



**FEB. 2023**

# **Innovation Acceleration:**

**How building decarbonization  
has transformed the U.S. building  
sector in just four years**

**A report by the Building Decarbonization Coalition**

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[www.buildingdecarb.org](http://www.buildingdecarb.org)



## Topline Findings

- Less than four years after Berkeley, Calif., passed an ordinance to eliminate gas hookups in new buildings, at the start of 2023 one in every five Americans lives in an area that has passed a building decarbonization policy.
- In every month of 2022, [heat pump shipments](#) outpaced gas furnaces, signaling American households' strong preference for all-electric space heating and cooling over gas.
- In 2022, for the first time in U.S. history, [more households use electricity for heating](#) than gas. [Thirty years ago](#), only 25% of homes used electric heating. That number is surging thanks to heat pumps' explosion in popularity and advanced efficiency compared with older electric heating options. The U.S. now ranks [second in the world](#) in growth of heat pump sales, trailing only Europe.
  - As states like California lead a charge in transitioning buildings away from fossil fuel appliances, and major cities like New York implement their citywide electrification policies, we're witnessing a rapidly accelerating need for contractors in every state—and training programs that will build their knowledge and skill-levels for heat pump installations.
- In January 2023, charged political debate over gas stove pollution and its link to childhood asthma triggered an avalanche of media coverage throughout the nation. It created another ripple effect—unprecedented consumer interest in induction cooktops. [Google search interest](#) for induction hit an all-time peak that month.
- For heat pumps, [Google search interest](#) in heat pumps crested at an all-time high last fall, after President Biden signed the Inflation Reduction Act into law. Biden accomplished another historic first soon after by becoming the [first U.S. president](#) to tout the benefits of getting a heat pump in an official address.
  - As states transition away from fossil fuel heat in favor of clean electricity, gas infrastructure worth as much as \$180 billion could become stranded assets, according to [estimates](#) from the consulting firm Brattle Group. This massive financial risk will only grow in coming years if regulators continue greenlighting new gas system investments.
- In nine states and the District of Columbia, regulators are conducting “future of gas” proceedings that evaluate decommissioning gas infrastructure and how to replace it with electrification and how to adjust rates given the shortened life of assets, among other issues. Regulators in six states have reined in gas utility spending plans or ended or reduced subsidies for expanding the gas system.
- We're building more than ever before. Across the globe, the square-foot equivalent of an entire New York City is [projected to be built](#), every month, until 2060. Every new building with gas hookups and appliances will someday require expensive retrofitting to switch to electricity. It is vital that we avoid these costs by building all-electric from the start.

## Executive Summary

In just four years, a movement to eliminate pollution from buildings has spread rapidly across the United States. In July 2019, Berkeley, Calif., became the first city in the U.S. to adopt an ordinance requiring all new buildings to be built 100% electric. Since then, policies requiring all-electric construction, or creating incentive programs to accelerate the switch from fossil fuel appliances to electric alternatives like heat pumps and induction cooktops have swept every level of government, from local, to state, to federal policymaking.

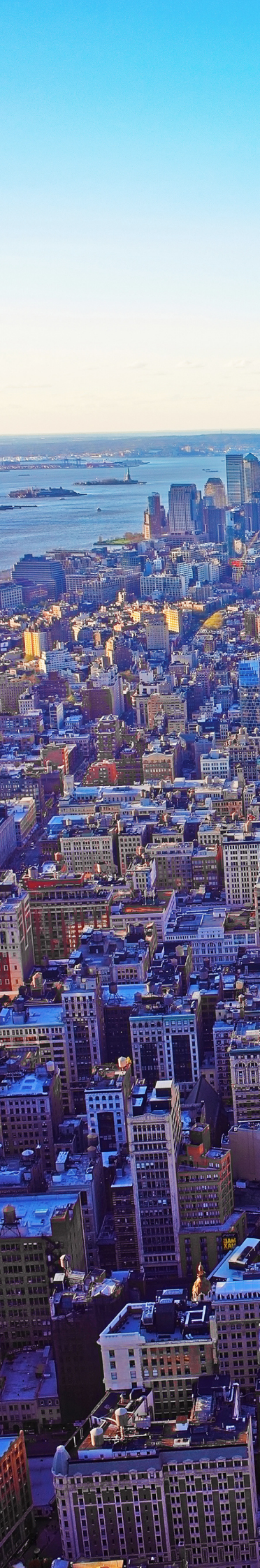
Almost 100 municipalities and four states have now adopted policies that require or encourage building electrification. From L.A., to New York City, to the Pacific Northwest, to Washington, D.C., Maine and up near the crest of the Rocky Mountains — in Crested Butte, Colo. — cities, states, corporations and other private entities are reshaping every building type imaginable to be all-electric: apartments, homes that are brand new and more than a century old, retail stores, schools, restaurants, offices, and skyscrapers. In the entirety of Washington state, the vast majority of every new building will be all-electric starting in June 2023.

As a result, the entire landscape of building in the U.S. has permanently changed. This movement has transformed numerous sectors and industries and will forever alter how American households perform basic necessities like heating and cooling their living spaces, cooking their meals, or getting hot water. Innovative companies are responding to these market signals. New technologies like cold-climate heat pumps and battery-powered induction stoves are rolling out and solving some of the most challenging aspects of making buildings 100% electric. Because they deliver unmatched efficiency and are pollution free, electric appliances lower energy usage and save money on bills, while making buildings healthier, safer, more comfortable, and with better indoor air quality. All-electric buildings create a better quality of life for Americans while slashing a massive portion of U.S. greenhouse gas emissions.

A growing body of scientific research has also exposed the concerning health risks of living in homes with gas appliances like stoves and furnaces, and added greater urgency to the building decarbonization movement. Studies have shown that gas appliances leak toxic chemicals and [carcinogens such as benzene](#) even while turned off, and pollution from gas stove use is attributed to [one in every eight cases of childhood asthma](#) in the U.S. Because methane is an extremely potent greenhouse gas, leaks in the delivery system also compound climate change impacts.

This report captures how quickly perceptions have shifted, how the market is reacting to the swift policy development and consumer preference for electric appliances, and gauges the impact this shift has had on the spaces where we live, work, learn, and play. It charts a path to achieve a just transition away from fossil fuels and fully unlock building decarbonization's potential to create pollution-free homes, schools, and workplaces in every community in the U.S.





