



Factsheet

Why EPA Must Address Appliance Pollution



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Fossil-fuel burning appliances have significant pollution, health, and climate impacts. Fortunately, electric appliances are widely available and produce zero direct combustion emissions, making them an effective, affordable control technology. The US Environmental Protection Agency (EPA) should adopt nitrogen oxides (NO_x) standards that phase in requirements for electric appliances when new units are installed, with the goal of reducing and ultimately eliminating pollution from appliances.

Pollution & Health Impacts from Appliances

Burning fossil fuels for space and water heating in residential and commercial buildings emits significant amounts of outdoor air pollution, including NO_x and fine particulate matter ($\text{PM}_{2.5}$). Fossil-fuel appliances also contribute significantly to climate change, producing over **643 million tons of CO_2 equivalent**, or **10 percent of total US emissions**, in 2018.ⁱ Additionally, appliances like **gas stoves expose millions of Americans** to indoor air pollution levels that would be illegal outdoors, contributing to further serious health harms.

Gas appliances represent about 80 percent of fossil-fuel appliances and emit the majority of appliance pollution.ⁱⁱ Because gas appliances lack effective

emission controls, they emit more than **twice as much NO_x** as gas power plants, **despite consuming less gas overall** (see Exhibit 1). Appliances' outsized emissions contribution will only increase as electricity generation and other sectors move to lower-emitting alternatives under existing and planned policies.

Appliance pollution has significant health impacts. According to data from one forthcoming study by researchers at the Harvard T.H. Chan School of Public Health, exposure to $\text{PM}_{2.5}$ pollution resulting from residential and commercial fossil-fuel appliance emissions caused an estimated **5,953 premature deaths** throughout the United States in 2017.ⁱⁱⁱ These pollution and health burdens **are not shared**

ⁱ EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990–2018*, ES-7 to ES-9 (2020). For consistency, emissions are reported in US tons throughout this fact sheet.

ⁱⁱ Based on the US Department of Energy Energy Information Administration's latest **Residential Energy Consumption Survey** and **Commercial Buildings Energy Consumption Survey**, as well as EPA's latest **National Emissions Inventory**.

ⁱⁱⁱ Jonathan Buonocore et al., *A Decade of the U.S. Energy Mix Transitioning Away from Coal: Historical Reconstruction of the Reductions in the Public Health Burden of Energy*, Environmental Research Letters (2021). The study reports health impact data from three reduced-form models. For each data point (consisting of a state, source type, fuel type, and pollutant), RMI's analysis selects the model that produces the middle value.

Exhibit 1

US gas appliance pollution rivals or exceeds gas power plant pollution

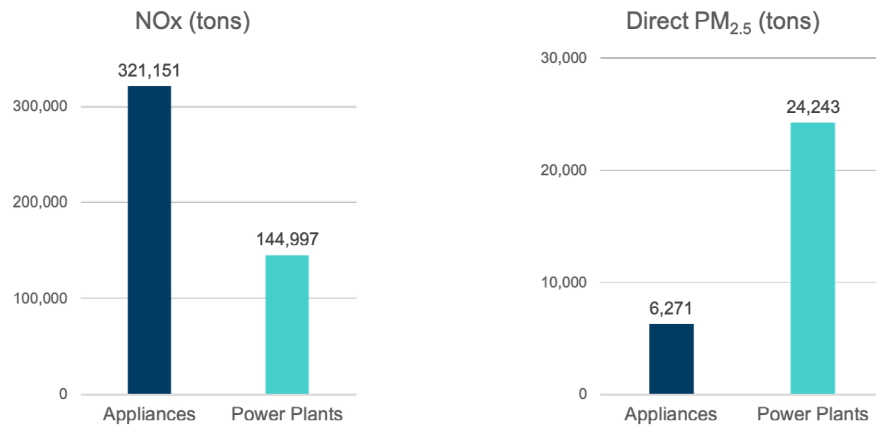
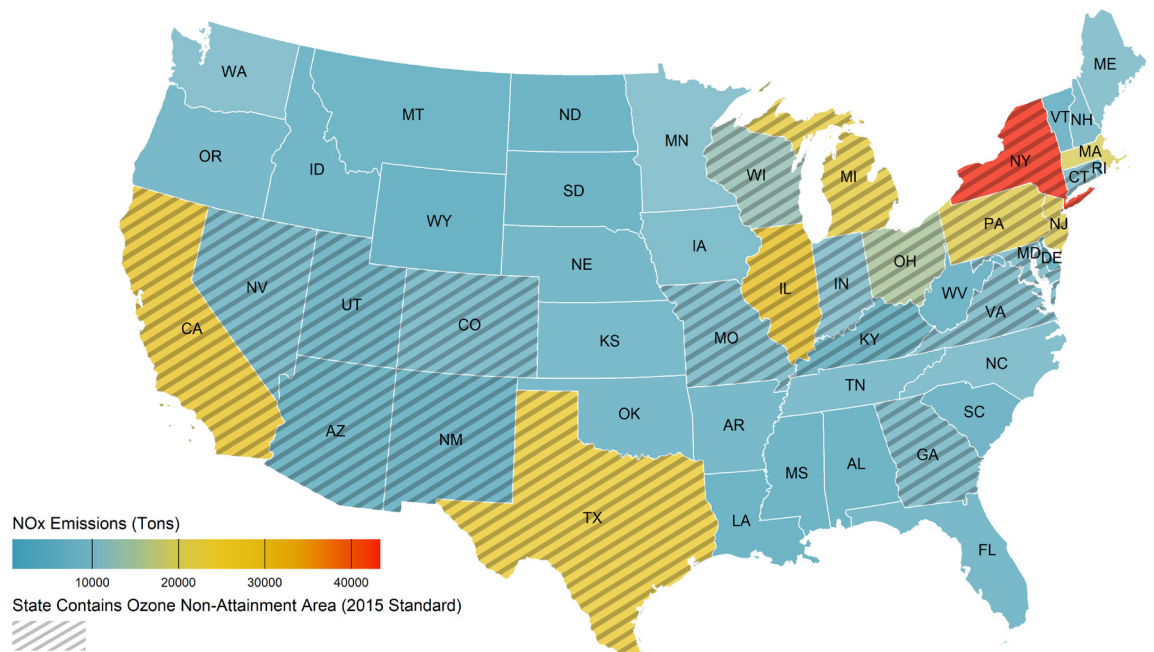


