

**tech overview**

- applicable building types
  - all buildings
- implementation
  - anytime
- fast facts
  - improves air quality
  - reduces GHG emissions
  - keeps the kitchen cooler
  - faster, more responsive cooking performance
  - sleek appliance that is easy to clean

**tech primer**

# Induction Cooking

User-friendly cooktops and ranges that reduce emissions and improve air quality.

**cost & benefits**

**GHG savings**



**Tenant Experience Improvements**



**Utility Savings**



**Capital Costs**



**Maintenance Requirements**



\*ratings are based on system end use, see back cover for details.



## Getting to know induction cooking

Induction cooking appliances utilize an electromagnetic field's natural properties to efficiently generate heat in a pot or pan faster than regular electric ranges and without the indoor pollution of gas stoves.

### How does induction work?

Induction technology in ranges and cooktops has been around since the 1970s, but has gained in popularity in recent years because of climate change. It works like this: When you turn an induction cooktop on, an alternating electric current is generated in a series of coils underneath its glass cooking surface. This alternating current naturally produces a fluctuating magnetic field. When a conductor—in this case a pot or pan—is placed within the electromagnetic field, a new electric current is triggered—or induced—inside that conductor. That tiny electric current has its own magnetic field which changes as the current grows. This induces other tiny currents, which in turn induce their own.

This new electric current generated in the bottom of a pot or pan—about one volt—encounters electrical resistance. The pushback caused by this

resistance on the electrical currents churning around in the bottom of the pot or pan is what creates heat. For induction to work properly, the cookware must be at least partially ferrous, meaning it must have some iron in it. This is because iron is a relatively poor conductor, which means it has a high electrical resistance and therefore generates heat in the pot or pan efficiently and effectively.

The process of induction cooking cuts out the intermediate step of heating up a burner, as an electrical stove top does, and then transferring that heat to a pot or pan, making it faster and more efficient than regular electric cooking. And since the heat is generated in the pot itself, induction cooktops are even able to outperform gas units and come with a more precise ability to control cooking temperatures.

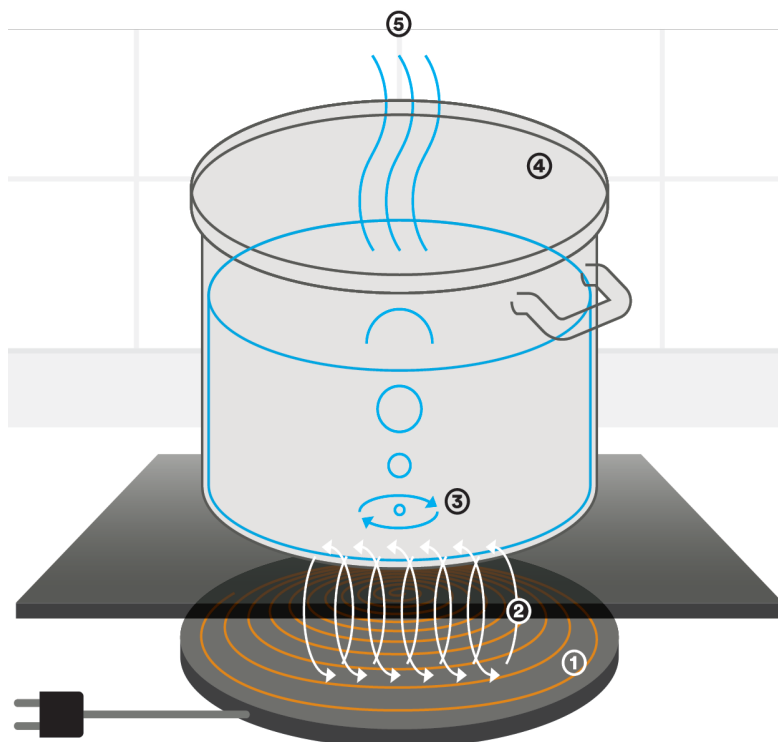


Figure 1:  
Alternating electric current in the power coil **1** produces a fluctuating electromagnetic field **2**. This field in turn generates small electrical currents **3** in the bottom of the pot. These currents encounter resistance in the metal of the cookware **4** which creates heat **5**.

## The benefits of induction cooking

Induction cooktops and ranges reduce GHG emissions and the risk of respiratory illness from noxious fumes. No combustion and no radiant heat mean a much safer cooking experience for both person and planet.

### Clearing the Air Inside Your Home

Cooking food, regardless of the type of range or stovetop, results in some amount of indoor air pollution, but no other ranges pollute at the levels or potency of gas units.<sup>1</sup> During cooking on these ranges, which involves the combustion of natural gas, high levels of nitrogen dioxide, carbon monoxide, and fine particulate pollutants known as PM2.5 are released.<sup>1</sup> At the size of 2.5 micrometers or less, PM2.5 particles are small enough to directly enter the bloodstream from the lungs making them especially dangerous.<sup>2</sup> Tests show PM2.5 emissions from gas ranges can be two times higher than from electric units.<sup>2</sup> The most heavily produced pollutant from natural gas combustion, however, is nitrogen dioxide (NO<sub>2</sub>).<sup>1</sup>



Cooking with gas ranges produces a noxious cocktail of pollutants inside the home that includes nitrogen dioxide, carbon monoxide, and PM2.5.