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### About the Building Decarbonization Coalition:

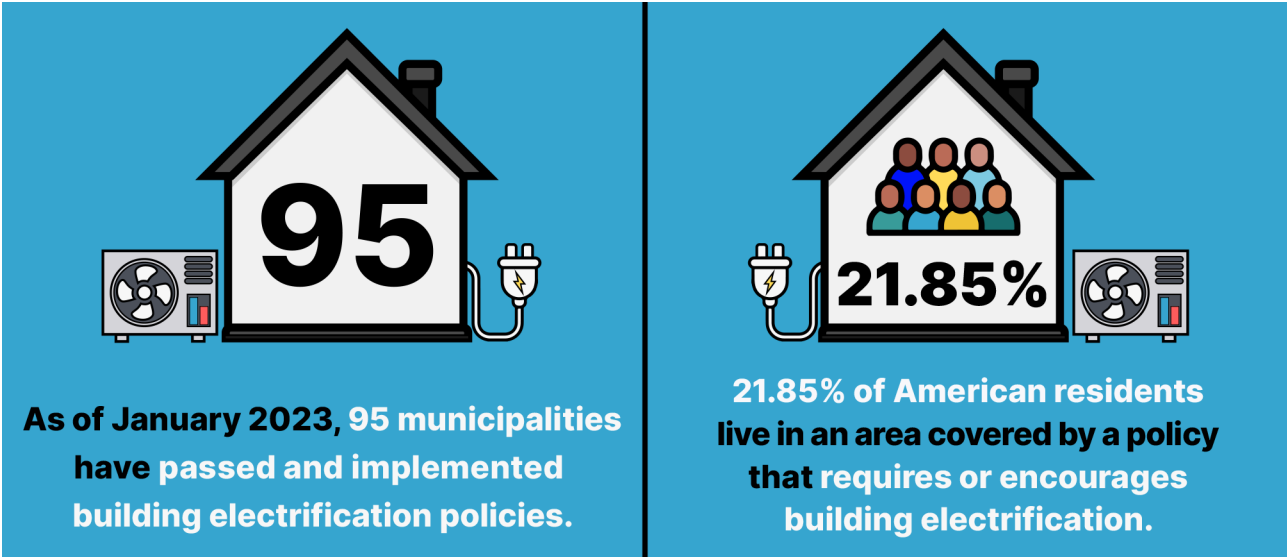
The Building Decarbonization Coalition (BDC) unites critical stakeholders on a path to transform the nation's buildings through clean energy, using policy, research, market development and public engagement. The BDC and its members are charting the course to eliminate fossil fuels in buildings to improve people's health, cut climate and air pollution, prioritize high-road jobs, and ensure that our communities are more resilient to the impacts of climate change.

# Part 1: Building decarbonization policies will guide America's clean energy future

At the start of 2023, one in every five Americans lives in an area that has passed electrification policies, and millions more will be able to tap into incentives to electrify their homes via the landmark Inflation Reduction Act beginning this year.

Government policy is a pivotal engine driving the building decarbonization transition forward, because it will determine which energy system America relies on in the future. The intensifying threat of climate change is making storm patterns and natural disasters more extreme, presenting enormous challenges to energy systems. Safely maintaining and upgrading fossil fuel delivery systems requires enormous amounts of time and money. These investments would be best spent evolving the electric and thermal network systems we need to sustain a renewable energy future. A fully electric energy system, powered by renewable energy, will do everything that fossil fuel systems can do, but better, more efficiently, and more affordably for consumers. Gas use in buildings also contributes to the planet-heating emissions that are worsening the impacts of climate change, and creates indoor and outdoor sources of pollution that are harming our families' health as well as sickening our communities and threatening their safety.

Policymakers and regulators have the power to change this. They must assure markets that the long-term policy is a transition off of fossil fuels, so companies can change the types of technologies that they're installing for customers and manufacturing for sale. Policies at the state and local level like building codes, air quality regulations, and ending subsidies of gas appliances and infrastructure are helping to stop the expansion of the gas system. Effective, affordable, and equitable electrification will require making large-scale investments of public and private dollars into incentives and accessible financing programs. By lowering and eliminating upfront costs, the U.S. can help families and communities access this transition — particularly low- to moderate-income households that are generally left out of capital markets.





## A year of historic federal action

2022 marked two historic firsts—it was the first time Congress passed a major law aimed at addressing climate change, and it was also the first time a U.S. president touted the benefits of [getting a heat pump](#) in an official address.

According to [modeling](#), the Inflation Reduction Act could cut annual emissions enough to close two-thirds of the remaining gap for the U.S. to reach its 2030 climate target (50% below 2005 levels). Building decarbonization will be a key part of the law's aims to slash emissions from the building and power sectors. The IRA's tax credit program is estimated to spur installation of [7.2 million heat pumps](#) in the U.S. in the next decade. While this investment is significant, the IRA alone cannot transform the market to the extent needed for mass-scale building electrification. It will, however, accelerate progress in numerous states and sound a starting gun in others.

Adding onto this momentum, the federal government has set a clear path toward electrifying federal buildings, and President Biden's embrace of heat pumps is an important standard-bearer. The total square feet of building space overseen by the U.S. General Services Administration is almost equal to all of the office space in L.A. and Denver. The GSA has committed to electrifying buildings it owns and manages. In the next two years, the Biden administration can go further by electrifying public housing overseen by the Department of Housing and Urban Development, and create incentives that will allow low-income households to acquire electric cooktops without tax credits. It must also do more to protect low- to moderate-income households from financial pain inflicted by skyrocketing fossil fuel prices and high energy bills.

**“That heat pump is going to save you hundreds of dollars a year on your energy bills, depending on where you live and what kind of heating system you rely on today.”**

**- President Biden on heat pumps from address at Eisenhower Building on Nov. 18, 2022**



Department of Energy Secretary Jennifer Granholm and Rep. Katie Porter test induction cooking during a home tour in Irvine, Calif.

## Tectonic shifts at state and local level create groundswell for policy change

At the state and local level, decision makers are racing to the top for who can pass the strongest electrification policies. State and local governments are where the real work is done — they adopt and implement building codes, set and monitor air quality, as well as regulate and reform energy utilities' rate making, infrastructure planning and spending, incentive programs, and subsidies. States are also the proving grounds for innovative approaches to regulating gas appliances that will set the stage for federal regulation. While local action creates a patchwork of policies that are difficult for manufacturers to respond to, they help kick-start a move toward broader state and federal rules that will provide the market certainty that manufacturers, contractors and other stakeholders need and are already spurring innovation in technology and building design.

Four states—California, Washington, Maryland, and Colorado—have adopted policies that address switching buildings from gas to electricity, or have enacted emissions-based building performance standards. California's latest energy code encourages all-electric new construction, while Washington state requires all-electric space and water heating in new construction. Colorado and Maryland have emissions-based building performance standards. But states are taking [many other important actions](#), such as setting goals, creating incentive programs, increasing energy efficiency, or expanding workforce development and training. Maine is making swift progress on its goal to install 100,000 heat pumps by 2025, while Massachusetts aims to electrify 1 million buildings by 2030 and power 2.5 million homes with off-shore wind in the next four years.

With the backing of a coalition of climate and environmental justice advocates, labor unions, and utilities, last year Massachusetts and New York advanced a series of neighborhood- and utility-scale networked ground-source heat pump projects that will deliver affordable clean heat to homes and grow good-paying union jobs. New York City and Ithaca are in the vanguard of cities working to electrify every building within their limits — new and existing. New York Gov. Kathy Hochul is also planning to retrofit 2 million homes to be all-electric or electrification-ready by 2030, in addition moving to all-electric new construction no later than 2027. New York City has launched the nation's largest school electrification effort, which includes a \$4 billion plan to make new schools all-electric and to electrify 100 existing schools.

**“It is critical that workers in new green industries are paid a fair wage and that workers in the fossil fuel industry are not left behind.”**

**John Murphy, International Representative, United Association of Plumbers, Pipefitters and Sprinkler Fitters, on New York's [network geothermal law](#).**



Montgomery County, Md., and Washington, D.C., passed laws requiring new buildings to be all-electric, and the DC City Council is considering legislation that would go a step further to retrofit 30,000 low-income homes to be all-electric, at no cost to homeowners. The Maryland Legislature passed a law requiring large buildings to begin reducing emissions by 2030, and reach net-zero by 2040.

