electricity between 4pm and 7pm will be more expensive than between 10am and 2pm. So, when you move from using gas to using electricity, especially for water heating and space heating, the time of day when you use these appliances will affect your electricity bill.

Whether You Make Your Own Electricity

If you own your home, you may be able to install solar panels on your rooftop. This would allow you to make your own electricity to offset the cost of your increased use. With current California incentive programs, income-qualified homeowners can receive a free solar installation, the cost of If you own your home, you may be able to install solar panels on your rooftop. This would allow you to make your own electricity to offset the cost of your increased use.

⁷ <https://www.energystar.gov/products>

With current California incentive programs, income-qualified homeowners can receive a free solar installation, the cost of which never has to be paid back. This program⁸ is managed by GRID Alternatives, a nonprofit organization working for the State of California.

Q5. How much will electrification help to improve air quality and slow climate change?

As we discussed in Section 1, burning methane gas creates pollutants. These include nitrogen dioxide and particulate matter which reduce air quality in your community and in the greater LA Region. Burning methane also creates carbon dioxide, which causes climate change globally.

Appliances that use the most gas are the ones that create the most pollution (hot water heater, furnace). Changing those appliances to electric will make the most total improvement in air quality and in slowing climate change. However, it also matters where those reductions happen - inside your house or outside? This important point is discussed next.

Q6. Will appliance electrification improve my indoor or my outdoor air quality?

When methane gas is burned inside your home, pollutants build up indoors. Good ventilation can reduce the amount of pollution that remains in your home, but most gas stoves and ovens are not properly vented to the outdoors. There are many reasons for this, such as: there is no range hood, the range hood fan is weak, the hood doesn't properly cover the stove, or the air is just recirculated and not vented to the outdoors.

Results from our study in your community showed that **using gas stoves and ovens affects your indoor air quality more than your use of other appliances**. Other studies showed the same thing.

Ventilation can be especially poor in winter when your doors and windows are closed. A build-up of pollutants within the small space of your home increases concentrations, making it worse for your health. In our study, levels of the pollutant nitrogen dioxide were found to be higher in homes during the winter. Higher levels of nitrogen dioxide can cause asthma / allergies, respiratory infections, chronic headaches, lung cancer, and rashes.

If you are concerned about your indoor air quality, especially if you cannot vent the smoke and fumes from your cooking area to the outside, replacing your gas cooking appliances with electric appliances may be a priority for you. If you are a renter, there are still ways in which you can shift many of your cooking activities to be powered by electricity without completely replacing your stove or oven (see Part 3 for details).

Other appliances, such as hot water heaters, furnaces, and clothes dryers, are typically well ventilated. This means that the pollutants created from burning methane gas to power these appliances quickly moves to the outdoors and doesn't build up inside the home (unless there is a leak or problem with the appliance installation). Pollutants from these appliances still cause air quality problems outdoors, especially in combination with all the other gas appliances in your neighborhood, your city, and the wider region.

So, to recap: The biggest reduction in total pollution will come from electrifying the appliances that use the most gas, like water heaters and furnaces. But these are different from the appliances that will give the most improvement in indoor air quality, which are stoves and ovens.



⁸ <https://www.energyforallprogram.org/> - available in Spanish

3. ELECTRIFICATION BY APPLIANCE TYPE

This section is organized by 4 types of appliances. We include example photos and review the issues to consider specific to that appliance type.

COOKING

There are two types of electric ranges: resistance and induction.

Electric Resistance Range	Electric Induction Range
	
Features	
<ul style="list-style-type: none"> • An electric resistance cooktop uses heating elements under the surface 	<ul style="list-style-type: none"> • Electric induction cooktops use a more efficient method of heating
<ul style="list-style-type: none"> • Can be used with any type of pot or pan 	<ul style="list-style-type: none"> • Can only be used with certain types of pots and pans (like stainless steel or cast iron)
<ul style="list-style-type: none"> • Slower to heat food and less precise temperature control 	<ul style="list-style-type: none"> • Heats food faster and provides more precise control of cooking temperatures
Air Quality Benefits	
Electrifying your gas range provides the most benefit to your <i>indoor</i> air quality, and can be especially beneficial for people with asthma or other respiratory problems	
Purchase Price and Operating Costs	
<ul style="list-style-type: none"> • Purchase price is slightly more expensive than a gas range 	<ul style="list-style-type: none"> • Purchase price is more expensive than a gas or electric resistance range
<ul style="list-style-type: none"> • An induction range will cost less to operate than an electric resistance range, but more than a gas stove. However, because cooking is only a very small portion of total gas use for a typical household, the total dollar change in your overall energy costs should be small. 	
Changes to Your Electrical System	
<p>You will need to add a 240V outlet for either type of range.</p> <p>You may also have to upgrade your electrical panel.</p>	

Other Options (especially for renters)

Instead of replacing your gas range, you can switch to cooking with small electric appliances, such as: a slow cooker, induction plate (see photo), or electric kettle.




These small appliances can run on your standard 110V outlets, but you still need to be careful not to overload your electrical circuits.