Exhibit 2

NO_x emissions and ozone non-attainment areas



Note: Map depicts NO_x emissions associated with natural gas, oil, and propane combustion in residential and commercial buildings

equitably. Nationally, NO₂ exposure levels are **27 percent higher** for low-income Black, Indigenous, and people of color compared to high-income whites. And African-American children are more than **twice as likely** as white children to have asthma,^{iv} which can be caused or exacerbated by NO_x exposure.^v

This pollution also contributes to nonattainment with

EPA's national ambient air quality standards (NAAQS) program. The NO_x emissions from appliances are a precursor to harmful ground-level ozone (smog). As shown in the map above, nonattainment of the 2015 ozone NAAQS occurs in many states and regions with elevated NO_x emissions from fossil-fuel appliances, including New York, California, and Illinois.

^{iv} Brady Anne Seals & Andee Krasner, *Health Effects from Gas Stove Pollution* (2020) (reporting that 15.7% of African American non-Hispanic children have asthma, compared to 7.1% of white non-Hispanic children and 6.7% of Hispanic children).

^v Id. at 12 (citing EPA, *Integrated Science Assessment (ISA) for Oxides of Nitrogen—Health Criteria*, Tbl. ES 1, p. lxxxii (2016), <https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879>).

Electric Appliances An Effective, Affordable Emissions Control Technology

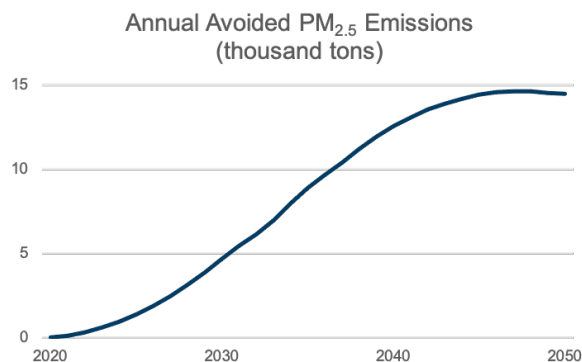
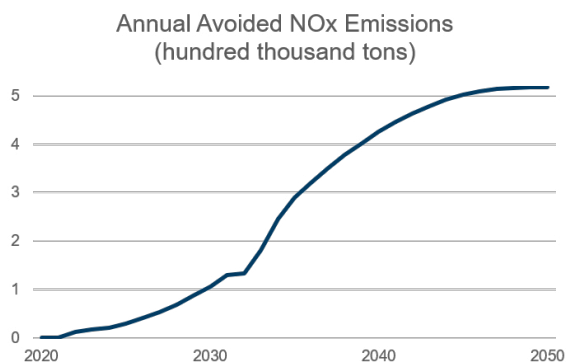
Electric appliances produce no direct combustion emissions, and result in substantial emission reductions even when upstream emissions from electricity generation are considered. Ramping up to a requirement that all new appliances be electric by 2030 would yield an almost fully electric fleet by 2045, when any previously-sold fossil fuel appliances would reach the end of their roughly 15-year lifespan. This could avoid over **500,000 tons of NO_x** and **14,400 tons of PM_{2.5}** annually by 2045.^{vi} That's about 16 percent more NO_x reduction and 3 percent more PM_{2.5} reduction than EPA's 2014 **Tier 3 vehicle standards** are projected to achieve by 2030.^{vii}