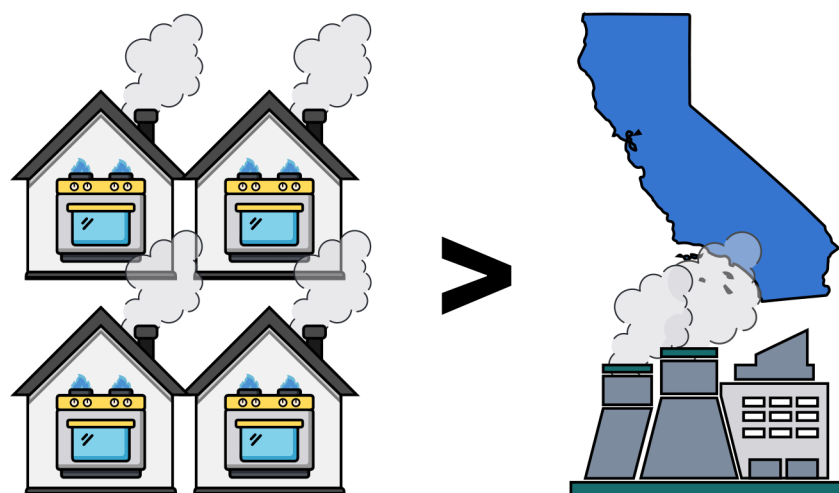
In Illinois, utility company ComEd is investing \$40 million to transition thousands of homes from fossil fuel appliances to electric. In Colorado, a new law requires local governments to update their building energy codes to increase energy efficiency and slash emissions from new homes and commercial buildings. A new initiative by Colorado Gov. Jared Polis will examine how to better deploy geothermal energy technologies in western states, including for building heating and cooling.

West Coast states are adopting a slew of first-in-the-nation policies. Last fall, California became the first in the U.S. to phase out the sale of gas appliances for heating and hot water by 2030, citing their pollution and health impacts. The move garnered support from major HVAC and water heater vendors including Carrier, Daikin, Fujitsu, Johnson Controls, Mitsubishi Electric, Rheem and Trane.

In 2022, the California Legislature allocated \$1.1 billion to electrifying homes statewide, which supports Gov. Gavin Newsom's goal of installing heat pumps in 6 million homes by 2030. While this funding was tentatively reduced by \$100 million in Newsom's budget proposal last month, the governor is also targeting 3 million climate-ready homes by 2030, and 7 million by 2035. Beginning in 2023, California's largest affordable housing program requires that new projects be built without fossil fuel hookups, and is making \$750 million in funding available to construct all-electric housing projects.

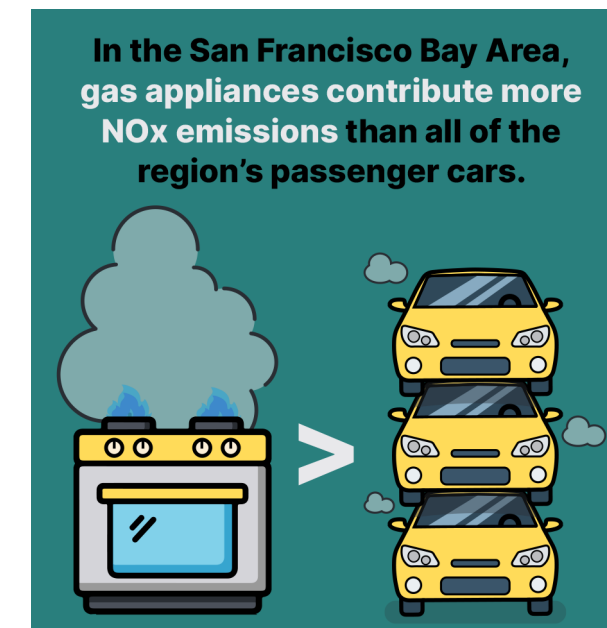
In Washington state, the Building Codes Council enacted new rules requiring that every new residential and commercial building must use electric appliances like heat pumps for space and water heating. Driven by growing need for space cooling to combat extreme heat during summer months, Washington, Oregon, and California have created programs designed to help homeowners and renters install heat pumps.

**FOSSIL FUEL  
APPLIANCES IN  
CALIFORNIA'S HOMES  
AND BUILDINGS  
GENERATE FOUR  
TIMES MORE  
NITROGEN OXIDE  
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THE STATE'S  
GAS POWER  
PLANTS COMBINED.**



## A positive impact for health, affordability, and equity

Across the U.S., building decarbonization policies are starting to have a significant impact – preventing future deaths as well as generations of kids from growing up with a significant source of air pollution in their homes and neighborhoods, protecting the health and safety of communities, and saving households hundreds of dollars annually on utility bills. Because burning gas for heating and cooking creates nitrogen oxide pollution, venting the appliances outside contributes to the formation of smog. Gas appliances are an under-recognized contributor to the worsening air quality crises afflicting many metropolitan areas in the U.S. Elevated exposure to these pollutants can aggravate [respiratory symptoms](#) and lead to higher susceptibility to lung infections, as well as [42% increased risk](#) of developing asthma symptoms, [IQ and learning deficits](#) in children, and increased risk of [cardiovascular problems](#).



By enacting zero-emissions standards, states have a powerful policy tool that will achieve a swift, inclusive, and equitable transition to electric appliances. This yields immense public health benefits, particularly for low-income residents and communities of color who suffer disproportionately higher pollution burdens. Californians breathe some of the worst levels of ozone pollution in America. If every residential gas appliance in California were replaced with electric alternatives, the reduction in [outdoor air pollution](#) would prevent approximately 350 deaths, 600 cases of acute bronchitis, and 300 cases of chronic bronchitis annually.

Going all-electric also provides relief from staggeringly high gas bills that have hit households in the past year. In December 2022, households across the U.S. were served a painful reminder of the price volatility that's inherent with fossil fuels. Wholesale gas prices [skyrocketed](#) between 50-500% compared with the same month in 2021, before falling at the beginning of January.

### Equitable communities:

The building decarbonization movement must make an equitable transition from fossil fuels to clean energy its highest priority. Every year, the high utility bills force almost one third of American families to decide between heating their homes or paying for food and medicine. Research has also shown that gas leaks occur more frequently in communities with a majority of people of color and in lower-income areas, because the gas infrastructure is older and lacks repairs. That means lower-income households and communities of color should be first in line to electrify, and funding and programs must be geared to address pollution burdens and affordability. For more ways to advance equity and environmental justice, read part 3 of this report for policy recommendations to develop equitable electrification financing programs.



Last fall, think tank RMI [released new data](#) comparing all-electric homes to those that rely on fossil fuel appliances in nine U.S. cities, from Seattle, to Austin, Minneapolis, Columbus, Ohio, New York City, and Boston. In every city, all-electric homes were between \$50 and approximately \$1,900 cheaper to build and resulted in annual savings on bills of \$50-\$1,000 for households. Over a 15-year period, all-electric homes will substantially lower greenhouse gas emissions, according to RMI.

## Part 2: Real world impacts

Change is happening at an astonishing pace. In 2022, for the first time in U.S. history, [more households use electricity for heating](#) than gas. [Thirty years ago](#), only 25% of homes used electric heating. That number is surging thanks to heat pumps’ explosion in popularity and advanced efficiency compared with older electric heating options. The U.S. now ranks [second in the world](#) in growth of heat pump sales, trailing only Europe. The global market value of the induction cooktops is projected to [almost double](#) in the next five years. [Google search interest](#) in heat pumps crested at an all-time high last fall, after President Biden signed the Inflation Reduction Act into law.

