

Issue At A Glance:

Indoor Air Pollution from Gas Appliances

Natural gas used for cooking and heating in millions of U.S. homes releases methane, nitrogen dioxide, carbon monoxide, benzene, and other hazardous air pollutants contributing to poor indoor air quality. This issue brief explores the scientific findings regarding indoor natural gas pollution, potential health effects, and policy efforts to address this concern.

Introduction

Gas stoves and other appliances that use natural gas for cooking and heating in homes release harmful indoor air pollutants such as methane, nitrogen dioxide, carbon monoxide, benzene, and ultrafine particulate matter. Recent studies reveal that these pollutants are emitted at levels that exceed U.S. Environmental Protection Agency (EPA) standards when in use and are also emitted at low levels even when the appliances are off.¹

Pollutants from gas-powered appliances can lead to the development and worsening of asthma and contribute to respiratory and neurological symptoms. A 2022 study found that 12.7% of childhood asthma in the U.S. is attributable to gas stove use.² Furthermore, fossil fuel usage in homes and businesses produces 10% of US greenhouse gas emissions, worsening climate change and associated health impacts such as extreme heat, drought, and flooding.³ With 88% of households in California powered by natural gas for cooking and heating,⁴ gas appliances pose a significant health concern.

This brief highlights the health effects of indoor gas appliance usage and reviews potential solutions and policies to address indoor air pollution.

Key Definitions

Fossil fuels are energy sources formed from decayed organic matter on Earth's crust. Fossil fuels include coal, petroleum, and natural gas.

Natural gas is a fossil fuel composed of hydrocarbons (e.g., methane), carbon dioxide, and water vapor.

A **gas stove** uses natural gas and an open flame to heat pots and pans. An **induction stove/cooktop** uses an electromagnetic field to transfer energy to pots and pans.

Heat pump technology extracts heat from air and is used to heat or cool air or water.

Building electrification is the replacement of building equipment that runs on gas, propane, or other fossil fuels with electric alternatives (e.g., heating systems, water heaters, stoves, and ovens).

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How Gas Appliances Impact Indoor Air

The combustion of natural gas for cooking on gas stoves primarily produces nitrogen dioxide (NO₂) and carbon monoxide (CO). The Environmental Protection Agency (EPA) sets standards for a safe outdoor NO₂ exposure limit. A 2014 study showed that gas stoves used without exhaust hoods produce levels of NO₂ that exceed EPA outdoor air quality standards.⁵ Homes with gas stoves can have 50-400% higher NO₂ levels compared to homes with electric stoves.⁶ There is a strong link between long-term NO₂ exposure and the development of asthma in children: a 2013 study of children with asthma found that severity of asthma increased as NO₂ levels increased in the home each month.⁷ Additional pollutants released from gas appliances include carbon monoxide, formaldehyde, methane, benzene, and particulate matter (PM_{2.5}). Carbon monoxide is an invisible and odorless gas produced by cooking and heating appliances that can cause headaches, fatigue, disorientation, and death at increasingly high levels. Pollution from combustion products is linked to impaired cognitive function,⁸ cardiovascular effects, diabetes, cancer, and reproductive effects.⁹

Children are more susceptible to illness from air pollution compared to adults because of their immature respiratory and immune systems, higher rates of breathing, greater physical activity, and larger lung surface to body weight ratios. Lower-income households may also be at greater risk of gas stove pollution due to overcrowded living situations and inadequate cooktop ventilation systems in older, multifamily buildings.¹⁰ Coupled with higher rates of asthma in African American and Puerto Rican children compared to non-Hispanic white children, African American and Hispanic children are disproportionately affected by gas stove pollution.^{11,12}

Ways to Reduce Exposure at Home

You can take the following steps to reduce household exposure to indoor air pollution from gas appliances.

1. Install and maintain a carbon monoxide detector in the home.
2. If available, run an exhaust hood while cooking.
3. Open windows while cooking to improve ventilation.
4. Use electric appliances such as toaster ovens and hot water kettles instead of gas ovens or stoves.
5. Use a standalone plug-in electric or induction burner.
6. Remodel your kitchen cooktop fully: Remove your gas stove and replace with an electric or induction stove.