These NO_x and PM_{2.5} reductions alone could save over **3,750 lives per year** by 2045.^{viii}

With the right policies and incentives, electrification can also reduce consumer costs and create new jobs. **RMI analysis** shows that a new all-electric single-family home has a **lower net present cost** than a home with gas appliances in every city studied, and a lower upfront cost in six of seven cities studied. And even for existing buildings, electric appliances have become cheaper and more efficient in recent years, and costs are expected to continue declining in the future.^{ix}

Accounting for the expected reduction in premature deaths from electrification adds over **\$21 billion** of annual economic benefits by 2045.^x **Rewiring America estimates** that decarbonizing our economy will create at least **2 million new jobs** in the energy efficiency sector, a large portion of which will come from electrifying appliances.^{xi}

Exhibit 3 Annual avoided emissions from all new electric appliance requirement by 2030



^{vi} Based on RMI analysis using **Energy Innovation's U.S. Policy Simulator**. This analysis assumes that the share of carbon-free electricity on the grid will reach 90 percent by 2035. The Biden Administration has set a target of 100 percent carbon-free electricity by 2035. See Executive Order 14,008 § 205(b)(i) (Jan. 27, 2021). The Policy Simulator does not support selection of fuel types, so its scenarios include the benefits of electrifying non-fossil fuel appliances like wood and biomass burners. RMI estimated the benefits of electrifying only fossil-fuel appliances by multiplying the Simulator's total NO_x and PM_{2.5} reductions by the percentage of each pollutant attributable to gas, oil, and other appliance types. These percentages are based on EPA data and can be calculated from the Particulates tab of Energy Innovation's Pollution Emission Intensities file, available for download with the Policy Simulator at <https://us.energypolicy.solutions/docs/download.html>.

^{vii} See 79 Fed. Reg. 23,414, 23,443 (Apr. 28, 2014).

^{viii} Based on RMI analysis using emission reduction estimates described *supra* note 6 and health impact estimates calculated from Buonocore et al., *supra* note 3 (forthcoming). Including benefits from reducing other pollutants like ammonia could increase this figure substantially.

^{ix} See Sherri Billimoria et al., *The Economics of Electrifying Buildings*, 48 (2018) (citing the National Renewable Energy Laboratory's projected cost declines of 20-38% for air-source heat pumps and 42-48% for heat pump water heaters by 2050).

^x Based on analysis described *supra* note 8 and a value of statistical life of \$11,200,000 (2017 dollars, used in Buonocore et. al., *supra* note 3 (forthcoming)), converted to 2021 dollars and discounted to 2021 at a rate of 3%. Additional health and climate benefits could add substantially to this figure.

^{xi} Saul Griffith & Sam Calisch, *Mobilizing for a Zero Carbon America*, 14, 17-19, 23 (2020).

Policy Approaches to Addressing Appliance Pollution

In light of the substantial pollution and health impacts from fossil-fuel appliances and the ready availability of zero-emitting electric alternatives, **EPA should initiate procedures to set standards that will reduce and eventually eliminate pollution from new space and water heating appliances.**

Clean Air Act Section 111(b) authorizes EPA to do just that. As described above, fossil-fuel appliances emit large amounts of NO_x, PM_{2.5}, and other harmful pollutants. As a category, they undoubtedly cause or contribute significantly to dangerous air pollution. Accordingly, EPA may define a source category for residential and commercial fossil-fuel burning appliances and set federal standards of performance for new sources in the category. Because electric appliances are widely available, cost-effective, and adequately demonstrated, they represent the best system of emission reduction and should form the basis of a NO_x standard of performance for these sources.

Such a standard should be designed to reduce and eventually eliminate emissions from the new appliances that replace existing fossil-fuel appliances

as they reach the end of their lifespan. And because electric appliances are already easily the most cost-effective option for new buildings, EPA is poised to immediately set strong standards for appliances in new buildings. To achieve health and climate benefits without burdening low-income consumers, the NO_x performance standard should be paired with incentives that reduce upfront costs and allow all consumers to benefit from the long-term energy savings of electrification.

Other policy pathways to reducing appliance emissions are also available. For example, EPA could address interstate transport of appliance emissions through the Clean Air Act's **Good Neighbor Provision**. It could encourage states to adopt protective appliance standards like those already passed in **California**, **Utah**, and **Texas**, or issue SIP calls requiring such standards in states that fail to comply with Clean Air Act requirements. EPA could award grants to tribes, states, and environmental justice communities to promote electric appliance adoption. EPA should consider these and other policy options as it works to limit health-harming and climate-destabilizing emissions from fossil-fuel appliances.

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