These appliances have the potential to rival laptops and cellphones as foundational technologies in American life. How quickly this happens will have drastic consequences for our future, because the world is building at a rapid pace. Across the globe, the square-foot equivalent of an entire New York City is [projected to be built](#), every month, until 2060.

The combination of exploding consumer demand and widespread policy adoption and incentives is driving innovation and improvements at the product level. Innovative companies and manufacturers are scrambling to make the products to meet demand, and this will only continue to grow as states like California stop selling fossil fuel heating appliances before 2030. Every new building with gas hookups and appliances will someday require expensive retrofitting to switch to electricity.

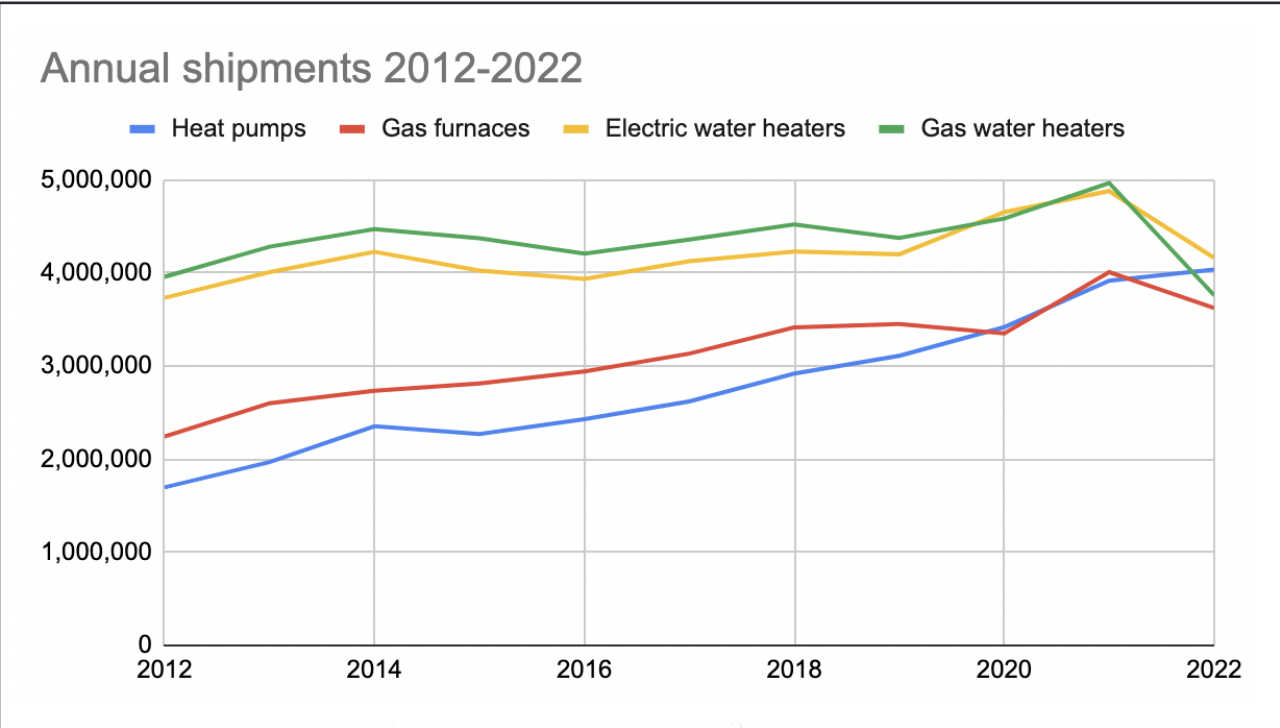
For induction cooktops, [Google search interest](#) hit an all-time peak last month, after charged political debate over gas stove pollution and its link to childhood asthma triggered an avalanche of media coverage throughout the nation. Growing awareness of gas stoves’ pollution and health hazards hasn’t been limited to scientific researchers and government regulators, either. Electric kitchens are a key component of plans from companies such as Adobe, JP Morgan Chase, Google, Microsoft, and Salesforce to reduce their buildings’ carbon footprint - while creating safer, healthier workplaces for employees. In addition to speaking out about gas stove pollution, a burgeoning cohort of professional chefs is using social media and other digital platforms to popularize induction cooktops’ sleek design, easy clean up, precision, superior temperature control, and faster cooking times.

## Heat pump shipments overtake gas furnaces

In every month of 2022, [heat pump shipments](#) outpaced gas furnaces, signaling that American households’ preference for heat pumps extends beyond a basic decision not to use gas. They’re choosing heat pumps over other traditional electric HVAC options such as resistance heating, because heat pumps deliver superior performance, unmatched efficiency, lower energy bills, and keep homes comfortable year-round. Heat pumps use 50% less energy than resistance heating. Nationwide heat pump sales [grew by 15%](#) in 2021, which places the U.S. behind Europe’s 35% sales growth but ahead of China and Japan’s 13%.

In 2020, 18 million homes in the U.S. used heat pumps for space heating and cooling, a 34% increase from 2015, according to the [most recent data](#) from the U.S. Energy Information Administration. Heat pump adoption differs by geographic region, primarily due to variability in climate and development patterns. Because of their mild year-round climate, states in the Southeast have historically had the highest number of heat pumps.

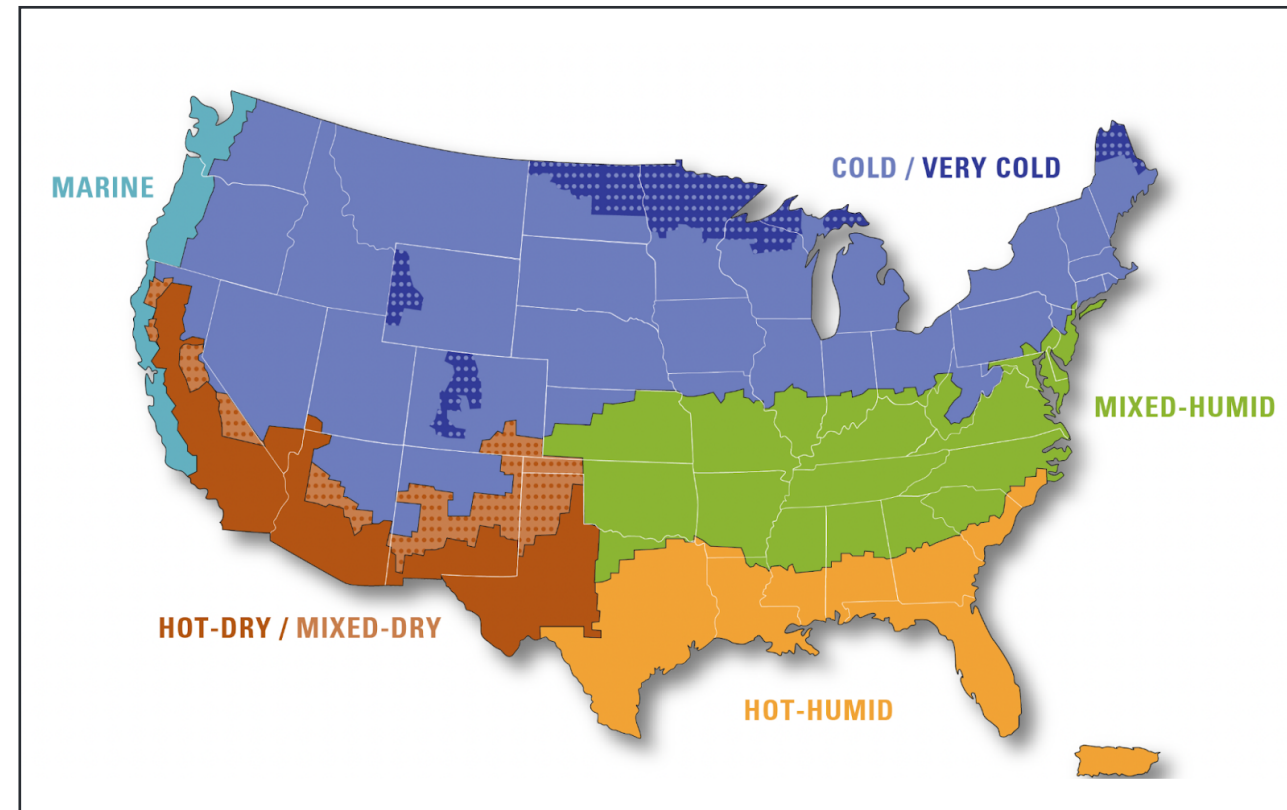
This has begun to change, as states like California lead a charge in transitioning buildings away from fossil fuel appliances, and major cities like New York implement their citywide electrification policies. This shift spotlights the need for contractors in every state—and training programs that will build their knowledge and skill-levels for heat pump installations.