HOT WATER HEATING

There are several types of electric water heaters: **the most efficient type is a heat pump water heater** (see below).

Other options include:



- Electric resistance water heaters. These heaters have low efficiency and we don't recommend them.
- Tankless water heaters (also called on-demand heaters). These are efficient. But you'd need to make even more expensive changes to your electric system.

Electric Heat Pump Water Heater	
<p><u>Features</u></p> <ul style="list-style-type: none"> • Looks similar to a gas storage tank hot water heater • Uses high efficiency heat pump technology, which takes advantage of heat that is already in the air • A "hybrid" heat pump system uses electric resistance to help heat the water when demand is high - this is the type that most people buy. • For more information, see: https://marketplace.sce.com/electric-water-heaters/?filters=type%3Dhybrid%252Felectric-heat-pump 	
<p><u>Air Quality Benefits</u></p> <ul style="list-style-type: none"> • Electrifying a gas hot water heater provides the largest total reduction in air pollution, because most of the gas in a typical SoCal home is used for hot water heating. • Because hot water heaters are usually well-vented to the outdoors, and many are located outside, electrifying a hot water heater will probably not change your <i>indoor</i> air quality by very much. 	
<p><u>Purchase Price and Operating Costs</u></p> <ul style="list-style-type: none"> • Purchase price is high, but rebates are available. • Operating costs will be similar to, or slightly lower than, a traditional gas water heater. • For information on rebates, see: https://marketplace.sce.com/heat-pump-water-heaters/ 	
<p><u>Changes to Your Electrical System</u></p> <ul style="list-style-type: none"> • You will need to add a 240V outlet for a heat pump water heater. • You may also have to upgrade your electrical panel. 	

SPACE HEATING

Your choice for electric space heating depends on what type of system you have now.

- If you have central heating and cooling with ducting: You can replace both your heating and cooling systems with a high efficiency “mini split” heat pump system.
- If you have a gas furnace only (with no ducting): You can replace your gas furnace with a mini-split ductless heat pump system, which also provides cooling.

Electric Heat Pump Split System (Ducted)	Electric Heat Pump Mini-Split (Ductless)
	
Features	
<ul style="list-style-type: none"> • Provide centralized heating <u>and</u> cooling for homes with ducting • Use highly efficient heat pump technology 	<ul style="list-style-type: none"> • Provide localized heating <u>and</u> cooling for individual rooms • Use highly efficient heat pump technology
Air Quality Benefits	
<ul style="list-style-type: none"> • Electrifying your gas furnace will give the second largest reduction in air pollution, after electrification of your water heater. • Because furnaces are usually well-vented to the outdoors, electrifying a furnace will probably not change your <i>indoor</i> air quality very much. 	
Purchase Price and Operating Costs	
<p>Electric heat pumps are highly efficient, which can make up for the high cost of electricity compared to natural gas. Operating costs for heating should be similar or slightly lower than a traditional gas furnace. If you do not already have air conditioning in your home, there will be additional costs to operate the system for cooling. But costs will be lower compared to running a traditional central or window air conditioner.</p>	
Changes to Your Electrical System	
<ul style="list-style-type: none"> • You may already have a 240V outlet for your central gas heater. If not, you will need to install one to electrify. • You may also have to upgrade your electrical panel. 	


Portable electric heating and cooling options are available for renters.

For more information on heat pumps for heating and cooling, see:

<https://www.consumerreports.org/cro/heat-pumps/buying-guide/index.htm>, and

<https://www.energy.gov/energysaver/heat-pump-systems>

Clothes Drying

Electric Clothes Dryer	
Features	
<ul style="list-style-type: none"> Gas and electric clothes dryers have the same features, and they look similar in the front. The main difference is the gas line connection at the back of the gas dryer. To tell if your dryer is powered by gas, look for a gas line at the back of the unit (see example in photo). Some electric dryers use heat pump technology, making them more efficient⁹. 	
Air Quality Benefits	
<ul style="list-style-type: none"> Because clothes dryers use the least gas in most households, electrifying your dryer will result in a smaller reduction in pollutants compared to other appliances. Gas clothes dryers are usually well vented to the outdoors, so electrifying will probably not change your <i>indoor</i> air quality very much. 	
Purchase Price and Operating Costs	
<ul style="list-style-type: none"> Electric dryers are similar in price to gas dryers. There are no current rebates available. Operating costs will be similar or a little higher compared to a gas dryer. 	
Changes to Your Electrical System	
<ul style="list-style-type: none"> You will probably need to add a 240V outlet for an electric dryer. You may also have to upgrade your electrical panel. 	

MORE INFORMATION

Please contact Active SGV at info@activesgv.org for questions or to join their advocacy efforts around electrification.

More information about electrification can be found in this very detailed document “A Pocket Guide to All-Electric Retrofits of Single-Family Homes” (which also has info helpful for renters):

<https://www.sanjoseca.gov/home/showpublisheddocument?id=69602>

⁹ For information about heat pump dryers, see: https://www.energystar.gov/products/heat_pump_dryer