Many homes with gas cooktops and ranges have high levels of NO<sub>2</sub>, which is emitted during cooking and can take hours to dissipate.<sup>1</sup> Old ranges in ill-ventilated kitchens are the worst culprits and are a common feature of many low-income households.<sup>1</sup> This reality makes replacement of older gas cooking equipment an equity issue that currently impacts historically marginalized populations in the state at a greater rate. In fact, the Rocky Mountain Institute (RMI) reports that homes with gas ranges have 50 to 400 percent higher NO<sub>2</sub> concentrations than those with electric ranges.<sup>1</sup> And the risks to health are well documented by the US Environmental Protection Agency.<sup>3</sup> Long term exposure to NO<sub>2</sub> can lead to the development of asthma in children and presents a danger to people living with other respiratory illnesses like chronic obstructive pulmonary disease and emphysema.<sup>3</sup> A 2013 meta-analysis of 41 different studies found that children growing up in a home with a gas range have a 32 percent increased risk of having asthma.<sup>4</sup>

Gas cooking also contributes to climate change. The main component of natural gas is methane, which has 25 times the atmospheric warming potential of carbon dioxide.<sup>5</sup> About one percent of this is released unburned during cooking, but a recent study demonstrated that 75 percent of an average gas range's emissions occurs when the appliance is off, due to leaky connections with service lines.<sup>6</sup> Induction ranges and cooktops have none of these onsite emissions.

### How to Install Induction Cooktops or Ranges

Induction cooking appliances replace one of the dirtiest appliances in a home or kitchen but require some planning to install.

- Replacing a regular electric cooktop or range with an induction appliance is basically a one-to-one swap, but you may still need an electrician to evaluate wiring if it is older or in poor condition.
- If you're switching from gas, expect to pay an electrician to install the necessary wiring.
- It is important to be sure that the building's electrical service, electrical panel, and wiring can handle the new load somewhere in the range of 208–240 volts, with breakers up to 50 amperes needed.<sup>8</sup>

### Other Things to Consider

- While prices for induction ranges have come down in recent years, Consumer Reports has them selling for roughly \$1,100. That's more than double some of the least expensive gas or electric ranges but comes with improved safety and a healthier environment.<sup>7</sup>
- Because induction cooking can only be done with ferrous metal pots and pans, owners may have to replace some copper and aluminum cookware with cast iron, stainless steel, or composite pots and pans.
- There is a slight learning curve required to use induction ranges and cooktops. Some have knobs like gas or electric stoves, but others have buttons and screens that display temperature settings that can take some getting used to.

# Costs and benefits of induction cooking\*

## Greenhouse Gas (GHG) Savings



No combustion, and no chance of leaks at the gas hookup mean no onsite GHG emissions. Installing induction appliances removes a barrier to full building electrification.

## Tenant Experience Improvements



A high performing induction range can greatly improve homeowner and tenant comfort, health, and safety by eliminating many of the harmful air pollutants generated during combustion cooking with gas. It also reduces the danger of serious injury from burns, particularly with children and the elderly. In addition, users from novice cooks to professional chefs can appreciate the faster heat-up time and cooler kitchen temperatures associated with induction cooking.

## Utility Savings



Induction ranges and cooktops come with modest utility savings over time compared to what you get with the low energy efficiency of gas and regular electric ranges.

## Capital Costs



Induction ranges require a modest capital investment that in some instances may be double that of cheap gas or electric ranges. Additional costs may also be incurred for electric upgrades, and potentially new cookware, which needs to be ferrous to work with induction appliances.

## Maintenance Requirements



An induction range is very low maintenance compared to gas. Cleaning is the biggest difference. No combustion means no buildup of grime on the stovetop. The cooking surface is smooth glass, so all that's required for cleaning up spilled food is just a simple wipe down.

## Take Action

This document is one of more than a dozen High Performance Technology Primers prepared by the Building Performance Partnership (BPP) to introduce decision-makers to solutions that can help them save energy and improve comfort in their buildings.

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The Building Performance Partnership (BPP), created by Building Energy Exchange (BE-Ex) and the Institute for Market Transformation (IMT), supports the creation and operation of local high-performance building hubs that accelerate measurable, equitable, and sustainable action to improve the health, comfort, and performance of buildings. With support from both BE-Ex and IMT, partner hubs serve their respective regions with customized resources that cater to the needs of their communities while benefiting from the existing resources and expertise of our network.

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\*The Costs & Benefits rating system is based on a qualitative 1 to 4 scale where 1 (🍃🍃🍃) is lowest and 4 (🍃🍃🍃🍃) is highest. Green correlates to savings and improvements, dark blue correlates to costs and requirements. Ratings are determined by industry experts and calculated relative to the system end use, not the whole building.