Source: Air-Conditioning, Heating, and Refrigeration Institute shipment data



## Breakthroughs in cold-climate heat pumps



Source: U.S. Department of Energy

***In the hot-humid areas of the Deep South, 30% of homes use heat pumps. In the mixed-humid areas of the Upper South, 22% of homes use heat pumps. It's less than 10% in the marine areas of the West Coast and less than 5% in the Northeast, Midwest, and Mountain West.***

Yet 50% of residential gas consumption in the U.S. occurs in nine cold-climate states, and heat pump adoption has historically been weakest in these states because older technologies struggled in cold climates. That's no longer the case. Existing models of cold-climate heat pumps are performing exceptionally well in extreme winter storms, but technological breakthroughs are keeping homes comfortable when it's below 20 degrees Fahrenheit outside.

The shift to cold climate heat pump use is exemplified by Maine's goal of installing 100,000 heat pumps by 2025, which is set forth in [state law](#)—and they are on track to meet. From Colorado to the Canadian border, cold climate heat pumps were put to a major test during an [extreme winter storm in December 2022](#). They passed—these systems kept homes warm as temperatures remained well below zero degrees day and night.

Other recent cold climate heat pump innovations include:

- Last year, heat pump manufacturer Lennox was the first company to complete the U.S. Department of Energy's Cold-Climate Heat Pump Challenge, and has developed an air-source model that delivers 100% heating at -15 degrees, and 70- to 80% heating at -23 degrees. The company hopes to bring the product to markets in 2024. Trane is field-testing its own model of cold-climate heat pump as part of the DOE challenge.
- Other types of heat pump technology are being adapted for cold climates. Manufacturers Johnson Controls and SpacePak produce a mini-split system and air-to-water system, respectively, that work effectively in bitterly cold conditions. SpacePak's system performs well at -22 degrees.
- This technological innovation isn't limited to extreme winter weather, either. For the first time in North America, in 2021 Manufacturer Daikin began selling a ducted heat pump system called Atmosphaera that uses a refrigerant with one-third of the global-warming potential of commonly used refrigerants in HVAC systems. Last year, Rheem began selling a heat-pump water heater that works with buildings' 120-volt electrical systems, helping some homeowners avoid costs of upgrading to 240-volt electrical panels.
- Startup heat pump company [Harvest Thermal](#) has created a system that shifts its performance for times of day when there's lower demand for electricity, helping balance the power grid—which is critically important as operators navigate more extreme heat waves every summer. The system is able to store energy while electricity is plentiful on the grid, and reduce electricity demand while the grid is under stress.

**“We couldn't be happier. I can't tell you how comfortable we are. It's not freezing like a window AC [that's] harder to control the temperature. We don't touch the thermostat.”**

***Cathy Hardy, Maine homeowner, on the year-round benefits of [installing a heat pump](#)***



## Now we're cooking—with induction

Similar to heating, consumer demand for electric cooking is soaring. Part of this outpouring of interest is due to health concerns about gas stove pollution. Induction cooktops have achieved a mainstream breakthrough thanks to endorsements and acclaim by celebrity chefs like [Martin Yan](#) and [Jon Kung](#), Michelin star chef [Eric Ripert](#), renowned New York Times food columnist [Melissa Clark](#), and the world's most popular band—[K-pop megastars BTS](#). In 2021, the support grew stronger with the [launch of the Global CookSafe Coalition](#), a union of chefs, doctors, developers, and more across the globe advocating for the transition to electric cooking.

For decades, gas stoves had been considered the gold standard in cooking appliances, thanks in part to aggressive gas industry [marketing campaigns](#) that popularized the slogan “now we're cooking with gas” and in recent years recruited [social media influencers](#) to do the job. In the past four years, a wave of public health reports, peer-reviewed studies, and intense media scrutiny has made consumers question gas stoves by revealing the health-harming air pollutants that accumulate in homes from gas stove use, such as nitrogen dioxide.

The health risks of gas stove pollution have actually been long been recognized. In 1982, [Consumer Reports noted](#) that “children from gas-stove homes have a greater incidence of respiratory illness and impaired lung function than those from homes with electric stoves.” In 1986, the [U.S. Environmental Protection Agency](#) reported concerns to the Consumer Product Safety Commission about the impact of nitrogen dioxide emitted from gas stoves. The EPA stated that the pollutant could have harmful health effects, and CPSC should investigate the concentrations of NO<sub>2</sub> occurring in America's kitchens. But the agencies took no further action. In the decades since, consumers have been largely unaware of the risks of cooking with gas-burning stoves and ovens and what they can do to safeguard themselves and their families.

Among homes that cook with gas, [90% will have unhealthy levels of nitrogen dioxide \(NO<sub>2</sub>\) pollution](#) after cooking on a gas stove for just an hour. Breathing it is dangerous for everyone, but especially children, older adults, and those living with chronic diseases. [Additional studies](#) revealed that gas appliances leak constantly, even while switched off, and the leaks of unburnt gas are a health risk. [One study](#) found gas leaks include 21 different hazardous air pollutants linked to cancer and known to be toxic. Further research determined that gas stoves emit benzene—a chemical known to cause cancer—and that levels are similar to secondhand smoke. The [most recent major study](#) attributes gas stove pollution to almost 13 percent of childhood asthma cases in the U.S. It's the latest in a series of more than four dozen peer-reviewed studies to examine the impacts of gas stove pollution on human health.

Leading medical and health organizations have responded. In 2022, the American Medical Association [adopted a resolution](#) recognizing that gas stoves increase household air pollution and the risk of childhood asthma, while the American Lung Association [published results](#) of a comprehensive literature review of gas appliances' pollution impacts in homes. The [American Public Health Association](#) passed a policy statement calling gas stoves a public health concern. Earlier research first documented many of these health hazards decades ago, but nothing was done due to inaction by state and federal regulators. That may finally change beginning in 2023.