Policy Efforts to Reduce Indoor Gas Pollution

Federal Policy

The federal Inflation Reduction Act (IRA) of 2022 offers tax credits for purchasing and installing electric appliances in the home including electric stoves, heat pump water heater, heat pump space heaters, and electric clothes dryers. The bill also includes additional rebates for low- and moderate-income households to go electric.¹³

State Policy in California

California has set a 2030 climate goal to cut greenhouse gas emissions (GHG) by at least 40 percent compared to 1990 levels. In 2018, the California Energy Commission's (CEC) Integrated Energy Policy Report found that buildings are the second largest source of GHG emissions, behind the transportation sector.¹⁴ Reducing building GHG emissions via switching from gas-fueled appliances to more efficient electric appliances—known as building decarbonization and electrification—is a priority.

The CEC adopted a new, electric-friendly statewide building code that went into effect in 2023, which encourages and incentivizes developers to choose all-electric designs and install highly-efficient electric heat pumps for space and water heating.¹⁵ Builders are still permitted to install gas appliances in new homes and buildings, but the buildings must be “all-electric ready,” and builders must offset the higher carbon emissions from gas with additional energy efficiency measures. Cookstoves, fireplaces, and laundry dryers are not regulated by building code, so builders may continue to include them.

The California Air Resources Board (CARB) adopted a State Implementation Plan in 2022 that includes a first-in-the-nation standard requiring 100 percent of the sales of new space and water heaters to comply with zero-emissions standards.¹⁶ This will increase the deployment of electric heat pumps for heating, cooling, and water heating.

Critical laws that have paved the way for building electrification in California include SB 1477 (Stern) and AB 3232 (Friedman). SB 1477 established funding for building electrification programs under the California Public Utilities Commission (CPUC), and AB 3232 required the CEC to assess how to reduce GHG emissions in buildings to 40% below 1990 levels by 2030.¹⁷ SB 527 (Min), a bill being considered in the CA Senate Committee on Appropriations, directs the CPUC to create equitable neighborhood decarbonization programs that prioritize low-income and disadvantaged communities to invest in clean and affordable energy.¹⁸

California Cities and Counties

Over 75 jurisdictions in California, including the cities of Los Angeles and Riverside,¹⁹ have adopted policies requiring new buildings to reduce reliance on gas.²⁰ Many of these are considered “reach codes” that go beyond the state's building code to prohibit fossil fuels in new buildings, requiring new residential and commercial buildings to be built all-electric. Many codes have exceptions for residential and commercial kitchens, commercial laundry, emergency back-up power, and laboratories.

Conclusion

Cooking with gas stoves and using gas appliances in the home generate large amounts of toxic indoor pollutants that increase the risk of respiratory illnesses like asthma, especially among children and in low-income households. Electric or induction cooktops, electric water heaters, and heat pumps are highly efficient, healthier, and more environmentally-friendly options.

Mitigating the health risks of indoor air pollution from gas stoves and appliances requires partnership and action at multiple levels: Individuals can control in-home pollution by opening windows, using exhaust fans and hoods while cooking, and cooking with electric or induction cooktops (whether plug-in or fully replacing their gas stoves). Health professionals can identify and assess risks from gas stoves and engage in education and advocacy. Researchers can conduct studies on health effects of gas appliances and identify effective interventions. Policymakers and advocates can develop guidelines and incentives to encourage the transition to electric appliances to reduce fossil fuel use, improve indoor air quality, and support public health.

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Did you know?

Studies from the EPA show that humans are exposed to indoor air pollutants that are two to five times (and sometimes more than 100 times) greater than outdoor levels. People spend about 90% of their time indoors.²¹



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Institute for Health Policy and Leadership

11209 Anderson Street
Loma Linda, CA 92354
Phone: 909-558-7022
Fax: 909-558-5638
www.IHPL.llu.edu

Special guest contributor:
Brianna Egan, MPH, RDN, MS2

Questions?
Please contact the Institute for Health
Policy & Leadership (ihpl@llu.edu).