## GAS STOVE POLLUTION IS ATTRIBUTABLE TO ONE IN EVERY EIGHT CASES OF CHILDHOOD ASTHMA IN THE U.S.





## Induction seduction

Induction cooktop technology is also advancing rapidly to meet consumer demand and preferences.

Induction cooking uses electromagnetism rather than flame or hot coil, which delivers greater precision and consistent temperature control. Induction cooktops boil water [twice as fast](#) as gas stoves, and are safer and easier to clean because the cooktops themselves are not a source of heat. Kitchens also stay cooler during hot summer months, which is of critical importance to home and professional chefs as climate change causes more extreme heat waves to occur every year.

Induction can accommodate almost every dish and cooking style, including styles once thought to be completely reliant on flames, like woks. Innovative companies have developed a flame-free induction wok, which Microsoft has installed in kitchens in its new all-electric office campus. Microsoft partnered with commercial kitchen equipment manufacturer Jade Range to create an induction cooktop that perfectly mimics the types of motion and heating that gas-powered woks provide. The system also maintains the constant contact induction cooking requires — and [Microsoft workers have favored the resulting dishes](#) in taste tests with gas-flame woks.

Induction innovation is reaching homes, too. In 2022, two companies announced they were developing full-sized, battery-powered induction stoves that plug into any existing 120v home outlet, eliminating the need for costly electrical upgrades. [Channing Street Copper Company](#) announced plans to release Charlie, their induction range equipped with a 4kWh battery at its base, in 2023. After successfully raising \$20 million in investor funding, [Impulse](#) announced a battery-integrated smart induction cooktop, also slated for release in 2023.



Image owned by Building Decarbonization Coalition

## Commercial real estate, higher education embraces all-electric shift

As the owners of some of the largest buildings in the U.S., commercial real estate developers and higher education institutions have given markets powerful signals on where the future lies by quickly embracing the shift to all-electric buildings. They're recognizing the litany of benefits that all-electric buildings provide, but also the inherent financial and regulatory risks that exist in delaying the transition.

New construction for commercial buildings is transforming rapidly, particularly office, retail, and mixed-use buildings. In Fayetteville, Ark., Entegry Energy Partners built a 27,000-square-foot, all-electric building that houses ground-floor offices as well as two floors of apartment units. In San Francisco, developers constructed the Maceo May Apartments as a highly efficient all-electric affordable housing project. Because the development didn't connect to the gas system, designers were able to apply cost savings to better insulation, energy recovery, solar arrays, and other improvements. San Francisco is also home to the 30 Van Ness tower, an all-electric development that includes 250,000 square feet of commercial office space, more than 300 condominiums and affordable housing, as well as retail space. In New York City, JP Morgan Chase is in the process of constructing an all-electric 60-story skyscraper.

Owners of existing buildings are also investing in electrification. In Memphis, Tenn., 88 buildings spanning approximately 565,000 square feet are planned to be retrofitted to be all-electric. Coupled with other renovations, this project re-envisioned a mile-long strip of aging commercial corridor becoming a conduit for economic activity and community building. Near downtown San Francisco, six buildings in the Levi Plaza development will eliminate on-site fossil fuel use by replacing boilers with electric heat pumps, producing solar electricity on site, and purchasing 100 percent carbon-free electricity from the grid.

Higher education institutions are also investing in electrification. The University of California, Irvine, is building a 144-bed hospital with all-electric heating and cooling systems, while Boston University constructed a new data center that gets power from wind energy and is heated and cooled by geothermal wells underground. In Portland, Ore., all new [public school buildings](#) and facilities will be all-electric, and existing buildings will be retrofitted to eliminate fossil fuel use by 2050.

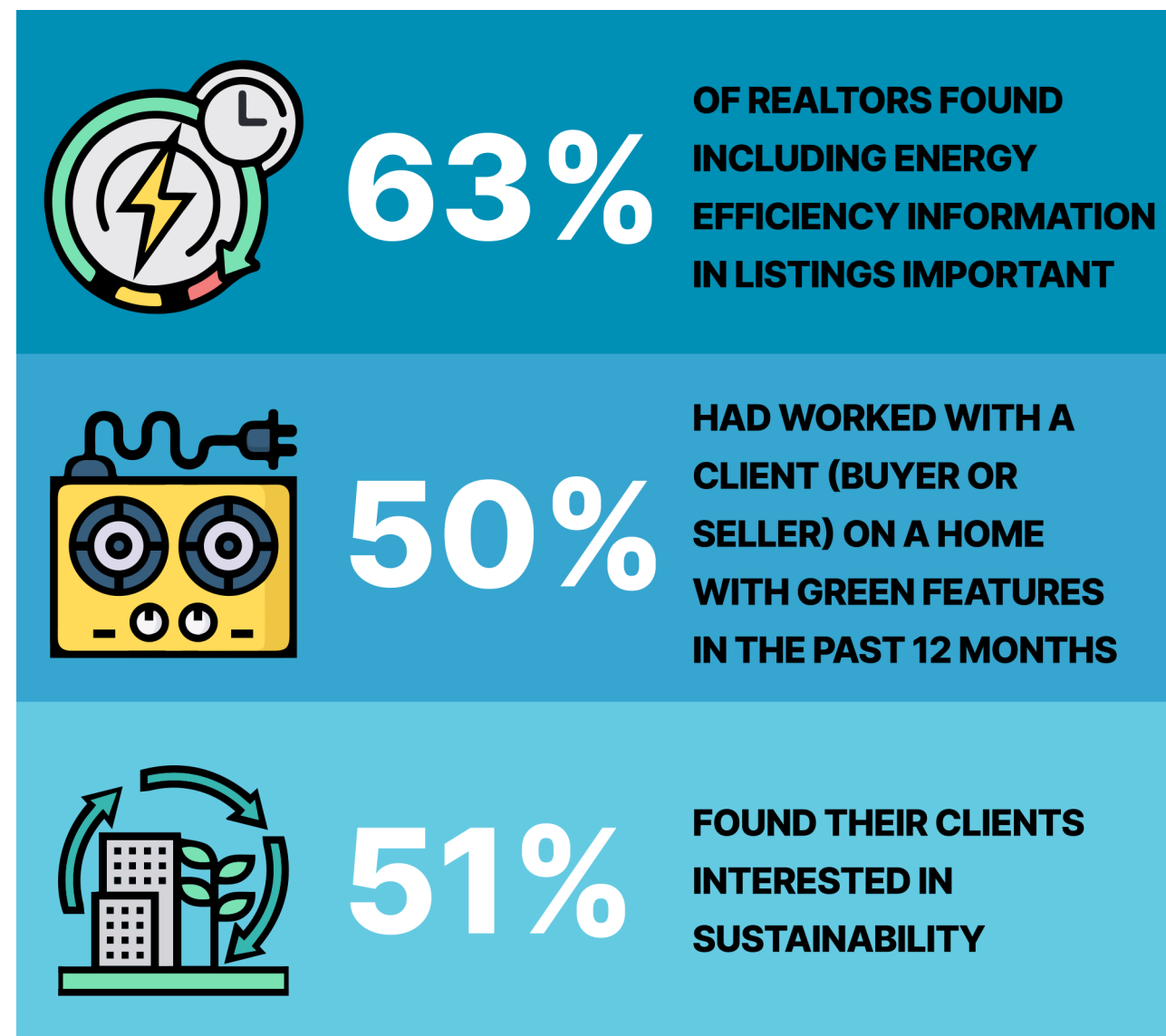


## Homebuyers prefer all-electric

Building decarbonization has changed the real estate industry, too, as Realtors, agents, and other industry leaders recognize the shift in consumer preferences. Redfin CEO Glenn Kelman said home electrification would be one of the most significant trends of 2022 because builders understand that homes or office towers that rely on fossil fuels are obsolete as soon as permits are issued.

All-electric homes are selling at a premium. A study by the University of Maryland found that installing heat pumps in homes increases the value by 7%, or \$10,400–\$17,000, on average, in over half of U.S. states. Interior designers are advising clients to choose induction cooktops in kitchen designs because of their sleek look, safety, efficiency, and unobtrusive surfaces.

A national survey of Realtors in 2022 found their clients highly interested in the benefits of home electrification, including:



## Innovative approaches to workforce transformation

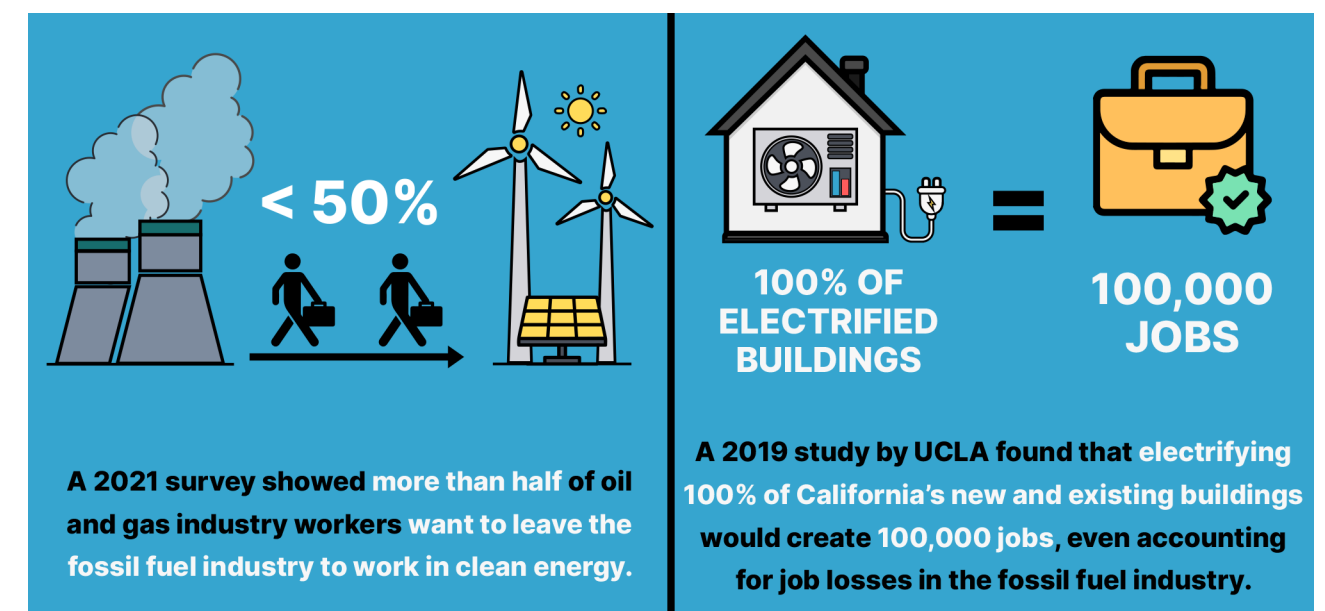
The building decarbonization movement is growing good-paying jobs while fostering support from labor unions. This has been key to advancing neighborhood- and utility-scale network thermal energy projects in Massachusetts and New York, which are establishing a new national model for building decarbonization.

Thermal energy networks connect multiple buildings into a shared network with sources of thermal energy, and can be built under streets. Using a variety of energy sources including geothermal boreholes, surface water, or wastewater, the networks power heat pumps in buildings and deliver space heating or cooling.

Constructing and maintaining these networks allows utility and building trades workers to apply their existing skill sets, so jobs are easily transferable for the gas industry workforce. In addition to jobs, the networks deliver lower energy bills for customers, consistent sources of energy, better indoor and outdoor air quality, help manage the peak loads on the electricity grid, and slash in carbon pollution from buildings. In 2022, New York approved a new law expanding neighborhood-scale thermal energy networks statewide, and Massachusetts is advancing a pilot project in a neighborhood in Framingham.

In New York, labor unions, environmental justice organizations, buildings industry leaders, and climate groups are uniting through a [new collaboration](#) to advocate Gov. Hochul and the Legislature eliminate on-site pollution from state-owned facilities by 2040.

To meet consumer demand for heat pumps, trade groups and labor unions are launching programs to educate contractors and build their skills for installing these systems. The Mechanical Contractors Association of America and the United Association created a heat pump installation training program.





## Eyeing risk, regulators begin to pivot from gas

Gas distribution infrastructure is extremely expensive to install and maintain, so its value has long relied on the assumption that its components would be in use for many decades. But as states transition away from fossil fuel heat in favor of clean electricity, gas infrastructure worth as much as \$180 billion could become stranded assets, according to [estimates](#) from the consulting firm Brattle Group. This massive financial risk will only grow in coming years if regulators fail to plan for an orderly transition off the gas system that aligns with shifts in consumer preferences and emissions reductions requirements.

Seeing this risk on the horizon, state regulators across the country are reining in gas utility spending by slashing subsidies for expanding the gas system, and paring down rate requests geared towards gas system investments.

In April 2022, [Connecticut](#) ended a ratepayer-funded program aimed at expanding the gas system, citing cost and climate concerns. In August, California became the first state in the nation to end subsidies for connecting new homes to the gas system – a move that will save ratepayers [\\$164 million](#) annually. In the next two years, Colorado will recalculate these subsidies with the goal of shrinking the contributions over time. Regulators in [Oregon](#) slashed subsidies for connecting new homes to the gas system as part of a rate case decision. In 2021, [Washington](#) significantly reduced gas hookup subsidies.

In January 2023, following months of outcry by ratepayer advocates, [Arizona regulators](#) cut one-third from a rate increase request by utility Southwest Gas. In Colorado, last November regulators slashed a [proposed \\$188 million](#) rate increase for investments over three years by 70%, and limited the increase to just one year. In Oregon, regulators took aim at gas utility lobbying against local climate policies in a [rate case decision](#) handed down in October. They slashed a proposed increase for lobbying expenses from NW Natural, the state's largest utility, and called out the utility for its inappropriate use of ratepayer dollars.

In nine states and the District of Columbia, regulators are conducting [“future of gas” proceedings](#) that are intended to evaluate decommissioning gas infrastructure and how to replace it with electrification as well as adjusting rates given the shortened life of assets, among other issues.

## Part 3: What's next & BDC's policy recommendations

The next phase of building decarbonization must prioritize both policy reform and market development. Policymakers must be assured that the electrification marketplace can be built. They must be confident this market will respond to their policy and accept the regulations and incentive programs that they adopt. On the other hand, markets need to be certain that the U.S.'s long-term policy is to phase out the gas system and transition to electricity as the primary energy source for all buildings. This creates the conditions necessary for mass-scale product manufacturing and installation, as well as the continued innovation that will drive down costs for consumers and improve product performance, reliability, and efficiency.

This requires coalitions in each state consisting of labor, environmental justice, environmental groups, and manufacturers, collectively coming together and putting pressure on state governments and legislatures to enact reasonable phase out policies for natural gas within their states and buildings. This is a necessary prerequisite to move federal policy, because states are vitally important proving grounds for policy approaches that can be adopted federally.

This will also need widespread, multi-sectoral collaboration. No one group by themselves will have the clout or the authority to be able to craft a vision for how to completely eliminate gas use in buildings across the U.S. It will take a large, diverse, and dedicated coalition of vested stakeholders collaborating on common solutions. This will accelerate both policy adoption and the market transformation changes that are required to make those policies work, while ensuring the benefits of building decarbonization reach those who need them most.



Credit to Maciejbledowski.



## BDC RECOMMENDATIONS FOCUS ON THREE KEY AREAS: INVESTMENTS, REFORMS, AND PHASEOUTS



### INVESTMENTS

#### Create equitable electrification financing programs —

Transitioning away from gas must benefit, not burden, the millions of LMI households and renters that live in the U.S. Tariffed on-bill financing (TOB), which is site-specific and not tied to the consumer or renter, allows building electrification to be financed over long periods (10-15 years) using utility bill savings to defray investment costs rather than consumer credit or home equity—even in rental units with multiple changes in tenancy. BDC and our coalition are participating in the early TOB pilots and regulatory proceedings. We must educate key decision makers (regulators, legislatures) while in parallel working with utilities and energy providers to develop accessible financing program proposals for regulatory proceedings.

#### Accelerate adoption of zero-emissions appliances —

To build a strong coalition of stakeholders that support the needed regulations, we must take immediate actions to accelerate adoption of zero emission appliances and direct as much funding as possible to LMI and environmental justice communities. It is critical that states set aggressive goals for decarbonizing homes and public buildings and match funding from the IRA with in-state investment.



### REFORMS

#### Stop all gas subsidies —

Taxpayers should not be subsidizing gas system expansion or appliance purchases that run counter to the states' clean air and climate laws. Instead, all existing subsidies should be redirected toward ensuring adequate cost coverage for gas system decommissioning, leak detection and repair, equitable building electrification, and energy resilience. To achieve this objective, the following subsidies must be reformed:

- Line extension subsidies from investor-owned utility (IOU) tariffs should be ended;
- Stop purchasing fossil fuel appliances for state owned and operated buildings;
- Taxpayer funding should be available for school and affordable housing decarbonization projects;

Rate- and taxpayer incentives and rebates for gas appliances in energy efficiency programs should be ended.

#### Reform electricity and gas rates —

Utility rates consist of fixed and volumetric fees, and in general are heavily regulated. Fixed charges are intended to help fund maintenance and construction of capital assets, while volumetric fees are largely correlated to wholesale energy prices and other variable costs. For a utility to justify rate increases, they must prove that an asset is “used and useful” or show that variable costs have increased. This raises a number of issues for both gas and electric ratemaking, including:

- For gas rates, it is important to question whether new pipelines can be considered “used and useful” when they are working in direct competition with a state’s climate goals. However, while gas rates and state climate goals have been at odds for years, utilities, regulators and legislators are just starting to align gas ratemaking with climate goals.
- For electric rates, each customer end use that transitions from gas to electric incrementally reduces the amount of fixed costs that must be covered by the retail price of energy. However, while some utilities have started to address this misalignment with electric vehicles, in general electric rates penalize or discourage electrification of other end uses.

We must reform electricity and gas rates. States must move forward with equitable rate structures that end gas subsidies, stabilize electric rates, and protect LMI ratepayers from additional energy burden.

#### Implement neighborhood decarbonization pilots with a focus on gas system retirements —

Charting a pathway for an orderly and equitable decommissioning of the gas distribution system is one of the most complex building decarbonization challenges. The institutional inertia, combined with entrenched political power of utilities and the gas industry, have made discussions about a future without gas challenging in even the most progressive states. But, this is changing. Utility regulatory proceedings across the country are becoming increasingly contentious as advocates, consumers, and commissioners are pushing back on gas companies’ projected growth and gas system expansion plans. Commissioners are having to discuss the long-term, planet-wide implications of approving a new gas pipeline or allowing gas utilities to subsidize this new infrastructure with ratepayer money ratepayers from additional energy burden.



A just and orderly transition requires balancing affordability for ratepayers, a just transition for impacted workers, and safety and reliability of the entire grid. [New York](#) provided a key example for this. In 2022, when it passed the Utility Thermal Energy Networks and Jobs Act. This law creates large-scale infrastructure projects that connect multiple buildings in a shared thermal network. This means entire neighborhoods and communities can access affordable clean heating and cooling at once, while lowering greenhouse gas emissions from buildings and providing a just transition for workers. Neighborhood-scale decarbonization geographically decommissions portions of the gas system as customers are being electrified. By decreasing the costs required to maintain the system at the same time that throughput is decreasing, rates are more likely to remain stable for customers who are unable or unwilling to transition away from the gas system. This is especially important to mitigate the risk of increased energy burden for low-income ratepayers.

The current appliance-by-appliance approach to building decarbonization, by itself, likely will not allow us to meet our climate and clean air goals in time and rely upon a low-wage industry that largely eschews permitting. Zonal decarbonization presents the opportunity to work with utilities to bring large capital investment, deployed by skilled union labor capable of making high quality installations. We must support zonal electrification pilots where they are already underway, work with utilities, unions and other stakeholders to develop transition roadmaps, and reform outdated policies that stand in the way of zonal decarbonization, such as the “obligation to serve.”



## PHASEOUTS

### Phase out the use of gas in new building —

While they produce a relatively small portion of the emissions from the building sector, it is extremely important that we immediately stop connecting new buildings to the gas grid. The gas infrastructure being placed in service has a 60-80 year life and will become stranded rate-payer assets before a third of their life is over. Laying new pipe and maintaining it is the vast majority of gas utilities revenue. While only 27% of gas consumption in the U.S. occurs in buildings, buildings generate a much higher percentage of the gas industry's revenue. Buildings generate the largest profits for the industry—and residential developments are by far the most profitable of all building types. Moreover, while new construction only amounts to about one percent of the total building stock, because appliances last 12-20 years, it accounts for roughly 5-10 percent of total annual equipment sales.

Thus, stopping the expansion of the gas distribution grid catalyzes the market, avoids forcing ratepayers to finance future stranded assets, and harms the gas industry's bottom line (eliminates growth potential of a highly profitable aspect of the business model). Nearly 100 U.S. jurisdictions (cities and states) have enacted policies that require or strongly encourage all-electric new construction. Many of these jurisdictions are already creating plans for accessible retrofitting policies to address existing construction as well.

### Wind down gas appliance sales —

Federal appliance standard preemption laws dramatically limit what states can do to regulate appliances based on fuel type. However, as with building codes, state and local air authorities can adopt pollution regulations for appliances (impacting new construction and existing buildings). Regulating pollution metrics like GHGs and NOx is the most effective policy tool to wind down the sale of gas appliances.



## CREDITS

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[www.buildingdecarb.org](http://www.buildingdecarb.org)